

## **CHAPTER 1**

### **Feedstuff Composition and Nutritional Value**

Arele A. Calderano<sup>1</sup>, Jansller L. Genova<sup>1</sup>, Fernando C. Tavernari<sup>2</sup>,  
Luiz F.T. Albino<sup>1</sup> and Horacio S. Rostagno<sup>1</sup>

<sup>1</sup>Department of Animal Science, Federal University of Viçosa, Viçosa, Brazil.

<sup>2</sup>CNPQA, EMBRAPA, Concórdia, Brazil



## INTRODUCTION

The feedstuffs' chemical analyses were mainly carried out in the Animal Nutrition Laboratories of the Department of Animal Science and Chemical Analysis of the Department of Soils of the Federal University of Viçosa (UFV). Some feedstuffs were analyzed in the laboratories of several animal nutrition companies.

The following procedures and methods were applied to determine nutrient levels: dry Matter (DM): drying samples in an oven at 105 °C for four to six hours; total nitrogen (Total N): mainly by the Kjeldahl method, and the result was used to calculate the Crude Protein (CP) content as N multiplied by 6.25; ether extract (EE): by heating, using the Goldfish extracter and petroleum ether as the solvent; starch: enzymatic method; crude fiber (CF): Weende method; fiber in neutral detergent (NDF) and fiber in acid detergent (ADF): Van Soest method; gross energy (GE): burned in a "Parr" bomb calorimeter; ash: burning at 600 °C for 4 hours; minerals: by atomic absorption spectrophotometer, except for sodium and potassium (flame emission spectrophotometer). Minerals from a limited number of feedstuffs were also analyzed by plasma induction spectrophotometer; phosphorus (P): by colorimetry; total amino acids: by High Performance Liquid Chromatography (HPLC); fatty acids in oils and fats commonly used in monogastric diets were determined by chromatography.

The quantification of the amino acids Glutamine (Gln) and Asparagine (Asn) in feedstuffs presents limitations due to the amidation reaction, which promotes the conversion (approximately 80%) of these amino acids into Glutamic (Glu) and Aspartic (Asp) acids, respectively. In this edition, Glu:Gln and Asp:Asn ratios were calculated using data from 16 feedstuffs analyzed by Li et al. (2011) and Li and Wu (2020). For other feedstuffs, these ratios were estimated based on the similarity of their proteins with those of the analyzed feedstuffs.

Determining the amino acid content and standardized ileal digestibility of feedstuffs for poultry and swine feedstuffs is difficult and

expensive. Thanks to the collaboration of the companies Adisseo, Ajinomoto, DSM, and Evonik, it was possible to analyze many feedstuffs and digesta samples.

Standardized ileal digestible amino acid (SID) values of poultry feedstuffs were determined using the Sibbald precision feeding method with cecectomized roosters; and mainly, by the ileal collection method in broilers (21 to 28 days). Endogenous amino acid excretion was estimated in fasting cecectomized roosters (Sibbald) and by the supply of a protein-free diet to broilers (ileal collection). In swine, amino acid ileal digestible content was determined using growing swine fitted with a T-cannula at the terminal ileum or ileorectal anastomosis for a few feedstuffs. Endogenous amino acid excretion was estimated using a protein-free diet. The standardized ileal digestibility coefficient of protein in poultry and swine was calculated as the ratio between the feedstuffs' SID amino acid content and total amino acid content. Amino acid digestibility coefficients available in literature were used for some feedstuffs.

Essential nitrogen content was calculated as the molecular nitrogen content in each essential amino acid multiplied by its percentage in the feedstuff. The essential nitrogen digestibility coefficient was calculated as the ratio between standardized digestible essential amino acid content and total essential amino acid content. For poultry, the calculations considered glycine and serine as essential amino acids.

In this 5<sup>th</sup> edition, two categories of corn grain and soybean meal (SBM) are included in addition to the average values. The nutritional values of the additional corn categories were calculated considering the average DM value  $\pm$  1 standard deviation and higher or lower hulls proportion for soybean meal relative to that present in the average SBM.

In plant feedstuffs, phytate phosphorus content was determined in addition to total phosphorus. We thank the company AB Vista, which kindly provided the results of phosphorus and phytic phosphorus analyses of Brazilian feedstuffs. Non-phytic phosphorus content (total phosphorus – phytic phosphorus) was considered as available phosphorus.



The calculation of available phosphorus content in animal feedstuffs was based on total phosphorus content considering 100% availability, except for pork and bovine meat and bone meals (90% availability). Standardized digestible phosphorus values determined in growing and finishing broilers and swine are also listed. Those values were obtained in experiments carried out at UFV or published in the literature. The apparent digestible phosphorus content of some feedstuffs mentioned in the literature was converted into standardized digestible values, applying endogenous P excretion values of 0.138 mg P/kg DM intake for poultry and 0.258 mg P/kg DM intake for pigs. The results of experiments conducted by Bunzen (2009; Ph.D. thesis at UFV) expressed in mg P/unit of metabolic weight ( $W^{0.75}$ ) were transformed into mg P/kg DM intake.

The metabolizable energy (ME) content of most poultry feedstuffs was determined by the total excreta collection method. The ME content of some feedstuffs was measured using chromic oxide or acid-insoluble ash as a fecal marker. Feedstuffs ME Poultry values were corrected for nitrogen retention determined in broilers of different ages.

Research carried out at UFV to evaluate the influence of bird age on feedstuff ME values showed that hens and mature chickens generally obtain higher ME values from plant feedstuffs than broilers. Those experimental data estimated a 0.3 kcal/g ME increase from undigestible nitrogen-free extract + crude fiber (NDNFEF) fraction for mature poultry (Hens). That fraction was calculated as  $NDNFEF = (\text{total nitrogen-free extract} - \text{digestible nitrogen-free extract}) + \text{crude fiber}$ . Therefore, two ME values are presented for each feedstuff: one for poultry in general (ME Poultry) and the other for mature poultry or Hens ( $ME\ Hens = ME\ Poultry + 0.3\ NDNFEF$ ).

The net energy values (NE) of poultry feedstuffs were calculated by applying the following coefficients of ME utilization estimated by Carré et al. (2014): 76% (-24%) for digestible protein and 80% (-20%) for digestible starch, considered as digestible nitrogen-free extract. A 90% efficiency

(-10%) was considered for digestible EE, as proposed by De Groote (1974), which is similar to that determined in swine (Noblet et al., 1994).

Digestible Energy (DE) and ME values of feedstuffs for swine were determined in growing swine weighing between 20 and 75 kg and housed in metabolic cages. The total fecal collection method used ferric oxide as a fecal marker. Swine ME values are corrected for nitrogen retention. In addition to the results of research at UFV, feedstuff ME values for swine available in the literature were considered. Net energy values were calculated according to the equation proposed by Noblet et al. (1994).

Dr. Noblet calculated an increase of 1 kcal NE/g of undigested residue in mature pigs (sows) compared with growing swine, as published in the Food Composition Tables in France. This value was used to correct the DE Pigs, and 0.75 kcal/g to adjust the ME Pigs. Therefore, two DE (DE Pig and DE Sow) and ME (ME Pig and ME Sow) values are presented for each feedstuff. This correction was applied only for plant feedstuffs, using Undigested Organic Matter (Total Organic Matter - Digested Organic Matter) data.

Several digestibility tests were carried out with growing and finishing swine to determine the digestibility coefficients of EE, CF, NDF, and ADF in the feedstuffs. The coefficient of organic matter digestibility for swine was calculated as the DE to GE ratio.

The digestibility coefficients of EE and nitrogen-free extract in poultry feeds presented were obtained from experimental trials and the literature.

Alternative feedstuff practical levels and maximum inclusion levels, which do not negatively affect animal performance, are presented.

Equations to estimate ME and NE values of poultry feedstuffs (Table 1.02) and DE, ME, and NE values for swine and, in particular, for sows (Tables 1.03 and 1.04) are included to allow correcting feedstuff energy values according to their chemical composition. Composition data and digestibility coefficients of the main nutrients were used. The digestibility coefficients of EE (poultry and swine), nitrogen-free extract

(poultry), and organic matter (swine) of some feedstuffs were adjusted in the equations to obtain energy values similar to those presented in Table 1.01. Those equations can be used to calculate the energy values, when the feedstuff composition is different from those listed, allowing nutritionists to correct and adjust composition matrices.

Equations were developed to calculate the sum of all essential amino acid levels in corn, sorghum, and soybean (grain and meal) (Tables 1.06 and 1.07). Based on that sum and assuming a constant amino acid ratio in the feedstuff protein, the content of each essential amino acid can be estimated. The equations help adjust amino acid values as a function of feedstuff protein content.

The standardized ileal digestibility (SID) of crystalline amino acids was determined in broiler chicks, cecectomized roosters, and swine fitted with a T-cannula in the terminal ileum (Tables 1.08 and 1.09). Based on the gross energy (GE) and digestibility values of each amino acid, their Standardized Metabolizable Energy (SMEn) was calculated, considering a 50% conversion of nitrogen into uric acid in poultry, except for the conversion of arginine in urea. The SMEn for swine was calculated considering a 35% conversion of nitrogen into urea. Amino acid net energy levels were calculated assuming that the efficiency of utilization of amino acids is 70% for protein deposition and 30% for deamination and catabolism. SMEn utilization efficiency values of 85% ( $70 \times 85/100 = 0.595$ ) for protein deposition and 60% ( $30 \times 60/100 = 0.18$ ) for deaminated and catabolized amino acids were calculated. Therefore,  $NE = SMEn \times 0.595 + SMEn \times 0.18$ .

Phosphorus bioavailability in phosphate products was determined by comparison with a standard source (dicalcium phosphate), which was assigned an availability coefficient of 100% (Table 1.10). Therefore, the available phosphorus content of some phosphate sources is higher than 100%.

International literature reports that some phosphates may contain high levels of heavy metals. Table 1.11 presents the composition of

Brazilian phosphates, particularly their heavy metal contents, including lead, cadmium, and vanadium.

Exogenous phytases have been commonly added to poultry and swine feed to improve phytic phosphorus utilization since the 1990s, and research has proven the benefits of their supplementation. Meta-analyses were conducted to estimate the amount of phosphorus made available by phytases to broilers and pigs (Tables 1.12 and 1.13).

The non-starch polysaccharide (NSP) contents of some feedstuffs were determined by the company ABVista, according to the methodology described by Englyst et al. (1994) and expressed as 'as-fed' (Table 1.14).

## Feedstuff List

| Feedstuff                            | Page | Feedstuff                                  | Page |
|--------------------------------------|------|--------------------------------------------|------|
| Albumin                              | 11   | Milk Whey, Permeate                        | 113  |
| Algae ( <i>Spirulina platensis</i> ) | 13   | Milk Whole, Powder                         | 115  |
| Algaroba, Flour                      | 15   | Millet, Grain                              | 117  |
| Babassu, Meal                        | 17   | Oats, Grain                                | 119  |
| Babassu, Starch Flour                | 19   | Ouricuri ( <i>Syagrus coronata</i> ), Meal | 121  |
| Bakery, By-products                  | 21   | Pasta/Spaghetti, By-product                | 123  |
| Barley, Grain                        | 23   | Peanuts, Meal                              | 125  |
| Blood, Meal                          | 25   | Pork Meat and Bone, Meal                   | 127  |
| Blood, Plasma                        | 27   | Poultry, By-product Meal                   | 129  |
| Blood, Red Cells                     | 29   | Poultry, By-product High-fat Meal          | 131  |
| Bovine Meat and Bone, Meal 38% CP    | 31   | Poultry, Fat                               | 133  |
| Bovine Meat and Bone, Meal 43% CP    | 33   | Poultry Feather and By-prod., Meal         | 135  |
| Bovine Meat and Bone, Meal 48% CP    | 35   | Rice, Bran                                 | 137  |
| Bovine Meat and Bone, Meal 52% CP    | 37   | Rice, Broken                               | 139  |
| Bovine Meat and Bone, Meal 58% CP    | 39   | Rice, Defatted Bran                        | 141  |
| Bread, By-products                   | 41   | Rye, Grain                                 | 143  |
| Canola, Meal                         | 43   | Shrimp, By-product Meal                    | 145  |
| Canola, Oil                          | 45   | Sorghum, Grain                             | 147  |
| Casein                               | 47   | Sorghum, Grain High Tannin                 | 149  |
| Cassava, Whole                       | 49   | Soybean, Acid Oil                          | 151  |
| Castor Plant, Meal                   | 51   | Soybean, Degummed Oil                      | 153  |
| Citrus Pulp                          | 53   | Soybean, Full-fat Extruded                 | 155  |
| Coconut, Meal                        | 55   | Soybean, Full-fat Micronized               | 157  |
| Coconut, Oil                         | 57   | Soybean, Full-fat Roasted                  | 159  |
| Corn, Bran with Solubles             | 59   | Soybean, Hulls                             | 161  |
| Corn, DDGS - 6 to 9% of EE           | 61   | Soybean, Meal 44.5% CP                     | 163  |
| Corn, HP-DDG                         | 63   | Soybean, Meal 45.6% CP (Aver.)             | 165  |
| Corn, Germ                           | 65   | Soybean, Meal 46.5% CP                     | 167  |
| Corn, Gluten Feed 21% CP             | 67   | Soybean, Meal 48% CP                       | 169  |
| Corn, Gluten Meal 60% CP             | 69   | Soybean, Protein Concentrate               | 171  |
| Corn, Grain (- 1 SD of DM)           | 71   | Soybean, Protein Isolate                   | 173  |
| Corn, Grain (Average)                | 73   | Soybean, Semi-defatted Extruded            | 175  |
| Corn, Grain (+ 1 SD of DM)           | 75   | Soybean, Semi-defatted Roasted             | 177  |
| Corn, High-lysine Gran               | 77   | Starch                                     | 179  |
| Corn, High-oil Gran                  | 79   | Sugar                                      | 181  |
| Corn, Pre-cooked                     | 81   | Sugarcane, Juice                           | 183  |
| Corn, Oil                            | 83   | Sugarcane, Molasses                        | 185  |
| Cottonseed, Meal 28% CP              | 85   | Sugarcane, Molasses Dried                  | 187  |
| Cottonseed, Meal 38% CP              | 87   | Sunflower, Meal                            | 189  |
| Cottonseed, Meal 43% CP              | 89   | Sweet Potato, Flour                        | 191  |
| Dendê Palm, Oil                      | 91   | Tallow                                     | 193  |
| Feather, Meal 76% CP                 | 93   | Triticale, Gran                            | 195  |
| Feather, Meal 84% CP                 | 95   | Wheat, Bran                                | 197  |
| Fish, Meal 54% CP                    | 97   | Wheat, Dark Flour                          | 199  |
| Fish, Meal 62% CP                    | 99   | Wheat, Flour                               | 201  |
| Glucose                              | 101  | Wheat, Germ                                | 203  |
| Lactose                              | 103  | Wheat, Gluten                              | 205  |
| Lard                                 | 105  | Wheat, Grain                               | 207  |
| Lecithin                             | 107  | Wheat, Screenings                          | 209  |
| Milk Skimmed, Powder                 | 109  | Yeast, Alcohol Distiller's                 | 211  |
| Milk Whey, Powder                    | 111  | Yeast, Brewer's                            | 213  |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Albumin**

| Main Components (%)                       |      |   |    |                              |      |   |    |
|-------------------------------------------|------|---|----|------------------------------|------|---|----|
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                                | 91.4 | 1 | -  | Organic Matter (OM)          | -    |   |    |
| Crude Protein (CP)                        | 85.7 | 1 | -  | Coef. Dig. OM Swine          | -    |   |    |
| Starch                                    | -    | - | -  | Digestible OM Swine          | -    |   |    |
| Crude Fiber (CF)                          | -    | - | -  | Undig. OM Pigs               | -    |   |    |
| Coef. Dig. CF Swine                       | -    |   |    | Ether Extract (EE)           | -    | - | -  |
| NDF                                       | -    | - | -  | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine                      | -    |   |    | Digestible EE Poultry        | -    |   |    |
| ADF                                       | -    | - | -  | Coef. Dig. EE Swine          | -    |   |    |
| Coef. Dig. ADF Swine                      | -    |   |    | Digestible EE Swine          | -    |   |    |
| N-Free Extract (NFE)                      | -    |   |    | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry                    | -    |   |    | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry                    | -    |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry                   | -    |   |    |                              |      |   |    |
| Energy (kcal/kg)                          |      |   |    |                              |      |   |    |
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy                              | 4700 | 1 | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>                            |      |   |    | Digestible Energy            | -    |   |    |
| Metabolizable Energy                      | 3757 |   |    | Metabolizable Energy         | -    |   |    |
| Std. Metab. Energy                        | -    |   |    | Net Energy                   | -    |   |    |
| Net Energy                                | -    |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>                               |      |   |    | Digestible Energy            | -    |   |    |
| Metabolizable Energy                      | -    |   |    | Metabolizable Energy         | -    |   |    |
| Net Energy                                | -    |   |    | Net Energy                   | -    |   |    |
| Minerals                                  |      |   |    |                              |      |   |    |
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Ash, %                                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b>                 |      |   |    | Manganese (Mn)               | 2.26 | 1 | -  |
| Potassium (K)                             | -    | - | -  | Iron (Fe)                    | 27.5 | 1 | -  |
| Sodium (Na)                               | -    | - | -  | Copper (Cu)                  | 6.19 | 1 | -  |
| Chlorine (Cl)                             | -    | - | -  | Zinc (Zn)                    | 6.16 | 1 | -  |
| Sulfur (S)                                | -    | - | -  | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)                            | -    | - | -  |                              |      |   |    |
| Total Calcium (Ca)                        | -    | - | -  |                              |      |   |    |
| Total Phosphorus (P)                      | -    | - | -  |                              |      |   |    |
| Phytate P                                 | -    | - | -  |                              |      |   |    |
| Available P (Pav)                         | -    |   |    |                              |      |   |    |
| Coef. Dig. P Poultry                      | -    |   |    |                              |      |   |    |
| Std. Dig. P Poultry                       | -    |   |    |                              |      |   |    |
| Coef. Dig. P Swine                        | -    |   |    |                              |      |   |    |
| Std. Dig. P Swine                         | -    |   |    |                              |      |   |    |
| Pav = Non Phytate P (Total P – Phytate P) |      |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Albumin**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 85.7                                 | 100   | -                | -     | 73.6             | 85.9  |
| Lysine, %                      | 5.22                                 | 6.09  | -                | -     | 4.36             | 83.6  |
| Methionine, %                  | 2.79                                 | 3.26  | -                | -     | 2.32             | 83.0  |
| Met + Cys, %                   | 4.90                                 | 5.72  | -                | -     | 4.09             | 83.4  |
| Threonine, %                   | 3.69                                 | 4.31  | -                | -     | 3.14             | 85.0  |
| Tryptophan, %                  | 1.00                                 | 1.17  | -                | -     | -                | -     |
| Arginine, %                    | 4.41                                 | 5.15  | -                | -     | 3.93             | 89.1  |
| Gly + Ser, %                   | 9.32                                 | 10.9  | -                | -     | -                | -     |
| Valine, %                      | 5.19                                 | 6.06  | -                | -     | 4.51             | 86.9  |
| Isoleucine, %                  | 4.58                                 | 5.34  | -                | -     | 3.72             | 81.2  |
| Leucine, %                     | 6.84                                 | 7.98  | -                | -     | 5.81             | 84.9  |
| Histidine, %                   | 1.83                                 | 2.14  | -                | -     | 1.50             | 81.9  |
| Phenylalanine, %               | 4.74                                 | 5.53  | -                | -     | -                | -     |
| Phe + Tyr, %                   | 7.79                                 | 9.09  | -                | -     | -                | -     |
| Alanine, %                     | 5.81                                 | 6.78  | -                | -     | 5.12             | 88.1  |
| Cysteine, %                    | 2.11                                 | 2.46  | -                | -     | 1.77             | 84.0  |
| Tyrosine, %                    | 3.05                                 | 3.56  | -                | -     | -                | -     |
| Glycine, %                     | 3.16                                 | 3.69  | -                | -     | 2.45             | 77.5  |
| Serine, %                      | 6.16                                 | 7.19  | -                | -     | 5.33             | 86.5  |
| Proline, %                     | 3.00                                 | 3.50  | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | 4.80                                 | 5.60  | -                | -     | 4.25             | 88.6  |
| Glutamic Acid <sup>2</sup> , % | 6.60                                 | 7.70  | -                | -     | 5.85             | 88.6  |
| Asparagine <sup>2</sup> , %    | 4.32                                 | 5.04  | -                | -     | 3.86             | 89.4  |
| Aspartic Acid <sup>2</sup> , % | 6.52                                 | 7.61  | -                | -     | 5.83             | 89.4  |
| Total Nitrogen (PB/6.25), %    | 13.7                                 | 16.0  | -                | -     | 11.8             | 85.9  |
| Essential Nitrogen Poultry, %  | 7.40                                 | 54.0* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | 5.99                                 | 43.7* | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | -            | -      | -        | -         | -         |
| Practical Maximum                                           | -            | -      | -        | -         | -         |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | -            | -      | -        | -         | -         |
| Practical Maximum                                           | -            | -      | -        | -         | -         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Algae (*Spirulina platensis*)**

| Main Components (%)       |      |   |    |                              |       |   |    |
|---------------------------|------|---|----|------------------------------|-------|---|----|
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Dry Matter                | 89.0 | 1 | -  | Organic Matter (OM)          | 79.6  |   |    |
| Crude Protein (CP)        | 51.5 | 1 | -  | Coef. Dig. OM Swine          | -     |   |    |
| Starch                    | -    | - | -  | Digestible OM Swine          | -     |   |    |
| Crude Fiber (CF)          | 1.06 | - | -  | Undig. OM Pigs               | -     |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 0.99  | 1 | -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -     |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -     |   |    |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -     |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -     |   |    |
| N-Free Extract (NFE)      | 26.0 |   |    | Linoleic Acid                | -     | - | -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -     | - | -  |
| Digestible NFE Poultry    | -    |   |    |                              |       |   |    |
| Undig. NFE + CF Poultry   | -    |   |    |                              |       |   |    |
|                           |      |   |    |                              |       |   |    |
| Energy (kcal/kg)          |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Gross Energy              | 4399 | 1 | -  | <b>Swine</b>                 |       |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | -     |   |    |
| Metabolizable Energy      | 2493 |   |    | Metabolizable Energy         | -     |   |    |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | -     |   |    |
| Net Energy                | -    |   |    | <b>Sows</b>                  |       |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -     |   |    |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -     |   |    |
| Net Energy                | -    |   |    | Net Energy                   | -     |   |    |
|                           |      |   |    |                              |       |   |    |
| Minerals                  |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Ash, %                    | 9.44 | 1 | -  | <b>Trace Minerals, mg/kg</b> |       |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 0.002 | 1 | -  |
| Potassium (K)             | 1.40 | 1 | -  | Iron (Fe)                    | 0.065 | 1 | -  |
| Sodium (Na)               | 1.59 | 1 | -  | Copper (Cu)                  | 0.001 | 1 | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | 0.002 | 1 | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -     | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |       |   |    |
| Total Calcium (Ca)        | 0.33 | 1 | -  |                              |       |   |    |
| Total Phosphorus (P)      | 1.10 | 1 | -  |                              |       |   |    |
| Phytate P                 | -    | - | -  |                              |       |   |    |
| Available P (Pav)         | 1.10 |   |    |                              |       |   |    |
| Coef. Dig. P Poultry      | -    |   |    |                              |       |   |    |
| Std. Dig. P Poultry       | -    |   |    |                              |       |   |    |
| Coef. Dig. P Swine        | -    |   |    |                              |       |   |    |
| Std. Dig. P Swine         | -    |   |    |                              |       |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Algae (*Spirulina platensis*)**

| Amino Acid Content and Digestibility |       |       |                  |      |                  |      |
|--------------------------------------|-------|-------|------------------|------|------------------|------|
|                                      | Total | % CP  | Poultry          |      | Swine            |      |
|                                      |       |       | SID <sup>1</sup> | Coef | SID <sup>1</sup> | Coef |
| Crude Protein, %                     | 51.5  | 100   | 40.6             | 78.9 | -                | -    |
| Lysine, %                            | 2.18  | 4.23  | 1.77             | 81.3 | -                | -    |
| Methionine, %                        | 0.81  | 1.57  | 0.67             | 82.4 | -                | -    |
| Met + Cys, %                         | 2.12  | 4.12  | 1.69             | 79.6 | -                | -    |
| Threonine, %                         | 2.49  | 4.83  | 2.08             | 83.4 | -                | -    |
| Tryptophan, %                        | 0.90  | 1.75  | 0.70             | 77.5 | -                | -    |
| Arginine, %                          | 3.92  | 7.61  | 3.05             | 77.9 | -                | -    |
| Gly + Ser, %                         | 5.50  | 10.7  | 4.09             | 74.3 | -                | -    |
| Valine, %                            | 2.61  | 5.07  | 2.08             | 79.8 | -                | -    |
| Isoleucine, %                        | 2.71  | 5.26  | 2.16             | 79.7 | -                | -    |
| Leucine, %                           | 4.40  | 8.54  | 3.39             | 77.1 | -                | -    |
| Histidine, %                         | 0.73  | 1.42  | 0.58             | 80.0 | -                | -    |
| Phenylalanine, %                     | 2.23  | 4.33  | 1.90             | 85.4 | -                | -    |
| Phe + Tyr, %                         | 4.89  | 9.50  | 4.18             | 85.4 | -                | -    |
| Alanine, %                           | 4.14  | 8.04  | 3.22             | 77.8 | -                | -    |
| Cysteine, %                          | 1.31  | 2.54  | 1.02             | 77.8 | -                | -    |
| Tyrosine, %                          | 2.66  | 5.17  | 2.22             | 83.5 | -                | -    |
| Glycine, %                           | 2.89  | 5.61  | 2.11             | 72.9 | -                | -    |
| Serine, %                            | 2.61  | 5.07  | 1.98             | 75.9 | -                | -    |
| Proline, %                           | 2.18  | 4.23  | 1.88             | 86.4 | -                | -    |
| Glutamine <sup>2</sup> , %           | 2.75  | 5.35  | 2.18             | 79.0 | -                | -    |
| Glutamic Acid <sup>2</sup> , %       | 4.42  | 8.58  | 3.49             | 79.0 | -                | -    |
| Asparagine <sup>2</sup> , %          | 2.22  | 4.30  | 1.64             | 74.0 | -                | -    |
| Aspartic Acid <sup>2</sup> , %       | 2.84  | 5.52  | 2.10             | 74.0 | -                | -    |
| Total Nitrogen (PB/6.25), %          | 8.24  | 16.0  | 6.50             | 78.9 | -                | -    |
| Essential Nitrogen Poultry, %        | 4.52  | 54.8* | 3.56             | 78.9 | -                | -    |
| Essential Nitrogen Swine, %          | 3.63  | 44.0* |                  |      | -                | -    |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |         |          |             |           |
|-------------------------------------------------------------|---------------------|---------|----------|-------------|-----------|
|                                                             | <b>Broilers</b>     |         |          | <b>Hens</b> |           |
|                                                             | Starter             | Grower  |          |             |           |
|                                                             | 5<br>10             | 5<br>10 |          | 5<br>10     |           |
| <b>Practical<br/>Maximum</b>                                | <b>Growing Pigs</b> |         |          | <b>Sows</b> |           |
|                                                             | Starter             | Grower  | Finisher | Gestation   | Lactation |
|                                                             | 5<br>10             | 5<br>10 | 5<br>10  | 5<br>10     | 5<br>10   |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Algaroba, Flour**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 90.7 | 1 | -  | Organic Matter (OM)          | 87.3 |      |
| Crude Protein (CP)        | 8.79 | - | -  | Coef. Dig. OM Swine          | 59.4 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 51.9 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 35.4 |      |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 0.52 | 1 -  |
| NDF                       | 17.7 | 1 | -  | Coef. Dig. EE Poultry        | -    |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -    |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -    |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -    |      |
| N-Free Extract (NFE)      | 77.9 |   |    | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | -    |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 4501 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 2675 |      |
| Metabolizable Energy      | 1520 |   |    | Metabolizable Energy         | 2432 |      |
| Std. Metab. Energy        | 1807 |   |    | Net Energy                   | -    |      |
| Energy Líquida            | -    |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -    |      |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -    |      |
| Net Energy                | -    |   |    | Energy Líquida               | -    |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | N | SD |                              | Mean | n SD |
| Ash, %                    | 3.45 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | 0.91 | 1 | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | 0.27 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.14 | 1 | -  |                              |      |      |
| Phytate P                 | 0.09 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.05 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |      |
| Std. Dig. P Poultry       | -    |   |    |                              |      |      |
| Coef. Dig. P Swine        | -    |   |    |                              |      |      |
| Std. Dig. P Swine         | -    |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Algaroba, Flour**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |      |                  |      |
|---------------------------------------------|-------|-------|------------------|------|------------------|------|
|                                             | Total | % CP  | Poultry          |      | Swine            |      |
|                                             |       |       | SID <sup>1</sup> | Coef | SID <sup>1</sup> | Coef |
| Crude Protein, %                            | 8.79  | 100.0 | -                | -    | -                | -    |
| Lysine, %                                   | 0.28  | 3.19  | -                | -    | -                | -    |
| Methionine, %                               | 0.07  | 0.80  | -                | -    | -                | -    |
| Met + Cys, %                                | -     | -     | -                | -    | -                | -    |
| Threonine, %                                | 0.27  | 3.07  | -                | -    | -                | -    |
| Tryptophan, %                               | 0.05  | 0.57  | -                | -    | -                | -    |
| Arginine, %                                 | 0.43  | 4.89  | -                | -    | -                | -    |
| Gly + Ser, %                                | -     | -     | -                | -    | -                | -    |
| Valine, %                                   | 0.54  | 6.14  | -                | -    | -                | -    |
| Isoleucine, %                               | 0.26  | 2.96  | -                | -    | -                | -    |
| Leucine, %                                  | 0.59  | 6.71  | -                | -    | -                | -    |
| Histidine, %                                | 0.12  | 1.37  | -                | -    | -                | -    |
| Phenylalanine, %                            | 0.20  | 2.28  | -                | -    | -                | -    |
| Phe + Tyr, %                                | 0.47  | 5.35  | -                | -    | -                | -    |
| Alanine, %                                  | -     | -     | -                | -    | -                | -    |
| Cysteine, %                                 | -     | -     | -                | -    | -                | -    |
| Tyrosine, %                                 | 0.27  | 3.07  | -                | -    | -                | -    |
| Glycine, %                                  | -     | -     | -                | -    | -                | -    |
| Serine, %                                   | -     | -     | -                | -    | -                | -    |
| Proline, %                                  | -     | -     | -                | -    | -                | -    |
| Glutamine <sup>2</sup> , %                  | -     | -     | -                | -    | -                | -    |
| Glutamic Acid <sup>2</sup> , %              | -     | -     | -                | -    | -                | -    |
| Asparagine <sup>2</sup> , %                 | -     | -     | -                | -    | -                | -    |
| Aspartic Acid <sup>2</sup> , %              | -     | -     | -                | -    | -                | -    |
| Total Nitrogen (PB/6.25), %                 | 1.41  | 16.0  | -                | -    | -                | -    |
| Essential Nitrogen Poultry, %               | -     | -     | -                | -    | -                | -    |
| Essential Nitrogen Swine, %                 | -     | -     | -                | -    | -                | -    |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |          |             |           |
|--------------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                                    | Starter             | Grower |          |             |           |
|                                                                    | 3                   | 4      |          | 5           |           |
| <b>Practical Maximum</b>                                           | 5                   | 8      |          | 10          |           |
|                                                                    | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                                    | 3                   | 5      | 7        | 7           | 5         |
| <b>Practical Maximum</b>                                           | 6                   | 8      | 10       | 10          | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Babassu, Meal**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 91.8 | 4 | 1.64 | Organic Matter (OM)          | 87.1 |        |
| Crude Protein (CP)        | 20.3 | 4 | 0.60 | Coef. Dig. OM Swine          | -    |        |
| Starch                    | 2.46 | 1 | -    | Digestible OM Swine          | -    |        |
| Crude Fiber (CF)          | 47.5 | 2 | 0.00 | Undig. OM Pigs               | -    |        |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 1.96 | 3 0.32 |
| NDF                       | 66.2 | 3 | 5.24 | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | -    |        |
| ADF                       | 39.5 | 3 | 4.45 | Coef. Dig. EE Swine          | -    |        |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | -    |        |
| N-Free Extract (NFE)      | 17.4 |   |      | Linoleic Acid                | -    | - -    |
| Coef. Dig. NFE Poultry    | -    |   |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    |   |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |   |      |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 4380 | 2 | 244  | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | -    |        |
| Metabolizable Energy      | 1116 |   |      | Metabolizable Energy         | -    |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | -    |        |
| Net Energy                | -    |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | -    |        |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | -    |        |
| Net Energy                | -    |   |      | Net Energy                   | -    |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 4.68 | 3 | 1.07 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 118  | 1 -    |
| Potassium (K)             | -    | - | -    | Iron (Fe)                    | 350  | 1 -    |
| Sodium (Na)               | -    | - | -    | Copper (Cu)                  | 16.8 | 1 -    |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | 38.2 | 1 -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.38 | 1 | -    |                              |      |        |
| Total Calcium (Ca)        | 0.12 | 3 | 0.01 |                              |      |        |
| Total Phosphorus (P)      | 0.94 | 3 | 0.50 |                              |      |        |
| Phytate P                 | 0.82 | 1 | -    |                              |      |        |
| Available P (Pav)         | 0.41 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | -    |   |      |                              |      |        |
| Std. Dig. P Poultry       | -    |   |      |                              |      |        |
| Coef. Dig. P Swine        | -    |   |      |                              |      |        |
| Std. Dig. P Swine         | -    |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Babassu Meal**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 20.3  | 100   | 14.5             | 71.6  | -                | -     |
| Lysine, %                                   | 0.67  | 3.30  | 0.39             | 57.6  | -                | -     |
| Methionine, %                               | 0.45  | 2.22  | 0.38             | 84.1  | -                | -     |
| Met + Cys, %                                | 0.62  | 3.05  | 0.41             | 66.3  | -                | -     |
| Threonine, %                                | 0.62  | 3.05  | 0.36             | 57.4  | -                | -     |
| Tryptophan, %                               | 0.12  | 0.59  | -                | -     | -                | -     |
| Arginine, %                                 | 2.39  | 11.8  | 1.92             | 80.3  | -                | -     |
| Gly + Ser, %                                | 1.83  | 9.01  | 0.99             | 54.1  | -                | -     |
| Valine, %                                   | 0.95  | 4.68  | 0.73             | 77.1  | -                | -     |
| Isoleucine, %                               | 0.64  | 3.15  | 0.48             | 75.5  | -                | -     |
| Leucine, %                                  | 1.26  | 6.21  | 0.97             | 76.8  | -                | -     |
| Histidine, %                                | 0.37  | 1.82  | 0.24             | 63.9  | -                | -     |
| Phenylalanine, %                            | 0.90  | 4.43  | 0.67             | 74.3  | -                | -     |
| Phe + Tyr, %                                | 1.36  | 6.70  | 0.94             | 69.1  | -                | -     |
| Alanine, %                                  | 0.86  | 4.24  | 0.62             | 72.6  | -                | -     |
| Cysteine, %                                 | 0.17  | 0.84  | 0.03             | 19.3  | -                | -     |
| Tyrosine, %                                 | 0.46  | 2.27  | 0.27             | 58.9  | -                | -     |
| Glycine, %                                  | 0.93  | 4.58  | 0.35             | 38.0  | -                | -     |
| Serine, %                                   | 0.90  | 4.43  | 0.64             | 70.7  | -                | -     |
| Proline, %                                  | -     | -     | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | 2.40  | 11.8  | 1.92             | 80.3  | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | 1.50  | 7.41  | 1.21             | 80.3  | -                | -     |
| Asparagine <sup>2</sup> , %                 | 0.77  | 3.78  | 0.55             | 71.2  | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | 0.94  | 4.64  | 0.67             | 71.2  | -                | -     |
| Total Nitrogen (PB/6.25), %                 | 3.25  | 16.0  | 2.33             | 71.6  | -                | -     |
| Essential Nitrogen Poultry, %               | 1.82  | 55.9* | 1.27             | 69.8  | -                | -     |
| Essential Nitrogen Swine, %                 | 1.52  | 46.8* | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 4      |          | 5         |           |
|                                                             | 6            | 8      |          | 8         |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 4      | 5        | 5         | 4         |
|                                                             | 5            | 7      | 8        | 10        | 7         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Babassu, Starch Flour**

| Main Components (%)       |      |   |    |                              |      |   |    |
|---------------------------|------|---|----|------------------------------|------|---|----|
|                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                | 86.3 | 1 | -  | Organic Matter (OM)          | 83.8 |   |    |
| Crude Protein (CP)        | 1.91 | 1 | -  | Coef. Dig. OM Swine          | -    |   |    |
| Starch                    | -    | - | -  | Digestible OM Swine          | -    |   |    |
| Crude Fiber (CF)          | 9.69 | 1 | -  | Undig. OM Pigs               | -    |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 0.29 | 1 | -  |
| NDF                       | 37.1 | 1 | -  | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -    |   |    |
| ADF                       | 15.1 | 1 | -  | Coef. Dig. EE Swine          | -    |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -    |   |    |
| N-Free Extract (NFE)      | 71.9 |   |    | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry    | -    |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry   | -    |   |    |                              |      |   |    |
|                           |      |   |    |                              |      |   |    |
| Energy (kcal/kg)          |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy              | 3687 | 1 | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | -    |   |    |
| Metabolizable Energy      | 1731 |   |    | Metabolizable Energy         | -    |   |    |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | -    |   |    |
| Net Energy                | -    |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -    |   |    |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -    |   |    |
| Net Energy                | -    |   |    | Net Energy                   | -    |   |    |
|                           |      |   |    |                              |      |   |    |
| Minerals                  |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Ash, %                    | 2.50 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - | -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |   |    |
| Total Calcium (Ca)        | -    | - | -  |                              |      |   |    |
| Total Phosphorus (P)      | -    | - | -  |                              |      |   |    |
| Phytate P                 | -    | - | -  |                              |      |   |    |
| Available P (Pav)         | -    |   |    |                              |      |   |    |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |   |    |
| Std. Dig. P Poultry       | -    |   |    |                              |      |   |    |
| Coef. Dig. P Swine        | -    |   |    |                              |      |   |    |
| Std. Dig. P Swine         | -    |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Babassu, Starch Flour**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |      |
|--------------------------------------|-------|-------|------------------|-------|------------------|------|
|                                      | Total | % CP  | Poultry          |       | Swine            |      |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef |
| Crude Protein, %                     | 1.91  | 100   | -                | -     | -                | -    |
| Lysine, %                            | 0.10  | 5.24  | -                | -     | -                | -    |
| Methionine, %                        | 0.03  | 1.57  | -                | -     | -                | -    |
| Met + Cys, %                         | 0.08  | 4.19  | -                | -     | -                | -    |
| Threonine, %                         | 0.11  | 5.76  | -                | -     | -                | -    |
| Tryptophan, %                        | -     | -     | -                | -     | -                | -    |
| Arginine, %                          | 0.11  | 5.76  | -                | -     | -                | -    |
| Gly + Ser, %                         | 0.26  | 13.6  | -                | -     | -                | -    |
| Valine, %                            | 0.11  | 5.76  | -                | -     | -                | -    |
| Isoleucine, %                        | 0.08  | 4.19  | -                | -     | -                | -    |
| Leucine, %                           | 0.16  | 8.38  | -                | -     | -                | -    |
| Histidine, %                         | 0.05  | 2.62  | -                | -     | -                | -    |
| Phenylalanine, %                     | 0.10  | 5.24  | -                | -     | -                | -    |
| Phe + Tyr, %                         | 0.17  | 8.90  | -                | -     | -                | -    |
| Alanine, %                           | 0.12  | 6.28  | -                | -     | -                | -    |
| Cistina, %                           | 0.05  | 2.62  | -                | -     | -                | -    |
| Tyrosine, %                          | 0.07  | 3.66  | -                | -     | -                | -    |
| Glycine, %                           | 0.13  | 6.81  | -                | -     | -                | -    |
| Serine, %                            | 0.13  | 6.81  | -                | -     | -                | -    |
| Proline, %                           | -     | -     | -                | -     | -                | -    |
| Glutamine <sup>2</sup> , %           | 0.12  | 6.43  | -                | -     | -                | -    |
| Glutamic Acid <sup>2</sup> , %       | 0.08  | 4.04  | -                | -     | -                | -    |
| Asparagine <sup>2</sup> , %          | 0.09  | 4.70  | -                | -     | -                | -    |
| Aspartic Acid <sup>2</sup> , %       | 0.11  | 5.77  | -                | -     | -                | -    |
| Total Nitrogen (PB/6.25), %          | 0.31  | 16.0  | -                | -     | -                | -    |
| Essential Nitrogen Poultry, %        | 0.17  | 56.5* | -                | -     | -                | -    |
| Essential Nitrogen Swine, %          | 0.13  | 42.9* | -                | -     | -                | -    |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
| <b>Practical</b>                                            | -                   | -      | -           |             |           |
| <b>Maximum</b>                                              | -                   | -      | -           |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                            | -                   | -      | -           | -           | -         |
| <b>Maximum</b>                                              | -                   | -      | -           | -           | -         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bakery, By-products**

| Main Components (%)       |      |    |      |                              |       |        |
|---------------------------|------|----|------|------------------------------|-------|--------|
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Dry Matter                | 92.5 | 12 | 1.07 | Organic Matter (OM)          | 91.2  |        |
| Crude Protein, %          | 8.76 | 14 | 2.14 | Coef. Dig. OM Swine          | 79.1  |        |
| Starch                    | 46.5 | 1  | -    | Digestible OM Swine          | 72.1  |        |
| Crude Fiber (CF)          | 1.57 | 6  | 0.37 | Undig. OM Pigs               | 19.1  |        |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 8.96  | 7 3.18 |
| NDF                       | 4.36 | 3  | 2.14 | Coef. Dig. EE Poultry        | 99.0  |        |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 8.87  |        |
| ADF                       | 1.61 | 3  | 0.59 | Coef. Dig. EE Swine          | 90.0  |        |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 8.06  |        |
| N-Free Extract (NFE)      | 71.9 |    |      | Linoleic Acid                | 1.79  | 2 0.27 |
| Coef. Dig. NFE Poultry    | 96.5 |    |      | Linolenic Acid               | -     | - -    |
| Digestible NFE Poultry    | 69.4 |    |      |                              |       |        |
| Undig. NFE + CF Poultry   | 4.09 |    |      |                              |       |        |
| Energy (kcal/kg)          |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Gross Energy              | 4341 | 4  | 136  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3551  |        |
| Metabolizable Energy      | 4010 |    |      | Metabolizable Energy         | 3480  |        |
| Std. Metab. Energy        | 4217 |    |      | Net Energy                   | 2756  |        |
| Net Energy                | 3279 |    |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3721  |        |
| Metabolizable Energy      | 4019 |    |      | Metabolizable Energy         | 3619  |        |
| Net Energy                | 3287 |    |      | Net Energy                   | 2857  |        |
| Minerals                  |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Ash, %                    | 1.31 | 3  | 0.64 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 13.4  | 1 -    |
| Potassium (K)             | 0.17 | 1  | -    | Iron (Fe)                    | 125.1 | 1 -    |
| Sodium (Na)               | 0.19 | 1  | -    | Copper (Cu)                  | 3.20  | 1 -    |
| Chlorine (Cl)             | 0.30 | 1  | -    | Zinc (Zn)                    | 61.5  | 1 -    |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -     | - -    |
| Magnesium (Mg)            | 0.04 | 1  | -    |                              |       |        |
| Total Calcium (Ca)        | 0.05 | 3  | 0.02 |                              |       |        |
| Total Phosphorus (P)      | 0.15 | 3  | 0.02 |                              |       |        |
| Phytate P                 | 0.10 | 1  | -    |                              |       |        |
| Available P (Pav)         | 0.05 |    |      |                              |       |        |
| Coef. Dig. P Poultry      | 28.0 |    |      |                              |       |        |
| Std. Dig. P Poultry       | 0.04 |    |      |                              |       |        |
| Coef. Dig. P Swine        | 28.0 |    |      |                              |       |        |
| Std. Dig. P Swine         | 0.04 |    |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bakery, By-products**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 8.76  | 100   | 7.21             | 82.4  | 7.80             | 89.1  |
| Lysine, %                                   | 0.23  | 2.63  | 0.15             | 66.8  | 0.19             | 84.0  |
| Methionine, %                               | 0.13  | 1.48  | 0.11             | 84.1  | 0.11             | 86.7  |
| Met + Cys, %                                | 0.29  | 3.31  | 0.23             | 78.5  | 0.26             | 88.0  |
| Threonine, %                                | 0.27  | 3.08  | 0.16             | 60.7  | 0.23             | 83.5  |
| Tryptophan, %                               | 0.10  | 1.14  | 0.08             | 78.9  | 0.08             | 78.9  |
| Arginine, %                                 | 0.36  | 4.11  | 0.30             | 84.4  | 0.30             | 83.5  |
| Gly + Ser, %                                | 0.79  | 9.02  | 0.61             | 77.8  |                  |       |
| Valine, %                                   | 0.37  | 4.23  | 0.29             | 77.7  | 0.32             | 87.8  |
| Isoleucine, %                               | 0.30  | 3.43  | 0.25             | 83.7  | 0.26             | 88.2  |
| Leucine, %                                  | 0.59  | 6.74  | 0.51             | 87.1  | 0.49             | 83.5  |
| Histidine, %                                | 0.19  | 2.17  | 0.14             | 76.3  | 0.16             | 83.5  |
| Phenylalanine, %                            | 0.39  | 4.45  | 0.35             | 88.7  | 0.33             | 83.5  |
| Phe + Tyr, %                                | 0.66  | 7.54  | 0.57             | 86.0  | 0.55             | 83.5  |
| Alanine, %                                  | 0.34  | 3.88  | 0.25             | 74.9  | 0.30             | 87.6  |
| Cysteine, %                                 | 0.16  | 1.83  | 0.12             | 74.0  | 0.14             | 89.1  |
| Tyrosine, %                                 | 0.27  | 3.08  | 0.22             | 82.2  | 0.23             | 83.5  |
| Glycine, %                                  | 0.40  | 4.57  | 0.32             | 79.5  | 0.36             | 89.9  |
| Serine, %                                   | 0.39  | 4.45  | 0.30             | 76.1  | 0.36             | 91.5  |
| Proline, %                                  | 0.90  | 10.3  | 0.71             | 78.6  | 0.76             | 84.9  |
| Glutamine <sup>2</sup> , %                  | 1.00  | 11.5  | 0.93             | 93.0  | 0.97             | 97.0  |
| Glutamic Acid <sup>2</sup> , %              | 1.34  | 15.3  | 1.24             | 93.0  | 1.30             | 97.0  |
| Asparagine <sup>2</sup> , %                 | 0.23  | 2.63  | 0.15             | 66.6  | 0.20             | 88.2  |
| Aspartic Acid <sup>2</sup> , %              | 0.26  | 2.96  | 0.17             | 66.6  | 0.23             | 88.2  |
| Total Nitrogen (PB/6.25), %                 | 1.40  | 16.0  | 1.15             | 82.4  | 1.25             | 89.1  |
| Essential Nitrogen Poultry, %               | 0.57  | 40.5* | 0.45             | 79.8  |                  |       |
| Essential Nitrogen Swine, %                 | 0.44  | 31.5* |                  |       | 0.37             | 84.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 5                   | 8      | 8           |             |           |
| <b>Practical</b>                                                   |                     |        |             |             |           |
| <b>Maximum</b>                                                     | 10                  | 15     | 15          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 8                   | 10     | 15          | 10          | 10        |
| <b>Practical</b>                                                   |                     |        |             |             |           |
| <b>Maximum</b>                                                     | 15                  | 20     | 30          | 20          | 20        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Barley, Grain**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 87.7 | 36 | 0.85 | Organic Matter (OM)          | 85.5 |         |
| Crude Protein (CP)        | 10.3 | 36 | 1.57 | Coef. Dig. OM Swine          | 81.5 |         |
| Starch                    | 52.1 | 4  | 0.66 | Digestible OM Swine          | 69.7 |         |
| Crude Fiber (CF)          | 4.74 | 29 | 0.97 | Undig. OM Pigs               | 15.8 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 2.02 | 36 0.37 |
| NDF                       | 16.2 | 6  | 1.98 | Coef. Dig. EE Poultry        | 54.0 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 1.09 |         |
| ADF                       | 5.31 | 4  | 0.66 | Coef. Dig. EE Swine          | 56.0 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.13 |         |
| N-Free Extract (NFE)      | 68.5 |    |      | Linoleic Acid                | -    | - -     |
| Coef. Dig. NFE Poultry    | 79.0 |    |      | Linolenic Acid               | -    | - -     |
| Digestible NFE Poultry    | 54.1 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 19.1 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 3857 | 12 | 48   | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3106 |         |
| Metabolizable Energy      | 2701 |    |      | Metabolizable Energy         | 3019 |         |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 2308 |         |
| Net Energy                | 2154 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3231 |         |
| Metabolizable Energy      | 2768 |    |      | Metabolizable Energy         | 3133 |         |
| Net Energy                | 2221 |    |      | Net Energy                   | 2391 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 2.18 | 36 | 0.25 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 16.2 | 2 0.21  |
| Potassium (K)             | 0.43 | 2  | 0.07 | Iron (Fe)                    | 116  | 2 58.7  |
| Sodium (Na)               | 0.02 | 2  | 0.01 | Copper (Cu)                  | 7.22 | 2 2.52  |
| Chlorine (Cl)             | 0.12 | 2  | 0.01 | Zinc (Zn)                    | 29.0 | 2 1.41  |
| Sulfur (S)                | 0.13 | 2  | 0.00 | Selenium (Se)                | 0.11 | 2 0.01  |
| Magnesium (Mg)            | 0.13 | 2  | 0.02 |                              |      |         |
| Total Calcium (Ca)        | 0.04 | 14 | 0.01 |                              |      |         |
| Total Phosphorus (P)      | 0.35 | 14 | 0.06 |                              |      |         |
| Phytate P                 | 0.20 | 2  | 0.02 |                              |      |         |
| Available P (Pav)         | 0.15 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.13 |    |      |                              |      |         |
| Coef. Dig. P Swine        | -    |    |      |                              |      |         |
| Std. Dig. P Swine         | -    |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Barley, Grain**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 10.3  | 100   | 8.57             | 83.5  | 8.42             | 82.1  |
| Lysine, %                                   | 0.41  | 4.00  | 0.32             | 79.0  | 0.30             | 73.7  |
| Methionine, %                               | 0.18  | 1.75  | 0.15             | 82.4  | 0.15             | 82.0  |
| Met + Cys, %                                | 0.44  | 4.29  | 0.36             | 82.5  | 0.36             | 82.0  |
| Threonine, %                                | 0.36  | 3.51  | 0.27             | 74.3  | 0.27             | 74.3  |
| Tryptophan, %                               | 0.13  | 1.27  | 0.10             | 79.0  | 0.10             | 76.9  |
| Arginine, %                                 | 0.53  | 5.17  | 0.44             | 83.3  | 0.44             | 83.3  |
| Gly + Ser, %                                | 0.90  | 8.77  | 0.76             | 84.2  |                  |       |
| Valine, %                                   | 0.48  | 4.68  | 0.38             | 78.9  | 0.38             | 78.9  |
| Isoleucine, %                               | 0.36  | 3.51  | 0.29             | 80.6  | 0.29             | 80.6  |
| Leucine, %                                  | 0.73  | 7.12  | 0.60             | 82.6  | 0.60             | 82.6  |
| Histidine, %                                | 0.25  | 2.44  | 0.22             | 86.4  | 0.20             | 81.8  |
| Phenylalanine, %                            | 0.52  | 5.07  | 0.45             | 85.7  | 0.44             | 83.7  |
| Phe + Tyr, %                                | 0.83  | 8.09  | 0.70             | 84.4  | 0.70             | 84.4  |
| Alanine, %                                  | 0.43  | 4.19  | 0.31             | 73.2  | 0.30             | 70.7  |
| Cysteine, %                                 | 0.26  | 2.53  | 0.21             | 82.6  | 0.21             | 82.0  |
| Tyrosine, %                                 | 0.31  | 3.02  | 0.25             | 82.1  | 0.27             | 85.7  |
| Glycine, %                                  | 0.44  | 4.29  | 0.40             | 90.0  | 0.34             | 77.5  |
| Serine, %                                   | 0.46  | 4.48  | 0.36             | 78.6  | 0.37             | 81.0  |
| Proline, %                                  | 1.12  | 10.9  | 0.98             | 87.2  | 0.95             | 84.4  |
| Glutamine <sup>2</sup> , %                  | 1.57  | 15.3  | 1.40             | 89.2  | 1.38             | 88.3  |
| Glutamic Acid <sup>2</sup> , %              | 0.98  | 9.58  | 0.88             | 89.2  | 0.87             | 88.3  |
| Asparagine <sup>2</sup> , %                 | 0.32  | 3.11  | 0.24             | 75.0  | 0.24             | 75.0  |
| Aspartic Acid <sup>2</sup> , %              | 0.39  | 3.82  | 0.29             | 75.0  | 0.29             | 75.0  |
| Total Nitrogen (PB/6.25), %                 | 1.64  | 16.0  | 1.37             | 83.5  | 1.35             | 82.1  |
| Essential Nitrogen Poultry, %               | 0.76  | 46.0* | 0.62             | 82.0  |                  |       |
| Essential Nitrogen Swine, %                 | 0.61  | 37.3* |                  |       | 0.49             | 80.3  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 8                   | 10     | 12          |             |           |
| <b>Practical Maximum</b>                                           | 15                  | 20     | 20          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 5                   | 10     | 15          | 15          | 10        |
| <b>Practical Maximum</b>                                           | 15                  | 20     | 25          | 25          | 20        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Blood, Meal**

| Main Components (%)       |      |   |      |                              |        |        |
|---------------------------|------|---|------|------------------------------|--------|--------|
|                           | Mean | n | SD   |                              | Mean   | n SD   |
| Dry Matter                | 92.7 | 5 | 0.96 | Organic Matter (OM)          | 89.3   |        |
| Crude Protein (CP)        | 85.8 | 6 | 2.98 | Coef. Dig. OM Swine          | 66.3   |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 59.1   |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 30.1   |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 0.60   | 5 0.36 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | 30.0   |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | 0.18   |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 70.0   |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 0.42   |        |
| N-Free Extract (NFE)      | 2.85 |   |      | Linoleic Acid                | -      | - -    |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | -      | - -    |
| Digestible NFE Poultry    | -    | - | -    |                              |        |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |        |        |
| Energy (kcal/kg)          |      |   |      |                              |        |        |
|                           | Mean | n | SD   |                              | Mean   | n SD   |
| Gross Energy              | 5103 | 4 | 61   | <b>Swine</b>                 |        |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3381   |        |
| Metabolizable Energy      | 2857 |   |      | Metabolizable Energy         | 2986   |        |
| Std. Metab. Energy        | 3067 |   |      | Net Energy                   | 1613   |        |
| Net Energy                | 2167 |   |      | <b>Sows</b>                  |        |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3381   |        |
| Metabolizable Energy      | 2857 |   |      | Metabolizable Energy         | 2986   |        |
| Net Energy                | 2167 |   |      | Net Energy                   | 1613   |        |
| Minerals                  |      |   |      |                              |        |        |
|                           | Mean | n | SD   |                              | Mean   | n SD   |
| Ash, %                    | 3.45 | 5 | 0.03 | <b>Trace Minerals, mg/kg</b> |        |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 7.3    | 1 -    |
| Potassium (K)             | 0.23 | 4 | 0.05 | Iron (Fe)                    | 1664.2 | 1 -    |
| Sodium (Na)               | 0.57 | 3 | 0.18 | Copper (Cu)                  | 13.8   | 1 -    |
| Chlorine (Cl)             | 0.36 | 1 | -    | Zinc (Zn)                    | 36.1   | 1 -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | 0.58   | 1 -    |
| Magnesium (Mg)            | 0.10 | 1 | -    |                              |        |        |
| Total Calcium (Ca)        | 0.20 | 5 | 0.06 |                              |        |        |
| Total Phosphorus (P)      | 0.24 | 5 | 0.05 |                              |        |        |
| Phytate P                 | -    | - | -    |                              |        |        |
| Available P (Pav)         | 0.24 |   |      |                              |        |        |
| Coef. Dig. P Poultry      | 92.0 |   |      |                              |        |        |
| Std. Dig. P Poultry       | 0.22 |   |      |                              |        |        |
| Coef. Dig. P Swine        | 92.0 |   |      |                              |        |        |
| Std. Dig. P Swine         | 0.22 |   |      |                              |        |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Blood, Meal**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 85.8  | 100   | 66.6             | 77.6  | 65.0             | 75.7  |
| Lysine, %                                   | 7.70  | 8.97  | 6.08             | 78.9  | 6.08             | 79.0  |
| Methionine, %                               | 1.06  | 1.24  | 0.84             | 79.6  | 0.75             | 70.7  |
| Met + Cys, %                                | 1.70  | 1.98  | 1.32             | 77.6  | 1.25             | 73.8  |
| Threonine, %                                | 4.14  | 4.83  | 3.27             | 78.9  | 3.03             | 73.3  |
| Tryptophan, %                               | 1.46  | 1.70  | 1.17             | 80.2  | 1.12             | 76.4  |
| Arginine, %                                 | 3.47  | 4.04  | 2.86             | 82.4  | 2.78             | 80.0  |
| Gly + Ser, %                                | 8.10  | 9.44  | 6.16             | 76.0  |                  |       |
| Valine, %                                   | 7.49  | 8.73  | 5.96             | 79.6  | 5.48             | 73.2  |
| Isoleucine, %                               | 0.69  | 0.80  | 0.50             | 73.1  | 0.56             | 80.7  |
| Leucine, %                                  | 11.2  | 13.1  | 9.18             | 82.0  | 7.78             | 69.5  |
| Histidine, %                                | 5.32  | 6.20  | 4.23             | 79.5  | 3.80             | 71.4  |
| Phenylalanine, %                            | 6.27  | 7.31  | 5.12             | 81.7  | 4.58             | 73.1  |
| Phe + Tyr, %                                | 8.50  | 9.91  | 6.52             | 76.7  | 6.42             | 75.5  |
| Alanine, %                                  | 7.19  | 8.38  | 5.46             | 76.0  | -                | -     |
| Cysteine, %                                 | 0.64  | 0.75  | 0.48             | 74.3  | 0.51             | 79.0  |
| Tyrosine, %                                 | 2.23  | 2.60  | 1.40             | 62.8  | 1.83             | 82.2  |
| Glycine, %                                  | 3.62  | 4.22  | -                | -     | -                | -     |
| Serine, %                                   | 4.48  | 5.22  | -                | -     | -                | -     |
| Proline, %                                  | 3.46  | 4.03  | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | 3.08  | 3.59  | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | 4.56  | 5.31  | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | 4.03  | 4.69  | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | 5.34  | 6.23  | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | 13.7  | 16.0  | 10.7             | 77.6  | 10.4             | 75.7  |
| Essential Nitrogen Poultry, %               | 8.79  | 64.0* | -                | -     |                  |       |
| Essential Nitrogen Swine, %                 | 7.52  | 54.7* |                  |       | 5.54             | 73.7  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 1                   | 2      | 1           |             |           |
| <b>Practical Maximum</b>                                           | 2                   | 3      | 2           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 1                   | 1      | 2           | 2           | 1         |
| <b>Practical Maximum</b>                                           | 2                   | 3      | 4           | 4           | 3         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Blood, Plasma**

| Main Components (%)       |      |    |      |                              |       |        |
|---------------------------|------|----|------|------------------------------|-------|--------|
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Dry Matter                | 91.3 | 10 | 1.73 | Organic Matter (OM)          | 79.4  |        |
| Crude Protein (CP)        | 71.7 | 11 | 3.83 | Coef. Dig. OM Swine          | 90.6  |        |
| Starch                    | -    | -  | -    | Digestible OM Swine          | 71.9  |        |
| Crude Fiber (CF)          | -    | -  | -    | Undig. OM Pigs               | 7.47  |        |
| Coef. Dig. CF Swine       | -    | -  | -    | Ether Extract (EE)           | 1.03  | 5 0.41 |
| NDF                       | -    | -  | -    | Coef. Dig. EE Poultry        | 95.0  |        |
| Coef. Dig. NDF Swine      | -    | -  | -    | Digestible EE Poultry        | 0.98  |        |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 95.0  |        |
| Coef. Dig. ADF Swine      | -    | -  | -    | Digestible EE Swine          | 0.98  |        |
| N-Free Extract (NFE)      | 6.67 |    |      | Linoleic Acid                | -     | - -    |
| Coef. Dig. NFE Poultry    | -    | -  | -    | Linolenic Acid               | -     | - -    |
| Digestible NFE Poultry    | -    | -  | -    |                              |       |        |
| Undig. NFE + CF Poultry   | -    | -  | -    |                              |       |        |
| Energy (kcal/kg)          |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Gross Energy              | 4550 | 5  | 177  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 4122  |        |
| Metabolizable Energy      | 3234 |    |      | Metabolizable Energy         | 3763  |        |
| Std. Metab. Energy        | 3304 |    |      | Net Energy                   | 2280  |        |
| Net Energy                | 2534 |    |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 4122  |        |
| Metabolizable Energy      | 3234 |    |      | Metabolizable Energy         | 3763  |        |
| Net Energy                | 2534 |    |      | Net Energy                   | 2280  |        |
| Minerals                  |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Ash, %                    | 11.9 | 5  | 2.35 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -     | - -    |
| Potassium (K)             | 0.56 | 1  | -    | Iron (Fe)                    | 106.0 | 1 -    |
| Sodium (Na)               | 3.12 | 1  | -    | Copper (Cu)                  | 45.9  | 1 -    |
| Chlorine (Cl)             | -    | -  | -    | Zinc (Zn)                    | 89.2  | 1 -    |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | 0.42  | 1 -    |
| Magnesium (Mg)            | 0.02 | 1  | -    |                              |       |        |
| Total Calcium (Ca)        | 0.17 | 5  | 0.03 |                              |       |        |
| Total Phosphorus (P)      | 0.46 | 4  | 0.02 |                              |       |        |
| Phytate P                 | -    | -  | -    |                              |       |        |
| Available P (Pav)         | 0.46 |    |      |                              |       |        |
| Coef. Dig. P Poultry      | 92.0 |    |      |                              |       |        |
| Std. Dig. P Poultry       | 0.42 |    |      |                              |       |        |
| Coef. Dig. P Swine        | 92.0 |    |      |                              |       |        |
| Std. Dig. P Swine         | 0.42 |    |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Blood, Plasma**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 71.7  | 100   | 66.8             | 93.2  | 66.4             | 92.6  |
| Lysine, %                            | 6.52  | 9.09  | 6.09             | 93.4  | 6.20             | 95.1  |
| Methionine, %                        | 0.89  | 1.24  | 0.83             | 93.2  | 0.83             | 93.5  |
| Met + Cys, %                         | 3.07  | 4.28  | 2.81             | 91.5  | 2.85             | 92.9  |
| Threonine, %                         | 4.47  | 6.23  | 4.18             | 93.5  | 4.13             | 92.5  |
| Tryptophan, %                        | 1.31  | 1.83  | 1.13             | 86.4  | 1.18             | 90.2  |
| Arginine, %                          | 3.95  | 5.51  | 3.66             | 92.7  | 3.80             | 96.1  |
| Gly + Ser, %                         | 7.17  | 10.0  | 6.65             | 92.7  |                  |       |
| Valine, %                            | 4.92  | 6.86  | 4.42             | 89.9  | 4.60             | 93.5  |
| Isoleucine, %                        | 2.26  | 3.15  | 1.89             | 83.8  | 2.02             | 89.5  |
| Leucine, %                           | 6.97  | 9.72  | 6.57             | 94.3  | 6.50             | 93.2  |
| Histidine, %                         | 2.21  | 3.08  | 2.05             | 92.6  | 2.10             | 95.1  |
| Phenylalanine, %                     | 3.90  | 5.44  | 3.70             | 95.0  | 3.64             | 93.3  |
| Phe + Tyr, %                         | 6.97  | 9.72  | 6.68             | 95.8  | 6.48             | 93.0  |
| Alanine, %                           | 3.74  | 5.22  | 3.57             | 95.5  | 3.47             | 92.7  |
| Cysteine, %                          | 2.18  | 3.04  | 1.98             | 90.8  | 2.02             | 92.7  |
| Tyrosine, %                          | 3.07  | 4.28  | 2.97             | 96.9  | 2.85             | 92.7  |
| Glycine, %                           | 2.64  | 3.68  | 2.44             | 92.3  | 2.39             | 90.7  |
| Serine, %                            | 4.53  | 6.32  | 4.21             | 93.0  | 4.29             | 94.7  |
| Proline, %                           | 3.90  | 5.44  | 3.64             | 93.5  | 3.03             | 77.8  |
| Glutamine <sup>2</sup> , %           | 3.96  | 5.52  | 3.75             | 94.7  | 3.73             | 94.1  |
| Glutamic Acid <sup>2</sup> , %       | 5.85  | 8.16  | 5.54             | 94.7  | 5.50             | 94.1  |
| Asparagine <sup>2</sup> , %          | 3.06  | 4.27  | 2.87             | 93.8  | 2.84             | 92.7  |
| Aspartic Acid <sup>2</sup> , %       | 4.07  | 5.67  | 3.81             | 93.8  | 3.77             | 92.7  |
| Total Nitrogen (PB/6.25), %          | 11.5  | 16.0  | 10.7             | 93.2  | 10.6             | 92.6  |
| Essential Nitrogen Poultry, %        | 6.91  | 60.2* | 6.38             | 92.4  |                  |       |
| Essential Nitrogen Swine, %          | 5.81  | 50.7* |                  |       | 5.44             | 93.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 1            | -      |          |           |           |
| Practical                                                   | 2            | -      |          |           |           |
| Maximum                                                     |              |        |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 4            | -      | -        | -         | -         |
| Practical                                                   | 8            | -      | -        | -         | -         |
| Maximum                                                     |              |        |          |           |           |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Blood, Red Cells**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 90.8 | 6 | 1.91 | Organic Matter (OM)          | 86.9 |        |
| Crude Protein (CP)        | 88.0 | 6 | 3.29 | Coef. Dig. OM Swine          | 86.8 |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 75.5 |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 11.5 |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 0.45 | 4 0.10 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | 30.0 |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | 0.14 |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 85.0 |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 0.38 |        |
| N-Free Extract (NFE)      | -    | - | -    | Linoleic Acid                | -    | - -    |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    | - | -    |                              |      |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 4980 | 4 | 27   | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 4300 |        |
| Metabolizable Energy      | 3200 |   |      | Metabolizable Energy         | 3787 |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 2181 |        |
| Net Energy                | 2326 |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 4300 |        |
| Metabolizable Energy      | 3200 |   |      | Metabolizable Energy         | 3787 |        |
| Net Energy                | 2326 |   |      | Net Energy                   | 2181 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 3.86 | 4 | 0.03 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.47 | 4 | 0.29 | Iron (Fe)                    | 2021 | 1 -    |
| Sodium (Na)               | 0.68 | 4 | 0.14 | Copper (Cu)                  | 13.8 | 1 -    |
| Chlorine (Cl)             | 0.80 | 1 | -    | Zinc (Zn)                    | 115  | 1 -    |
| Sulfur (S)                | 0.30 | 1 | -    | Selenium (Se)                | 0.21 | 1 -    |
| Magnesium (Mg)            | 0.02 | 2 | 0.01 |                              |      |        |
| Total Calcium (Ca)        | 0.03 | 5 | 0.01 |                              |      |        |
| Total Phosphorus (P)      | 0.25 | 5 | 0.07 |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | 0.25 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | 92.0 |   |      |                              |      |        |
| Std. Dig. P Poultry       | 0.23 |   |      |                              |      |        |
| Coef. Dig. P Swine        | 92.0 |   |      |                              |      |        |
| Std. Dig. P Swine         | 0.23 |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Blood, Red Cells**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 88.0  | 100   | 84.3             | 95.8  | 75.2             | 85.5  |
| Lysine, %                            | 8.39  | 9.53  | 7.81             | 93.1  | 7.74             | 92.2  |
| Methionine, %                        | 1.16  | 1.32  | 1.07             | 92.3  | 1.08             | 92.7  |
| Met + Cys, %                         | 1.62  | 1.84  | 1.44             | 88.9  | 1.33             | 82.4  |
| Threonine, %                         | 4.06  | 4.61  | 3.72             | 91.7  | 3.47             | 85.5  |
| Tryptophan, %                        | 1.49  | 1.69  | 1.36             | 91.6  | 1.30             | 87.3  |
| Arginine, %                          | 3.37  | 3.83  | 3.19             | 94.7  | 3.12             | 92.5  |
| Gly + Ser, %                         | 8.19  | 9.31  | 7.82             | 95.5  |                  |       |
| Valine, %                            | 8.17  | 9.28  | 7.52             | 92.1  | 7.22             | 88.4  |
| Isoleucine, %                        | 0.40  | 0.45  | 0.31             | 76.8  | 0.22             | 55.1  |
| Leucine, %                           | 12.3  | 14.0  | 12.1             | 98.2  | 11.7             | 95.0  |
| Histidine, %                         | 5.89  | 6.69  | 5.61             | 95.3  | 5.71             | 97.0  |
| Phenylalanine, %                     | 6.91  | 7.85  | 6.80             | 98.4  | 6.52             | 94.3  |
| Phe + Tyr, %                         | 10.1  | 11.5  | 9.91             | 98.1  | 9.35             | 92.6  |
| Alanine, %                           | 7.69  | 8.74  | 7.55             | 98.2  | -                | -     |
| Cysteine, %                          | 0.46  | 0.52  | 0.37             | 80.4  | 0.26             | 56.5  |
| Tyrosine, %                          | 3.19  | 3.63  | 3.11             | 97.6  | 2.84             | 89.0  |
| Glycine, %                           | 3.84  | 4.36  | 3.67             | 95.5  | -                | -     |
| Serine, %                            | 4.35  | 4.94  | 4.15             | 95.5  | -                | -     |
| Proline, %                           | 3.11  | 3.53  | 2.92             | 93.9  | -                | -     |
| Glutamine <sup>2</sup> , %           | 2.80  | 3.18  | 2.74             | 97.8  | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | 4.14  | 4.70  | 4.05             | 97.8  | -                | -     |
| Asparagine <sup>2</sup> , %          | 4.00  | 4.55  | 3.95             | 98.7  | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | 5.32  | 6.04  | 5.25             | 98.7  | -                | -     |
| Total Nitrogen (PB/6.25), %          | 14.1  | 16.0  | 13.5             | 95.8  | 12.0             | 85.5  |
| Essential Nitrogen Poultry, %        | 9.29  | 66.0* | 8.83             | 95.0  |                  |       |
| Essential Nitrogen Swine, %          | 8.00  | 56.8* |                  |       | 7.37             | 92.2  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 1            | -      |          | -         | -         |
|                                                             | 2            | -      |          | -         | -         |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | -      | -        | -         | -         |
|                                                             | 4            | -      | -        | -         | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 38% CP (35 – 40% CP)**

| Main Components (%)       |      |     |      |                       |       |          |
|---------------------------|------|-----|------|-----------------------|-------|----------|
|                           | Mean | n   | SD   |                       | Mean  | n SD     |
| Dry Matter                | 93.7 | 21  | 0.93 | Organic Matter (OM)   | 53.1  |          |
| Crude Protein (CP)        | 38.0 | 121 | 1.34 | Coef. Dig. OM Swine   | 61.5  |          |
| Starch                    | -    | -   | -    | Digestible OM Swine   | 32.6  |          |
| Crude Fiber (CF)          | -    | -   | -    | Undig. OM Pigs        | 20.4  |          |
| Coef. Dig. CF Swine       | -    | -   | -    | Ether Extract (EE)    | 12.4  | 112 1.57 |
| NDF                       | -    | -   | -    | Coef. Dig. EE Poultry | 37.0  |          |
| Coef. Dig. NDF Swine      | -    | -   | -    | Digestible EE Poultry | 4.58  |          |
| ADF                       | -    | -   | -    | Coef. Dig. EE Swine   | 27.5  |          |
| Coef. Dig. ADF Swine      | -    | -   | -    | Digestible EE Swine   | 3.41  |          |
| N-Free Extract (NFE)      | 2.70 |     |      | Linoleic Acid         | 0.34  | 4 0.03   |
| Coef. Dig. NFE Poultry    | -    | -   | -    | Linolenic Acid        | 0.08  | 4 0.01   |
| Digestible NFE Poultry    | -    | -   | -    |                       |       |          |
| Undig. NFE + CF Poultry   | -    | -   | -    |                       |       |          |
| Energy (kcal/kg)          |      |     |      |                       |       |          |
|                           | Mean | n   | SD   |                       | Mean  | n SD     |
| Gross Energy              | 3145 | 5   | 62   | <b>Swine</b>          |       |          |
| <b>Poultry</b>            |      |     |      | Digestible Energy     | 1935  |          |
| Metabolizable Energy      | 1786 |     |      | Metabolizable Energy  | 1738  |          |
| Std. Metab. Energy        | 1778 |     |      | Net Energy            | 1176  |          |
| Net Energy                | 1417 |     |      | <b>Sows</b>           |       |          |
| <b>Hens</b>               |      |     |      | Digestible Energy     | 1935  |          |
| Metabolizable Energy      | 1786 |     |      | Metabolizable Energy  | 1738  |          |
| Net Energy                | 1417 |     |      | Net Energy            | 1176  |          |
| Minerals                  |      |     |      |                       |       |          |
|                           | Mean | n   | SD   |                       | Mean  | n SD     |
| Ash, %                    | 40.7 | 112 | 2.37 | Trace Minerals, mg/kg |       |          |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)        | 11.7  | 1 -      |
| Potassium (K)             | 0.70 | 1   | -    | Iron (Fe)             | 816.0 | 1 -      |
| Sodium (Na)               | 0.41 | 1   | -    | Copper (Cu)           | 36.6  | 1 -      |
| Chlorine (Cl)             | 0.50 | 1   | -    | Zinc (Zn)             | 66.9  | 1 -      |
| Sulfur (S)                | -    | -   | -    | Selenium (Se)         | 0.42  | 1 -      |
| Magnesium (Mg)            | 0.22 | 1   | -    |                       |       |          |
| Total Calcium (Ca)        | 14.2 | 11  | 1.08 |                       |       |          |
| Total Phosphorus (P)      | 7.41 | 11  | 0.51 |                       |       |          |
| Phytate P                 | -    | -   | -    |                       |       |          |
| Available P (Pav)         | 6.67 |     |      |                       |       |          |
| Coef. Dig. P Poultry      | 62.0 |     |      |                       |       |          |
| Std. Dig. P Poultry       | 4.59 |     |      |                       |       |          |
| Coef. Dig. P Swine        | 64.0 |     |      |                       |       |          |
| Std. Dig. P Swine         | 4.74 |     |      |                       |       |          |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 38% CP (35 – 40%PB)**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 38.0                                 | 100   | 31.5             | 83.1  | 28.6             | 75.4  |
| Lysine, %                      | 1.76                                 | 4.64  | 1.38             | 78.5  | 1.28             | 72.7  |
| Methionine, %                  | 0.48                                 | 1.26  | 0.33             | 69.3  | 0.37             | 76.5  |
| Met + Cys, %                   | 0.60                                 | 1.58  | 0.42             | 70.2  | 0.44             | 73.2  |
| Threonine, %                   | 1.05                                 | 2.77  | 0.77             | 72.9  | 0.77             | 73.0  |
| Tryptophan, %                  | 0.15                                 | 0.40  | 0.11             | 74.3  | 0.11             | 73.6  |
| Arginine, %                    | 3.00                                 | 7.90  | 2.46             | 81.9  | 2.42             | 80.7  |
| Gly + Ser, %                   | 7.97                                 | 21.0  | 6.91             | 86.7  |                  |       |
| Valine, %                      | 1.40                                 | 3.69  | 1.06             | 75.6  | 1.04             | 74.4  |
| Isoleucine, %                  | 0.86                                 | 2.27  | 0.66             | 77.2  | 0.65             | 75.7  |
| Leucine, %                     | 1.84                                 | 4.85  | 1.40             | 76.0  | 1.41             | 76.5  |
| Histidine, %                   | 0.53                                 | 1.40  | 0.36             | 68.4  | 0.41             | 76.7  |
| Phenylalanine, %               | 1.31                                 | 3.45  | 1.00             | 76.7  | 0.99             | 75.9  |
| Phe + Tyr, %                   | 1.67                                 | 4.40  | 1.27             | 76.3  | 1.22             | 73.3  |
| Alanine, %                     | 3.14                                 | 8.27  | 2.83             | 90.0  | 2.34             | 74.5  |
| Cysteine, %                    | 0.12                                 | 0.32  | 0.09             | 73.9  | 0.07             | 60.2  |
| Tyrosine, %                    | 0.36                                 | 0.95  | 0.27             | 74.7  | 0.23             | 63.9  |
| Glycine, %                     | 6.60                                 | 17.4  | 5.71             | 86.5  | 5.08             | 76.9  |
| Serine, %                      | 1.37                                 | 3.61  | 1.20             | 87.5  | 0.97             | 71.0  |
| Proline, %                     | 1.89                                 | 4.98  | 1.69             | 89.3  | 1.53             | 81.0  |
| Glutamine <sup>2</sup> , %     | 0.88                                 | 2.32  | 0.79             | 89.7  | 0.63             | 71.6  |
| Glutamic Acid <sup>2</sup> , % | 1.27                                 | 3.34  | 1.14             | 89.7  | 0.91             | 71.6  |
| Asparagine <sup>2</sup> , %    | 0.55                                 | 1.44  | 0.47             | 86.0  | 0.38             | 68.6  |
| Aspartic Acid <sup>2</sup> , % | 0.76                                 | 2.01  | 0.66             | 86.0  | 0.52             | 68.6  |
| Total Nitrogen (PB/6.25), %    | 6.07                                 | 16.0  | 5.05             | 83.1  | 4.58             | 75.4  |
| Essential Nitrogen Poultry, %  | 3.62                                 | 59.5* | 2.92             | 80.8  |                  |       |
| Essential Nitrogen Swine, %    | 2.20                                 | 36.3* |                  |       | 1.68             | 76.3  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 4            | 4      | 4        |           |           |
| Practical                                                   |              |        |          |           |           |
| Maximum                                                     | 7            | 8      | 8        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 3            | 4      | 4        | 4         | 4         |
| Practical                                                   |              |        |          |           |           |
| Maximum                                                     | 5            | 6      | 7        | 7         | 7         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 43% CP (40.01 – 45.00% CP)**

| Main Components (%)       |      |     |      |                              |      |          |
|---------------------------|------|-----|------|------------------------------|------|----------|
|                           | Mean | n   | SD   |                              | Mean | n SD     |
| Dry Matter                | 93.9 | 166 | 1.53 | Organic Matter (OM)          | 57.3 |          |
| Crude Protein (CP)        | 42.8 | 538 | 1.38 | Coef. Dig. OM Swine          | 67.7 |          |
| Starch                    | -    | -   | -    | Digestible OM Swine          | 38.8 |          |
| Crude Fiber (CF)          | -    | -   | -    | Undig. OM Pigs               | 18.5 |          |
| Coef. Dig. CF Swine       | -    | -   | -    | Ether Extract (EE)           | 12.0 | 473 1.66 |
| NDF                       | -    | -   | -    | Coef. Dig. EE Poultry        | 51.8 |          |
| Coef. Dig. NDF Swine      | -    | -   | -    | Digestible EE Poultry        | 6.23 |          |
| ADF                       | -    | -   | -    | Coef. Dig. EE Swine          | 33.3 |          |
| Coef. Dig. ADF Swine      | -    | -   | -    | Digestible EE Swine          | 4.01 |          |
| N-Free Extract (NFE)      | 2.44 |     |      | Linoleic Acid                | 0.32 | 4 0.03   |
| Coef. Dig. NFE Poultry    | -    |     |      | Linolenic Acid               | 0.08 | 4 0.01   |
| Digestible NFE Poultry    | -    |     |      |                              |      |          |
| Undig. NFE + CF Poultry   | -    |     |      |                              |      |          |
| Energy (kcal/kg)          |      |     |      |                              |      |          |
|                           | Mean | n   | SD   |                              | Mean | n SD     |
| Gross Energy              | 3422 | 6   | 211  | <b>Swine</b>                 |      |          |
| <b>Poultry</b>            |      |     |      | Digestible Energy            | 2315 |          |
| Metabolizable Energy      | 2124 |     |      | Metabolizable Energy         | 2083 |          |
| Std. Metab. Energy        | 1899 |     |      | Net Energy                   | 1391 |          |
| Net Energy                | 1695 |     |      | <b>Sows</b>                  |      |          |
| <b>Hens</b>               |      |     |      | Digestible Energy            | 2315 |          |
| Metabolizable Energy      | 2124 |     |      | Metabolizable Energy         | 2083 |          |
| Net Energy                | 1695 |     |      | Net Energy                   | 1391 |          |
| Minerals                  |      |     |      |                              |      |          |
|                           | Mean | n   | SD   |                              | Mean | n SD     |
| Ash, %                    | 36.6 | 473 | 2.70 | <b>Trace Minerals, mg/kg</b> |      |          |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)               | 1.50 | 1 -      |
| Potassium (K)             | 0.55 | 3   | 0.23 | Iron (Fe)                    | 324  | 1 -      |
| Sodium (Na)               | 0.56 | 41  | 0.25 | Copper (Cu)                  | 48.0 | 1 -      |
| Chlorine (Cl)             | 0.62 | 2   | 0.02 | Zinc (Zn)                    | 69.3 | 1 -      |
| Sulfur (S)                | -    | -   | -    | Selenium (Se)                | 0.36 | 1 -      |
| Magnesium (Mg)            | 0.23 | 2   | 0.01 |                              |      |          |
| Total Calcium (Ca)        | 13.0 | 150 | 1.54 |                              |      |          |
| Total Phosphorus (P)      | 6.56 | 151 | 0.62 |                              |      |          |
| Phytate P                 | -    | -   | -    |                              |      |          |
| Available P (Pav)         | 5.91 |     |      |                              |      |          |
| Coef. Dig. P Poultry      | 62.0 |     |      |                              |      |          |
| Std. Dig. P Poultry       | 4.07 |     |      |                              |      |          |
| Coef. Dig. P Swine        | 64.0 |     |      |                              |      |          |
| Std. Dig. P Swine         | 4.20 |     |      |                              |      |          |

Pav = Non Phytate P (Total P – Phytate P).

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 43% CP (40.01 – 45.00%PB)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 42.8  | 100   | 35.9             | 83.7  | 34.4             | 80.4  |
| Lysine, %                            | 2.07  | 4.83  | 1.70             | 82.1  | 1.59             | 76.8  |
| Methionine, %                        | 0.56  | 1.31  | 0.45             | 80.4  | 0.44             | 78.6  |
| Met + Cys, %                         | 0.74  | 1.73  | 0.57             | 77.1  | 0.57             | 77.0  |
| Threonine, %                         | 1.29  | 3.01  | 1.01             | 78.3  | 0.98             | 76.0  |
| Tryptophan, %                        | 0.19  | 0.44  | 0.15             | 78.9  | 0.14             | 73.7  |
| Arginine, %                          | 3.21  | 7.49  | 2.71             | 84.4  | 2.66             | 82.9  |
| Gly + Ser, %                         | 9.20  | 21.5  | 7.61             | 82.7  |                  |       |
| Valine, %                            | 1.57  | 3.67  | 1.31             | 83.4  | 1.21             | 77.1  |
| Isoleucine, %                        | 1.03  | 2.40  | 0.87             | 84.5  | 0.81             | 78.6  |
| Leucine, %                           | 2.22  | 5.18  | 1.86             | 83.8  | 1.64             | 73.9  |
| Histidine, %                         | 0.65  | 1.52  | 0.51             | 78.5  | 0.49             | 75.4  |
| Phenylalanine, %                     | 1.35  | 3.15  | 1.13             | 83.7  | 1.07             | 79.3  |
| Phe + Tyr, %                         | 1.99  | 4.65  | 1.61             | 80.9  | 1.52             | 76.4  |
| Alanine, %                           | 3.46  | 8.08  | 2.99             | 86.4  | 2.86             | 82.7  |
| Cysteine, %                          | 0.18  | 0.42  | 0.12             | 66.7  | 0.13             | 72.2  |
| Tyrosine, %                          | 0.64  | 1.49  | 0.48             | 75.0  | 0.45             | 70.3  |
| Glycine, %                           | 7.69  | 18.0  | 6.30             | 81.9  | 6.74             | 87.6  |
| Serine, %                            | 1.51  | 3.53  | 1.31             | 86.8  | 1.20             | 79.5  |
| Proline, %                           | 4.02  | 9.39  | 3.38             | 84.1  | 3.26             | 81.1  |
| Glutamine <sup>2</sup> , %           | 1.91  | 4.46  | 1.68             | 88.0  | 1.48             | 77.5  |
| Glutamic Acid <sup>2</sup> , %       | 2.75  | 6.42  | 2.42             | 88.0  | 2.13             | 77.5  |
| Asparagine <sup>2</sup> , %          | 1.18  | 2.75  | 0.99             | 84.0  | 0.90             | 76.7  |
| Aspartic Acid <sup>2</sup> , %       | 1.63  | 3.81  | 1.37             | 84.0  | 1.25             | 76.7  |
| Total Nitrogen (PB/6.25), %          | 6.85  | 16.0  | 5.74             | 83.7  | 5.51             | 80.4  |
| Essential Nitrogen Poultry, %        | 4.12  | 60.1* | 3.41             | 82.7  |                  |       |
| Essential Nitrogen Swine, %          | 2.48  | 36.3* |                  |       | 1.94             | 78.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 4            | 4      | 4        |           |           |
| Practical Maximum                                           | 7            | 8      | 8        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 3            | 4      | 4        | 4         | 4         |
| Practical Maximum                                           | 5            | 6      | 7        | 7         | 7         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 48% CP (45.01 – 50.00% CP)**

| Main Components (%)       |      |     |      |                              |       |          |
|---------------------------|------|-----|------|------------------------------|-------|----------|
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Dry Matter                | 95.2 | 466 | 1.64 | Organic Matter (OM)          | 60.9  |          |
| Crude Protein (CP)        | 47.4 | 808 | 2.45 | Coef. Dig. OM Swine          | 71.9  |          |
| Starch                    | -    | -   | -    | Digestible OM Swine          | 43.8  |          |
| Crude Fiber (CF)          | -    | -   | -    | Undig. OM Pigs               | 17.1  |          |
| Coef. Dig. CF Swine       | -    | -   | -    | Ether Extract (EE)           | 11.8  | 782 1.92 |
| NDF                       | -    | -   | -    | Coef. Dig. EE Poultry        | 62.2  |          |
| Coef. Dig. NDF Swine      | -    | -   | -    | Digestible EE Poultry        | 7.33  |          |
| ADF                       | -    | -   | -    | Coef. Dig. EE Swine          | 47.5  |          |
| Coef. Dig. ADF Swine      | -    | -   | -    | Digestible EE Swine          | 5.60  |          |
| N-Free Extract (NFE)      | 1.70 |     |      | Linoleic Acid                | 0.36  | 2 0.01   |
| Coef. Dig. NFE Poultry    | -    | -   | -    | Linolenic Acid               | 0.08  | 2 0.00   |
| Digestible NFE Poultry    | -    | -   | -    |                              |       |          |
| Undig. NFE + CF Poultry   | -    | -   | -    |                              |       |          |
| Energy (kcal/kg)          |      |     |      |                              |       |          |
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Gross Energy              | 3665 | 4   | 276  | <b>Swine</b>                 |       |          |
| <b>Poultry</b>            |      |     |      | Digestible Energy            | 2634  |          |
| Metabolizable Energy      | 2373 |     |      | Metabolizable Energy         | 2389  |          |
| Std. Metab. Energy        | -    |     |      | Net Energy                   | 1581  |          |
| Net Energy                | 1899 |     |      | <b>Sows</b>                  |       |          |
| <b>Hens</b>               |      |     |      | Digestible Energy            | 2634  |          |
| Metabolizable Energy      | 2373 |     |      | Metabolizable Energy         | 2389  |          |
| Net Energy                | 1899 |     |      | Net Energy                   | 1581  |          |
| Minerals                  |      |     |      |                              |       |          |
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Ash, %                    | 34.3 | 782 | 3.32 | <b>Trace Minerals, mg/kg</b> |       |          |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)               | 12.9  | 1 -      |
| Potassium (K)             | 0.57 | 3   | 0.14 | Iron (Fe)                    | 449.7 | 1 -      |
| Sodium (Na)               | 0.66 | 3   | 0.08 | Copper (Cu)                  | 14.0  | 1 -      |
| Chlorine (Cl)             | 0.60 | 1   | -    | Zinc (Zn)                    | 80.6  | 1 -      |
| Sulfur (S)                | -    | -   | -    | Selenium (Se)                | 0.30  | 1 -      |
| Magnesium (Mg)            | 0.28 | 1   | -    |                              |       |          |
| Total Calcium (Ca)        | 12.0 | 440 | 1.33 |                              |       |          |
| Total Phosphorus (P)      | 5.90 | 439 | 0.64 |                              |       |          |
| Phytate P                 | -    | -   | -    |                              |       |          |
| Available P (Pav)         | 5.31 |     |      |                              |       |          |
| Coef. Dig. P Poultry      | 62.0 |     |      |                              |       |          |
| Std. Dig. P Poultry       | 3.66 |     |      |                              |       |          |
| Coef. Dig. P Swine        | 64.0 |     |      |                              |       |          |
| Std. Dig. P Swine         | 3.78 |     |      |                              |       |          |

Pav = Non Phytate P (Total P – Phytate P).

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 48% CP (45.01 – 50.00% CP)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 47.4  | 100   | 39.2             | 82.7  | 37.5             | 79.0  |
| Lysine, %                            | 2.44  | 5.14  | 2.03             | 83.2  | 1.88             | 77.0  |
| Methionine, %                        | 0.62  | 1.31  | 0.50             | 80.6  | 0.49             | 79.0  |
| Met + Cys, %                         | 0.98  | 2.07  | 0.79             | 80.6  | 0.71             | 72.4  |
| Threonine, %                         | 1.53  | 3.23  | 1.23             | 80.4  | 1.19             | 77.8  |
| Tryptophan, %                        | 0.24  | 0.51  | 0.19             | 79.2  | 0.18             | 75.0  |
| Arginine, %                          | 3.54  | 7.46  | 2.93             | 82.8  | 3.08             | 87.0  |
| Gly + Ser, %                         | 9.30  | 19.6  | 7.78             | 83.7  |                  |       |
| Valine, %                            | 1.98  | 4.17  | 1.60             | 80.8  | 1.56             | 78.8  |
| Isoleucine, %                        | 1.29  | 2.72  | 1.08             | 83.7  | 1.00             | 77.5  |
| Leucine, %                           | 2.60  | 5.48  | 2.15             | 82.7  | 2.04             | 78.5  |
| Histidine, %                         | 0.78  | 1.64  | 0.63             | 80.8  | 0.62             | 79.5  |
| Phenylalanine, %                     | 1.32  | 2.78  | 1.07             | 81.1  | 1.05             | 79.5  |
| Phe + Tyr, %                         | 2.26  | 4.77  | 1.83             | 81.0  | 1.76             | 77.8  |
| Alanine, %                           | 3.82  | 8.05  | 3.33             | 87.2  | 3.09             | 80.9  |
| Cysteine, %                          | 0.36  | 0.76  | 0.29             | 80.6  | 0.22             | 61.1  |
| Tyrosine, %                          | 0.94  | 1.98  | 0.76             | 80.9  | 0.71             | 75.5  |
| Glycine, %                           | 7.45  | 15.7  | 6.28             | 84.3  | 5.92             | 79.5  |
| Serine, %                            | 1.85  | 3.90  | 1.50             | 81.1  | 1.40             | 75.7  |
| Proline, %                           | 4.19  | 8.83  | 3.45             | 82.3  | 3.46             | 82.6  |
| Glutamine <sup>2</sup> , %           | 2.22  | 4.67  | 1.95             | 87.8  | 1.75             | 79.0  |
| Glutamic Acid <sup>2</sup> , %       | 3.19  | 6.73  | 2.80             | 87.8  | 2.52             | 79.0  |
| Asparagine <sup>2</sup> , %          | 1.37  | 2.89  | 0.96             | 70.0  | 0.97             | 70.5  |
| Aspartic Acid <sup>2</sup> , %       | 1.90  | 4.01  | 1.33             | 70.0  | 1.34             | 70.5  |
| Total Nitrogen (PB/6.25), %          | 7.59  | 16.0  | 6.27             | 82.7  | 6.00             | 79.0  |
| Essential Nitrogen Poultry, %        | 4.49  | 59.2* | 3.71             | 82.7  |                  |       |
| Essential Nitrogen Swine, %          | 2.85  | 37.6* |                  |       | 2.28             | 80.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 5            | 5      |          | 5         |           |
| Practical Maximum                                           | 8            | 10     |          | 10        |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 4            | 4      | 4        | 4         | 4         |
| Practical Maximum                                           | 6            | 7      | 8        | 8         | 8         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 52% CP (50.01 – 55.00% CP)**

| Main Components (%)       |      |     |      |                              |      |     |      |
|---------------------------|------|-----|------|------------------------------|------|-----|------|
|                           | Mean | n   | SD   |                              | Mean | n   | SD   |
| Dry Matter                | 95.8 | 139 | 1.51 | Organic Matter (OM)          | 65.8 |     |      |
| Crude Protein (CP)        | 51.9 | 246 | 1.53 | Coef. Dig. OM Swine          | 72.4 |     |      |
| Starch                    | -    | -   | -    | Digestible OM Swine          | 47.6 |     |      |
| Crude Fiber (CF)          | -    | -   | -    | Undig. OM Pigs               | 18.1 |     |      |
| Coef. Dig. CF Swine       | -    | -   | -    | Ether Extract (EE)           | 12.2 | 246 | 1.70 |
| NDF                       | -    | -   | -    | Coef. Dig. EE Poultry        | 75.6 |     |      |
| Coef. Dig. NDF Swine      | -    | -   | -    | Digestible EE Poultry        | 9.23 |     |      |
| ADF                       | -    | -   | -    | Coef. Dig. EE Swine          | 38.0 |     |      |
| Coef. Dig. ADF Swine      | -    | -   | -    | Digestible EE Swine          | 4.64 |     |      |
| N-Free Extract (NFE)      | 1.70 |     |      | Linoleic Acid                | 0.31 | 4   | 0.04 |
| Coef. Dig. NFE Poultry    | -    | -   | -    | Linolenic Acid               | 0.07 | 4   | 0.01 |
| Digestible NFE Poultry    | -    | -   | -    |                              |      |     |      |
| Undig. NFE + CF Poultry   | -    | -   | -    |                              |      |     |      |
| Energy (kcal/kg)          |      |     |      |                              |      |     |      |
|                           | Mean | n   | SD   |                              | Mean | n   | SD   |
| Gross Energy              | 3988 | 7   | 105  | <b>Swine</b>                 |      |     |      |
| <b>Poultry</b>            |      |     |      | Digestible Energy            | 2888 |     |      |
| Metabolizable Energy      | 2602 |     |      | Metabolizable Energy         | 2599 |     |      |
| Std. Metab. Energy        | 2705 |     |      | Net Energy                   | 1709 |     |      |
| Net Energy                | 2098 |     |      | <b>Sows</b>                  |      |     |      |
| <b>Hens</b>               |      |     |      | Digestible Energy            | 2888 |     |      |
| Metabolizable Energy      | 2602 |     |      | Metabolizable Energy         | 2599 |     |      |
| Net Energy                | 2098 |     |      | Net Energy                   | 1709 |     |      |
| Minerals                  |      |     |      |                              |      |     |      |
|                           | Mean | n   | SD   |                              | Mean | n   | SD   |
| Ash, %                    | 30.0 | 246 | 3.52 | <b>Trace Minerals, mg/kg</b> |      |     |      |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)               | 20.0 | 1   | -    |
| Potassium (K)             | 0.53 | 6   | 0.07 | Iron (Fe)                    | 248  | 1   | -    |
| Sodium (Na)               | 0.57 | 40  | 0.07 | Copper (Cu)                  | 8.50 | 1   | -    |
| Chlorine (Cl)             | 0.61 | 6   | 0.06 | Zinc (Zn)                    | 80.8 | 1   | -    |
| Sulfur (S)                | 0.89 | 1   | -    | Selenium (Se)                | 0.37 | 1   | -    |
| Magnesium (Mg)            | 0.42 | 1   | -    |                              |      |     |      |
| Total Calcium (Ca)        | 10.0 | 128 | 1.36 |                              |      |     |      |
| Total Phosphorus (P)      | 4.93 | 128 | 0.74 |                              |      |     |      |
| Phytate P                 | -    | -   | -    |                              |      |     |      |
| Available P (Pav)         | 4.44 |     |      |                              |      |     |      |
| Coef. Dig. P Poultry      | 62.0 |     |      |                              |      |     |      |
| Std. Dig. P Poultry       | 3.06 |     |      |                              |      |     |      |
| Coef. Dig. P Swine        | 64.0 |     |      |                              |      |     |      |
| Std. Dig. P Swine         | 3.16 |     |      |                              |      |     |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 52% CP (50.01 – 55.00% CP)**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 51.9                                 | 100   | 40.4             | 78.0  | 43.8             | 84.5  |
| Lysine, %                      | 2.73                                 | 5.26  | 2.21             | 81.0  | 2.18             | 79.9  |
| Methionine, %                  | 0.70                                 | 1.35  | 0.58             | 82.9  | 0.58             | 82.9  |
| Met + Cys, %                   | 1.21                                 | 2.33  | 0.93             | 76.9  | 0.96             | 79.4  |
| Threonine, %                   | 1.71                                 | 3.30  | 1.32             | 77.2  | 1.34             | 78.4  |
| Tryptophan, %                  | 0.28                                 | 0.54  | 0.23             | 82.1  | 0.23             | 82.1  |
| Arginine, %                    | 3.82                                 | 7.37  | 3.23             | 84.6  | 3.27             | 85.6  |
| Gly + Ser, %                   | 9.20                                 | 17.8  | 6.51             | 70.8  |                  |       |
| Valine, %                      | 2.30                                 | 4.44  | 1.88             | 81.7  | 1.83             | 79.6  |
| Isoleucine, %                  | 1.51                                 | 2.91  | 1.25             | 82.8  | 1.22             | 80.8  |
| Leucine, %                     | 2.94                                 | 5.67  | 2.48             | 84.4  | 2.44             | 83.0  |
| Histidine, %                   | 0.89                                 | 1.72  | 0.71             | 79.8  | 0.74             | 83.1  |
| Phenylalanine, %               | 1.53                                 | 2.95  | 1.29             | 84.3  | 1.27             | 83.0  |
| Phe + Tyr, %                   | 2.58                                 | 4.98  | 2.11             | 81.8  | 2.13             | 82.6  |
| Alanine, %                     | 4.05                                 | 7.81  | 3.28             | 81.0  | 3.58             | 88.4  |
| Cysteine, %                    | 0.51                                 | 0.98  | 0.35             | 68.6  | 0.38             | 74.5  |
| Tyrosine, %                    | 1.05                                 | 2.02  | 0.82             | 78.1  | 0.86             | 81.9  |
| Glycine, %                     | 7.09                                 | 13.7  | 5.04             | 71.1  | 6.53             | 92.1  |
| Serine, %                      | 2.11                                 | 4.07  | 1.47             | 69.7  | 1.73             | 82.0  |
| Proline, %                     | 4.68                                 | 9.03  | 3.88             | 82.9  | 3.88             | 82.9  |
| Glutamine <sup>2</sup> , %     | 2.50                                 | 4.82  | 1.91             | 76.4  | 2.13             | 85.3  |
| Glutamic Acid <sup>2</sup> , % | 3.60                                 | 6.95  | 2.75             | 76.4  | 3.07             | 85.3  |
| Asparagine <sup>2</sup> , %    | 1.54                                 | 2.98  | 1.04             | 67.5  | 1.26             | 81.8  |
| Aspartic Acid <sup>2</sup> , % | 2.15                                 | 4.14  | 1.45             | 67.5  | 1.75             | 81.8  |
| Total Nitrogen (PB/6.25), %    | 8.30                                 | 16.0  | 6.47             | 78.0  | 7.01             | 84.5  |
| Essential Nitrogen Poultry, %  | 4.78                                 | 57.6* | 3.76             | 78.6  |                  |       |
| Essential Nitrogen Swine, %    | 3.18                                 | 38.3* |                  |       | 2.61             | 82.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 5                   | 5      | 5           |             |           |
| <b>Practical Maximum</b>                                    | 8                   | 10     | 10          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 4                   | 4      | 4           | 4           | 4         |
| <b>Practical Maximum</b>                                    | 6                   | 7      | 8           | 8           | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 58% CP**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 95.9 | 20 | 0.86 | Organic Matter (OM)          | 70.7 |         |
| Crude Protein (CP)        | 58.0 | 32 | 2.25 | Coef. Dig. OM Swine          | 75.7 |         |
| Starch                    | -    | -  | -    | Digestible OM Swine          | 53.5 |         |
| Crude Fiber (CF)          | -    | -  | -    | Undig. OM Pigs               | 17.2 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 11.5 | 12 0.60 |
| NDF                       | -    | -  | -    | Coef. Dig. EE Poultry        | 74.0 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 8.50 |         |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 44.0 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 5.05 |         |
| N-Free Extract (NFE)      | 1.19 |    |      | Linoleic Acid                | 0.24 | 1 -     |
| Coef. Dig. NFE Poultry    | -    |    |      | Linolenic Acid               | 0.05 | 1 -     |
| Digestible NFE Poultry    | -    |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | -    |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 4176 | 3  | 284  | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3161 |         |
| Metabolizable Energy      | 2800 |    |      | Metabolizable Energy         | 2834 |         |
| Std. Metab. Energy        | 2872 |    |      | Net Energy                   | 1831 |         |
| Net Energy                | 2237 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3161 |         |
| Metabolizable Energy      | 2800 |    |      | Metabolizable Energy         | 2834 |         |
| Net Energy                | 2237 |    |      | Net Energy                   | 1831 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 24.2 | 15 | 2.54 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -    | - -     |
| Potassium (K)             | 0.46 | 3  | 0.02 | Iron (Fe)                    | -    | - -     |
| Sodium (Na)               | 0.56 | 6  | 0.13 | Copper (Cu)                  | -    | - -     |
| Chlorine (Cl)             | 0.58 | 3  | 0.05 | Zinc (Zn)                    | -    | - -     |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -     |
| Magnesium (Mg)            | -    | -  | -    |                              |      |         |
| Total Calcium (Ca)        | 8.59 | 18 | 1.14 |                              |      |         |
| Total Phosphorus (P)      | 4.44 | 20 | 0.61 |                              |      |         |
| Phytate P                 | -    |    |      |                              |      |         |
| Available P (Pav)         | 4.00 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 62.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 2.75 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 64.0 |    |      |                              |      |         |
| Std. Dig. P Swine         | 2.84 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bovine Meat and Bone, Meal 58% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 58.0  | 100   | 46.8             | 80.7  | 47.6             | 82.1  |
| Lysine, %                            | 3.03  | 5.23  | 2.45             | 80.9  | 2.55             | 84.2  |
| Methionine, %                        | 0.76  | 1.31  | 0.65             | 85.5  | 0.65             | 85.5  |
| Met + Cys, %                         | 1.45  | 2.50  | 1.06             | 73.1  | 1.00             | 68.9  |
| Threonine, %                         | 1.82  | 3.14  | 1.47             | 80.8  | 1.49             | 81.9  |
| Tryptophan, %                        | 0.36  | 0.62  | -                | -     | 0.29             | 80.6  |
| Arginine, %                          | 3.99  | 6.88  | 3.36             | 84.2  | 3.43             | 86.0  |
| Gly + Ser, %                         | 9.65  | 16.6  | -                | -     | -                | -     |
| Valine, %                            | 2.60  | 4.48  | 2.13             | 81.9  | 2.16             | 83.1  |
| Isoleucine, %                        | 1.61  | 2.78  | 1.34             | 83.2  | 1.35             | 83.9  |
| Leucine, %                           | 3.39  | 5.85  | 2.85             | 84.1  | 2.88             | 85.0  |
| Histidine, %                         | 1.10  | 1.90  | 0.91             | 82.7  | 0.87             | 79.1  |
| Phenylalanine, %                     | 1.93  | 3.33  | 1.62             | 83.9  | 1.64             | 85.0  |
| Phe + Tyr, %                         | 3.27  | 5.64  | -                | -     | 2.74             | 83.8  |
| Alanine, %                           | 4.47  | 7.71  | -                | -     | 3.71             | 83.0  |
| Cysteine, %                          | 0.69  | 1.19  | 0.41             | 59.4  | 0.35             | 50.7  |
| Tyrosine, %                          | 1.34  | 2.31  | -                | -     | 1.10             | 82.1  |
| Glycine, %                           | 7.24  | 12.5  | -                | -     | 5.86             | 80.9  |
| Serine, %                            | 2.41  | 4.16  | -                | -     | 1.93             | 80.1  |
| Proline, %                           | 4.68  | 8.07  | -                | -     | 3.93             | 84.0  |
| Glutamine <sup>2</sup> , %           | 2.87  | 4.95  | -                | -     | 2.38             | 83.0  |
| Glutamic Acid <sup>2</sup> , %       | 4.14  | 7.14  | -                | -     | 3.44             | 83.0  |
| Asparagine <sup>2</sup> , %          | 1.85  | 3.20  | -                | -     | 1.41             | 76.0  |
| Aspartic Acid <sup>2</sup> , %       | 2.58  | 4.44  | -                | -     | 1.96             | 76.0  |
| Total Nitrogen (PB/6.25), %          | 9.28  | 16.0  | 7.48             | 80.7  | 7.61             | 82.1  |
| Essential Nitrogen Poultry, %        | 5.18  | 55.8* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | 3.51  | 37.8* | -                | -     | 2.95             | 84.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |         |             |             |           |
|-------------------------------------------------------------|---------------------|---------|-------------|-------------|-----------|
| Practical<br>Maximum                                        | <b>Broilers</b>     |         | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower  |             |             |           |
|                                                             | 5<br>8              | 5<br>10 | 5<br>10     |             |           |
| Practical<br>Maximum                                        | <b>Growing Pigs</b> |         |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower  | Finisher    | Gestation   | Lactation |
|                                                             | 4<br>6              | 4<br>7  | 4<br>8      | 4<br>8      | 4<br>8    |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bread, By-products**

| Main Components (%)       |      |   |      |                              |      |      |
|---------------------------|------|---|------|------------------------------|------|------|
|                           | Mean | n | SD   |                              | Mean | n SD |
| Dry Matter                | 87.2 | 6 | 1.13 | Organic Matter (OM)          | 84.6 |      |
| Crude Protein (CP)        | 12.1 | 6 | 2.58 | Coef. Dig. OM Swine          | 94.6 |      |
| Starch                    | 39.3 | 1 | -    | Digestible OM Swine          | 80.1 |      |
| Crude Fiber (CF)          | 1.17 | 3 | 0.25 | Undig. OM Pigs               | 4.54 |      |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 1.57 | 1 -  |
| NDF                       | 6.48 | 3 | 0.60 | Coef. Dig. EE Poultry        | 87.0 |      |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 1.37 |      |
| ADF                       | 1.28 | 3 | 0.85 | Coef. Dig. EE Swine          | -    |      |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | -    |      |
| N-Free Extract (NFE)      | 69.8 |   |      | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | 98.0 |   |      | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | 68.4 |   |      |                              |      |      |
| Undig. NFE + CF Poultry   | 2.57 |   |      |                              |      |      |
| Energy (kcal/kg)          |      |   |      |                              |      |      |
|                           | Mean | n | SD   |                              | Mean | n SD |
| Gross Energy              | 4061 | 3 | 234  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3843 |      |
| Metabolizable Energy      | 3474 |   |      | Metabolizable Energy         | 3678 |      |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | -    |      |
| Net Energy                | 2780 |   |      | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | -    |      |
| Metabolizable Energy      | 3447 |   |      | Metabolizable Energy         | -    |      |
| Net Energy                | 2752 |   |      | Net Energy                   | -    |      |
| Minerals                  |      |   |      |                              |      |      |
|                           | Mean | n | SD   |                              | Mean | n SD |
| Ash, %                    | 2.58 | 4 | 0.06 | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | 0.31 | 1 | -    | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | 0.44 | 1 | -    | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -    |                              |      |      |
| Total Calcium (Ca)        | 0.16 | 3 | 0.05 |                              |      |      |
| Total Phosphorus (P)      | 0.30 | 3 | 0.05 |                              |      |      |
| Phytate P                 | 0.21 | 1 | -    |                              |      |      |
| Available P (Pav)         | 0.09 |   |      |                              |      |      |
| Coef. Dig. P Poultry      | 30.0 |   |      |                              |      |      |
| Std. Dig. P Poultry       | 0.09 |   |      |                              |      |      |
| Coef. Dig. P Swine        | 34.7 |   |      |                              |      |      |
| Std. Dig. P Swine         | 0.10 |   |      |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Bread, By-products**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 12.1  | 100   | 11.2             | 92.6  | 10.6             | 87.2  |
| Lysine, %                            | 0.24  | 1.98  | 0.20             | 85.0  | 0.19             | 80.0  |
| Methionine, %                        | 0.17  | 1.40  | 0.15             | 89.5  | 0.15             | 90.0  |
| Met + Cys, %                         | 0.44  | 3.64  | 0.38             | 86.9  | 0.41             | 92.5  |
| Threonine, %                         | 0.33  | 2.73  | 0.26             | 78.8  | 0.26             | 78.0  |
| Tryptophan, %                        | 0.11  | 0.91  | 0.09             | 84.0  | 0.09             | 83.0  |
| Arginine, %                          | 0.47  | 3.88  | 0.42             | 90.2  | 0.42             | 90.0  |
| Gly + Ser, %                         | 1.04  | 8.60  | 0.93             | 89.5  |                  |       |
| Valine, %                            | 0.47  | 3.88  | 0.44             | 92.7  | 0.41             | 87.0  |
| Isoleucine, %                        | 0.39  | 3.22  | 0.36             | 93.5  | 0.35             | 90.0  |
| Leucine, %                           | 0.77  | 6.36  | 0.74             | 95.5  | 0.70             | 91.0  |
| Histidine, %                         | 0.23  | 1.90  | 0.21             | 92.3  | 0.21             | 90.0  |
| Phenylalanine, %                     | 0.52  | 4.30  | 0.50             | 95.2  | 0.49             | 94.0  |
| Phe + Tyr, %                         | 0.90  | 7.44  | 0.85             | 94.7  | 0.84             | 93.2  |
| Alanine, %                           | 0.41  | 3.39  | 0.36             | 88.6  | 0.34             | 82.2  |
| Cysteine, %                          | 0.27  | 2.23  | 0.23             | 85.3  | 0.25             | 94.0  |
| Tyrosine, %                          | 0.38  | 3.14  | 0.36             | 94.1  | 0.35             | 92.0  |
| Glycine, %                           | 0.49  | 4.05  | 0.44             | 90.2  | 0.41             | 84.5  |
| Serine, %                            | 0.55  | 4.55  | 0.49             | 88.9  | 0.46             | 83.9  |
| Proline, %                           | 1.11  | 9.17  | 1.00             | 89.9  | 1.04             | 93.9  |
| Glutamine <sup>2</sup> , %           | 2.11  | 17.4  | 2.06             | 97.8  | 1.81             | 86.1  |
| Glutamic Acid <sup>2</sup> , %       | 1.32  | 10.9  | 1.29             | 97.8  | 1.14             | 86.1  |
| Asparagine <sup>2</sup> , %          | 0.23  | 1.93  | 0.20             | 84.8  | 0.17             | 74.9  |
| Aspartic Acid <sup>2</sup> , %       | 0.29  | 2.37  | 0.24             | 84.8  | 0.21             | 74.9  |
| Total Nitrogen (PB/6.25), %          | 1.94  | 16.0  | 1.79             | 92.6  | 1.69             | 87.2  |
| Essential Nitrogen Poultry, %        | 0.72  | 37.1* | 0.65             | 90.9  |                  |       |
| Essential Nitrogen Swine, %          | 0.55  | 28.6* |                  |       | 0.49             | 88.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 10           | 15     | 15       |           |           |
| Practical Maximum                                           | 20           | 25     | 25       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 12           | 20     | 20       | 25        | 25        |
| Practical Maximum                                           | 20           | 40     | 40       | 40        | 40        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Canola, Meal**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 89.5 | 38 | 1.16 | Organic Matter (OM)          | 82.9 |         |
| Crude Protein (CP)        | 36.2 | 37 | 2.24 | Coef. Dig. OM Swine          | 70.3 |         |
| Starch                    | 5.10 | 4  | 1.27 | Digestible OM Swine          | 58.3 |         |
| Crude Fiber (CF)          | 10.9 | 14 | 0.81 | Undig. OM Pigs               | 24.6 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 2.55 | 31 1.32 |
| NDF                       | 25.1 | 21 | 4.76 | Coef. Dig. EE Poultry        | 72.5 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 1.85 |         |
| ADF                       | 8.45 | 3  | 11.1 | Coef. Dig. EE Swine          | 72.5 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.85 |         |
| N-Free Extract (NFE)      | 33.3 |    |      | Linoleic Acid                | 0.48 | 1 -     |
| Coef. Dig. NFE Poultry    | 16.5 |    |      | Linolenic Acid               | 0.24 | 1 -     |
| Digestible NFE Poultry    | 5.49 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 38.7 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 4230 | 30 | 74   | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2983 |         |
| Metabolizable Energy      | 1743 |    |      | Metabolizable Energy         | 2746 |         |
| Std. Metab. Energy        | 1932 |    |      | Net Energy                   | 1709 |         |
| Net Energy                | 1358 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3197 |         |
| Metabolizable Energy      | 1856 |    |      | Metabolizable Energy         | 2933 |         |
| Net Energy                | 1470 |    |      | Net Energy                   | 1845 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 6.57 | 32 | 0.49 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -    | - -     |
| Potassium (K)             | 0.55 | 1  | -    | Iron (Fe)                    | -    | - -     |
| Sodium (Na)               | 0.10 | 2  | 0.01 | Copper (Cu)                  | -    | - -     |
| Chlorine (Cl)             | 0.11 | 1  | -    | Zinc (Zn)                    | -    | - -     |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -     |
| Magnesium (Mg)            | 0.52 | 1  | -    | Iodine (I)                   | -    | - -     |
| Total Calcium (Ca)        | 0.63 | 22 | 0.07 |                              |      |         |
| Total Phosphorus (P)      | 1.14 | 22 | 0.14 |                              |      |         |
| Phytate P                 | 0.75 | 1  | -    |                              |      |         |
| Available P (Pav)         | 0.39 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 43.1 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.49 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 35.2 |    |      |                              |      |         |
| Std. Dig. P Swine         | 0.40 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Canola, Meal**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 36.2  | 100   | 31.9             | 86.1  | 29.1             | 80.4  |
| Lysine, %                                   | 2.02  | 5.58  | 1.63             | 80.7  | 1.54             | 76.2  |
| Methionine, %                               | 0.78  | 2.15  | 0.70             | 89.7  | 0.67             | 85.9  |
| Met + Cys, %                                | 1.75  | 4.83  | 1.42             | 81.1  | 1.43             | 81.7  |
| Threonine, %                                | 1.57  | 4.34  | 1.26             | 80.3  | 1.17             | 74.5  |
| Tryptophan, %                               | 0.46  | 1.27  | 0.39             | 84.8  | 0.35             | 76.1  |
| Arginine, %                                 | 2.25  | 6.22  | 2.03             | 90.2  | 1.92             | 85.3  |
| Gly + Ser, %                                | 3.19  | 8.81  | 2.71             | 85.0  |                  |       |
| Valine, %                                   | 1.67  | 4.61  | 1.38             | 82.6  | 1.27             | 76.0  |
| Isoleucine, %                               | 1.31  | 3.62  | 1.09             | 83.2  | 1.02             | 77.9  |
| Leucine, %                                  | 2.53  | 6.99  | 2.20             | 87.0  | 2.04             | 80.6  |
| Histidine, %                                | 1.00  | 2.76  | 0.88             | 88.0  | 0.83             | 83.0  |
| Phenylalanine, %                            | 1.41  | 3.90  | 1.23             | 87.2  | 1.15             | 81.6  |
| Phe + Tyr, %                                | 2.34  | 6.46  | 2.01             | 85.9  | 1.87             | 79.9  |
| Alanine, %                                  | 1.55  | 4.28  | 1.31             | 84.5  | 1.19             | 76.8  |
| Cysteine, %                                 | 0.97  | 2.68  | 0.72             | 74.2  | 0.76             | 78.4  |
| Tyrosine, %                                 | 0.93  | 2.57  | 0.78             | 83.9  | 0.72             | 77.4  |
| Glycine, %                                  | 1.69  | 4.67  | 1.47             | 87.0  | 1.31             | 77.5  |
| Serine, %                                   | 1.50  | 4.14  | 1.24             | 82.7  | 1.13             | 75.3  |
| Proline, %                                  | 1.95  | 5.39  | 1.60             | 82.1  | 1.79             | 91.8  |
| Glutamine <sup>2</sup> , %                  | 2.80  | 7.74  | 2.54             | 90.7  | 2.35             | 84.0  |
| Glutamic Acid <sup>2</sup> , %              | 3.13  | 8.64  | 2.84             | 90.7  | 2.63             | 84.0  |
| Asparagine <sup>2</sup> , %                 | 1.09  | 3.01  | 0.99             | 91.0  | 0.83             | 76.0  |
| Aspartic Acid <sup>2</sup> , %              | 1.62  | 4.48  | 1.47             | 91.0  | 1.23             | 76.0  |
| Total Nitrogen (PB/6.25), %                 | 5.79  | 16.0  | 4.99             | 86.1  | 4.65             | 80.4  |
| Essential Nitrogen Poultry, %               | 2.95  | 50.9* | 2.51             | 85.2  |                  |       |
| Essential Nitrogen Swine, %                 | 2.43  | 42.0* |                  |       | 1.94             | 79.7  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 6            | 8      |          | 8         |           |
|                                                             | 8            | 12     |          | 12        |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 6            | 8      | 9        | 8         | 6         |
|                                                             | 8            | 12     | 13       | 12        | 10        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Canola, Oil**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 99.5 | 1 | -  | Organic Matter (OM)          | 99.5 |      |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 91.8 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 91.4 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 8.14 |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 99.5 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 95.0 |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | 94.5 |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 91.8 |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | 91.3 |      |
| N-Free Extract (NFE)      | -    | - | -  | Linoleic Acid                | 18.7 | 1 -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | 9.50 | 1 -  |
| Digestible NFE Poultry    | -    | - | -  |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 9399 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 8630 |      |
| Metabolizable Energy      | 8784 |   |    | Metabolizable Energy         | 8455 |      |
| Std. Metab. Energy        | 9130 |   |    | Net Energy                   | 7476 |      |
| Net Energy                | 7906 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 8630 |      |
| Metabolizable Energy      | 8784 |   |    | Metabolizable Energy         | 8455 |      |
| Net Energy                | 7906 |   |    | Net Energy                   | 7476 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | -    | - | -  |                              |      |      |
| Total Phosphorus (P)      | -    | - | -  |                              |      |      |
| Phytate P                 | -    | - | -  |                              |      |      |
| Available P (Pav)         | -    | - | -  |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |      |      |
| Coef. Dig. P Swine        | -    | - | -  |                              |      |      |
| Std. Dig. P Swine         | -    | - | -  |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Canola, Oil**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | -     | -    | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 3                   | 3      | 3           |             |           |
| Practical Maximum                                                  | 6                   | 7      | 7           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 2                   | 2      | 2           | 0           | 2         |
| Practical Maximum                                                  | 5                   | 5      | 5           | 4           | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Casein**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 91.5 | 7 | 0.77 | Organic Matter (OM)          | 87.9 |        |
| Crude Protein (CP)        | 86.2 | 6 | 2.92 | Coef. Dig. OM Swine          | 79.3 |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 69.7 |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 18.2 |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 0.55 | 4 0.31 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | -    |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 48.0 |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 0.26 | - -    |
| N-Free Extract (NFE)      | 1.12 |   |      | Linoleic Acid                | -    | - -    |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    | - | -    |                              |      |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 5467 | 4 | 300  | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 4151 |        |
| Metabolizable Energy      | 3900 |   |      | Metabolizable Energy         | 3529 |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 2006 |        |
| Net Energy                | -    |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 4251 |        |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | 3665 |        |
| Net Energy                | -    |   |      | Net Energy                   | 2105 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 3.63 | 3 | 1.79 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 1.67 | 1 -    |
| Potassium (K)             | 0.01 | 2 | 0.00 | Iron (Fe)                    | 21.4 | 1 -    |
| Sodium (Na)               | 0.01 | 4 | 0.00 | Copper (Cu)                  | 2.96 | 1 -    |
| Chlorine (Cl)             | 0.03 | 3 | 0.02 | Zinc (Zn)                    | 88.6 | 1 -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | 3.34 | 1 -    |
| Magnesium (Mg)            | -    | - | -    |                              |      |        |
| Total Calcium (Ca)        | 0.40 | 1 | -    |                              |      |        |
| Total Phosphorus (P)      | 0.79 | 3 | 0.18 |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | 0.79 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | 90.0 |   |      |                              |      |        |
| Std. Dig. P Poultry       | 0.71 |   |      |                              |      |        |
| Coef. Dig. P Swine        | 90.0 |   |      |                              |      |        |
| Std. Dig. P Swine         | 0.71 |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Casein**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 86.2  | 100   | 79.2             | 91.8  | 77.4             | 89.8  |
| Lysine, %                                   | 7.29  | 8.46  | 7.01             | 96.2  | 7.14             | 97.9  |
| Methionine, %                               | 2.67  | 3.10  | 2.60             | 97.4  | 2.63             | 98.5  |
| Met + Cys, %                                | 3.11  | 3.61  | 2.97             | 95.5  | 3.02             | 97.1  |
| Threonine, %                                | 4.05  | 4.70  | 3.85             | 95.1  | 3.84             | 94.8  |
| Tryptophan, %                               | 1.20  | 1.39  | 1.16             | 96.7  | 1.17             | 97.5  |
| Arginine, %                                 | 3.23  | 3.75  | 3.19             | 98.8  | 3.14             | 97.2  |
| Gly + Ser, %                                | 6.64  | 7.70  | 6.45             | 97.2  |                  |       |
| Valine, %                                   | 5.97  | 6.93  | 5.86             | 98.2  | 5.73             | 96.0  |
| Isoleucine, %                               | 4.80  | 5.57  | 4.70             | 97.9  | 4.60             | 95.8  |
| Leucine, %                                  | 8.32  | 9.65  | 8.27             | 99.4  | 8.16             | 98.1  |
| Histidine, %                                | 2.64  | 3.06  | 2.59             | 98.1  | 2.57             | 97.3  |
| Phenylalanine, %                            | 4.55  | 5.28  | 4.48             | 98.5  | 4.44             | 97.6  |
| Phe + Tyr, %                                | 7.87  | 9.13  | 7.77             | 98.7  | 7.66             | 97.3  |
| Alanine, %                                  | 2.72  | 3.16  | 1.90             | 69.9  | 2.69             | 98.9  |
| Cysteine, %                                 | 0.44  | 0.51  | 0.37             | 84.1  | 0.39             | 88.6  |
| Tyrosine, %                                 | 3.32  | 3.85  | 3.29             | 99.0  | 3.22             | 97.0  |
| Glycine, %                                  | 1.74  | 2.02  | 1.69             | 97.1  | 1.51             | 86.8  |
| Serine, %                                   | 4.90  | 5.68  | 4.77             | 97.3  | 4.51             | 92.0  |
| Proline, %                                  | 10.2  | 11.8  | 8.87             | 86.9  | 9.07             | 88.9  |
| Glutamine <sup>2</sup> , %                  | 10.7  | 12.4  | 8.90             | 83.4  | 8.21             | 77.0  |
| Glutamic Acid <sup>2</sup> , %              | 8.93  | 10.4  | 7.45             | 83.4  | 6.88             | 77.0  |
| Asparagine <sup>2</sup> , %                 | 2.46  | 2.86  | 2.07             | 84.2  | 1.75             | 71.0  |
| Aspartic Acid <sup>2</sup> , %              | 3.74  | 4.33  | 3.14             | 84.2  | 2.65             | 71.0  |
| Total Nitrogen (PB/6.25), %                 | 13.8  | 16.0  | 12.7             | 91.8  | 12.4             | 89.8  |
| Essential Nitrogen Poultry, %               | 7.52  | 54.5* | 7.35             | 97.7  |                  |       |
| Essential Nitrogen Swine, %                 | 6.54  | 47.4* |                  |       | 6.35             | 97.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |          |             |           |
|--------------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                                    | Starter             | Grower |          |             |           |
|                                                                    |                     |        |          |             |           |
| <b>Practical</b>                                                   | -                   | -      | -        | -           | -         |
| <b>Maximum</b>                                                     | -                   | -      | -        | -           | -         |
|                                                                    | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                                    |                     |        |          |             |           |
| <b>Practical</b>                                                   | -                   | -      | -        | -           | -         |
| <b>Maximum</b>                                                     | -                   | -      | -        | -           | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cassava, Whole**

| Main Components (%)       |      |   |      |                              |      |   |      |
|---------------------------|------|---|------|------------------------------|------|---|------|
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Dry Matter                | 87.7 | 2 | 0.01 | Organic Matter (OM)          | 84.2 |   |      |
| Crude Protein (CP)        | 2.64 | 2 | 0.23 | Coef. Dig. OM Swine          | 85.7 |   |      |
| Starch                    | 73.7 | 2 | 8.23 | Digestible OM Swine          | 72.2 |   |      |
| Crude Fiber (CF)          | 4.21 | 2 | 1.72 | Undig. OM Pigs               | 12.0 |   |      |
| Coef. Dig. CF Swine       | 64.6 |   |      | Ether Extract (EE)           | 0.52 | 2 | 0.09 |
| NDF                       | 13.2 | 2 | 2.02 | Coef. Dig. EE Poultry        | 20.0 |   |      |
| Coef. Dig. NDF Swine      | 59.0 |   |      | Digestible EE Poultry        | 0.10 |   |      |
| ADF                       | 5.73 | 2 | 2.07 | Coef. Dig. EE Swine          | 42.5 |   |      |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 0.22 |   |      |
| N-Free Extract (NFE)      | 76.9 |   |      | Linoleic Acid                | 0.08 | 1 | -    |
| Coef. Dig. NFE Poultry    | 91.4 |   |      | Linolenic Acid               | -    | - | -    |
| Digestible NFE Poultry    | 70.3 |   |      |                              |      |   |      |
| Undig. NFE + CF Poultry   | 10.8 |   |      |                              |      |   |      |
|                           |      |   |      |                              |      |   |      |
| Energy (kcal/kg)          |      |   |      |                              |      |   |      |
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Gross Energy              | 3621 | 1 | -    | <b>Swine</b>                 |      |   |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3048 |   |      |
| Metabolizable Energy      | 2973 |   |      | Metabolizable Energy         | 3020 |   |      |
| Std. Metab. Energy        | 3192 |   |      | Net Energy                   | 2426 |   |      |
| Net Energy                | 2378 |   |      | <b>Sows</b>                  |      |   |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3154 |   |      |
| Metabolizable Energy      | 3003 |   |      | Metabolizable Energy         | 3108 |   |      |
| Net Energy                | 2408 |   |      | Net Energy                   | 2490 |   |      |
|                           |      |   |      |                              |      |   |      |
| Minerals                  |      |   |      |                              |      |   |      |
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Ash, %                    | 3.44 | 2 | 0.23 | <b>Trace Minerals, mg/kg</b> |      |   |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 23.9 | 1 | -    |
| Potassium (K)             | 0.35 | 2 | 0.24 | Iron (Fe)                    | 92.6 | 1 | -    |
| Sodium (Na)               | 0.02 | 2 | 0.01 | Copper (Cu)                  | 4.50 | 1 | -    |
| Chlorine (Cl)             | 0.05 | 1 | -    | Zinc (Zn)                    | 11.1 | 1 | -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | 0.15 | 1 | -    |
| Magnesium (Mg)            | 0.05 | 2 | 0.05 |                              |      |   |      |
| Total Calcium (Ca)        | 0.21 | 2 | 0.01 |                              |      |   |      |
| Total Phosphorus (P)      | 0.08 | 2 | 0.01 |                              |      |   |      |
| Phytate P                 | 0.06 | 1 | -    |                              |      |   |      |
| Available P (Pav)         | 0.02 |   |      |                              |      |   |      |
| Coef. Dig. P Poultry      | 0.38 |   |      |                              |      |   |      |
| Std. Dig. P Poultry       | 0.03 |   |      |                              |      |   |      |
| Coef. Dig. P Swine        | 0.38 |   |      |                              |      |   |      |
| Std. Dig. P Swine         | 0.03 |   |      |                              |      |   |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cassava, Whole**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 2.64                                 | 100   | 1.21             | 46.0  | 2.18             | 82.6  |
| Lysine, %                      | 0.10                                 | 3.79  | -                | -     | 0.07             | 71.0  |
| Methionine, %                  | 0.03                                 | 1.14  | -                | -     | 0.03             | 84.0  |
| Met + Cys, %                   | 0.07                                 | 2.65  | -                | -     | 0.06             | 79.4  |
| Threonine, %                   | 0.07                                 | 2.65  | -                | -     | 0.05             | 73.0  |
| Tryptophan, %                  | 0.02                                 | 0.76  | -                | -     | 0.02             | 77.0  |
| Arginine, %                    | 0.16                                 | 6.06  | -                | -     | 0.14             | 90.0  |
| Gly + Ser, %                   | 0.17                                 | 6.44  | -                | -     | -                | -     |
| Valine, %                      | 0.12                                 | 4.55  | -                | -     | 0.09             | 76.0  |
| Isoleucine, %                  | 0.10                                 | 3.79  | -                | -     | 0.08             | 81.0  |
| Leucine, %                     | 0.13                                 | 4.92  | -                | -     | 0.10             | 79.0  |
| Histidine, %                   | 0.09                                 | 3.41  | -                | -     | 0.07             | 80.0  |
| Phenylalanine, %               | 0.09                                 | 3.41  | -                | -     | 0.07             | 80.0  |
| Phe + Tyr, %                   | 0.17                                 | 6.44  | -                | -     | 0.12             | 73.4  |
| Alanine, %                     | 0.12                                 | 4.55  | -                | -     | 0.10             | 85.0  |
| Cysteine, %                    | 0.04                                 | 1.52  | -                | -     | 0.03             | 76.0  |
| Tyrosine, %                    | 0.08                                 | 3.03  | -                | -     | 0.05             | 66.0  |
| Glycine, %                     | 0.09                                 | 3.41  | -                | -     | 0.08             | 86.0  |
| Serine, %                      | 0.08                                 | 3.03  | -                | -     | 0.07             | 87.0  |
| Proline, %                     | 0.11                                 | 4.17  | -                | -     | 0.10             | 87.0  |
| Glutamine <sup>2</sup> , %     | 0.18                                 | 6.75  | -                | -     | 0.16             | 90.0  |
| Glutamic Acid <sup>2</sup> , % | 0.11                                 | 4.24  | -                | -     | 0.10             | 90.0  |
| Asparagine <sup>2</sup> , %    | 0.07                                 | 2.72  | -                | -     | 0.06             | 86.0  |
| Aspartic Acid <sup>2</sup> , % | 0.09                                 | 3.34  | -                | -     | 0.08             | 86.0  |
| Total Nitrogen (PB/6.25), %    | 0.42                                 | 16.0  | -                | -     | 0.35             | 82.6  |
| Essential Nitrogen Poultry, %  | 0.18                                 | 43.3* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | 0.16                                 | 36.8* | -                | -     | 0.12             | 79.7  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 5            | 10     | 10       |           |           |
| Practical Maximum                                           | 20           | 20     | 20       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 10           | 15     | 15       | 15        | 15        |
| Practical Maximum                                           | 20           | 30     | 30       | 30        | 30        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Castor Plant, Meal**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 89.4 | 1 | -  | Organic Matter (OM)          | 82.6 |      |
| Crude Protein (CP)        | 39.2 | 1 | -  | Coef. Dig. OM Swine          | -    |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | -    |      |
| Crude Fiber (CF)          | 18.5 | 1 | -  | Undig. OM Pigs               | -    |      |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 1.55 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -    |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -    |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -    |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -    |      |
| N-Free Extract (NFE)      | 23.4 |   |    | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | -    |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | -    | - | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 2230 |      |
| Metabolizable Energy      | 1484 |   |    | Metabolizable Energy         | 2084 |      |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | 1100 |      |
| Net Energy                | -    |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -    |      |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -    |      |
| Net Energy                | -    |   |    | Net Energy                   | -    |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 6.80 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 23.7 | 1 -  |
| Potassium (K)             | 0.60 | 1 | -  | Iron (Fe)                    | 1.00 | 1 -  |
| Sodium (Na)               | 0.01 | 1 | -  | Copper (Cu)                  | 3.90 | 1 -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | 11.3 | 1 -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | 0.35 | 1 | -  |                              |      |      |
| Total Calcium (Ca)        | 0.62 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.62 | 1 | -  |                              |      |      |
| Phytate P                 | 0.42 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.20 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |      |
| Std. Dig. P Poultry       | -    |   |    |                              |      |      |
| Coef. Dig. P Swine        | -    |   |    |                              |      |      |
| Std. Dig. P Swine         | -    |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Castor Plant, Meal**

| Amino Acid Content and Digestibility |       |      |                  |       |                  |       |
|--------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                      | Total | % CP | Poultry          |       | Swine            |       |
|                                      |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 39.2  | 100  | -                | -     | -                | -     |
| Lysine, %                            | 0.78  | 1.99 | -                | -     | -                | -     |
| Methionine, %                        | 0.61  | 1.56 | -                | -     | -                | -     |
| Met + Cys, %                         | 1.07  | 2.73 | -                | -     | -                | -     |
| Threonine, %                         | 1.13  | 2.88 | -                | -     | -                | -     |
| Tryptophan, %                        | 0.58  | 1.48 | -                | -     | -                | -     |
| Arginine, %                          | 3.21  | 8.19 | -                | -     | -                | -     |
| Gly + Ser, %                         | 3.18  | 8.11 | -                | -     | -                | -     |
| Valine, %                            | 1.78  | 4.54 | -                | -     | -                | -     |
| Isoleucine, %                        | 1.75  | 4.46 | -                | -     | -                | -     |
| Leucine, %                           | 2.68  | 6.84 | -                | -     | -                | -     |
| Histidine, %                         | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                     | 1.35  | 3.44 | -                | -     | -                | -     |
| Phe + Tyr, %                         | 2.26  | 5.77 | -                | -     | -                | -     |
| Alanine, %                           | -     | -    | -                | -     | -                | -     |
| Cysteine, %                          | 0.46  | 1.17 | -                | -     | -                | -     |
| Tyrosine, %                          | 0.91  | 2.32 | -                | -     | -                | -     |
| Glycine, %                           | 1.59  | 4.05 | -                | -     | -                | -     |
| Serine, %                            | 1.59  | 4.05 | -                | -     | -                | -     |
| Proline, %                           | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %           | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %          | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %          | 6.27  | 16.0 | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %        | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             |              |        |          |           |           |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             |              |        |          |           |           |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Citrus Pulp**

| Main Components (%)       |      |    |      |                              |      |        |
|---------------------------|------|----|------|------------------------------|------|--------|
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Dry Matter                | 89.7 | 23 | 1.58 | Organic Matter (OM)          | 83.5 |        |
| Crude Protein (CP)        | 6.10 | 22 | 0.52 | Coef. Dig. OM Swine          | 80.0 |        |
| Starch                    | 6.00 | 1  | -    | Digestible OM Swine          | 66.8 |        |
| Crude Fiber (CF)          | 12.4 | 1  | -    | Undig. OM Pigs               | 16.7 |        |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 2.11 | 2 0.13 |
| NDF                       | 19.3 | 1  | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | -    |        |
| ADF                       | 13.8 | 1  | -    | Coef. Dig. EE Swine          | 55.0 |        |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.16 |        |
| N-Free Extract (NFE)      | 62.9 |    |      | Linoleic Acid                | 0.45 | 2 0.02 |
| Coef. Dig. NFE Poultry    | -    |    |      | Linolenic Acid               | 0.08 | 2 0.00 |
| Digestible NFE Poultry    | -    |    |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |    |      |                              |      |        |
| Energy (kcal/kg)          |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Gross Energy              | 3701 | 1  | -    | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2956 |        |
| Metabolizable Energy      | 1100 |    |      | Metabolizable Energy         | 2863 |        |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 1979 |        |
| Net Energy                | -    |    |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3068 |        |
| Metabolizable Energy      | -    |    |      | Metabolizable Energy         | 2992 |        |
| Net Energy                | -    |    |      | Net Energy                   | 2073 |        |
| Minerals                  |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Ash, %                    | 6.28 | 2  | 0.03 | <b>Trace Minerals, mg/kg</b> | -    | - -    |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.79 | 2  | 0.06 | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.11 | 2  | 0.05 | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.04 | 2  | 0.02 | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.11 | 1  | -    |                              |      |        |
| Total Calcium (Ca)        | 1.61 | 23 | 0.38 |                              |      |        |
| Total Phosphorus (P)      | 0.11 | 22 | 0.03 |                              |      |        |
| Phytate P                 | 0.04 | 1  | -    |                              |      |        |
| Available P (Pav)         | 0.07 |    |      |                              |      |        |
| Coef. Dig. P Poultry      | -    |    |      |                              |      |        |
| Std. Dig. P Poultry       | -    |    |      |                              |      |        |
| Coef. Dig. P Swine        | 33.0 |    |      |                              |      |        |
| Std. Dig. P Swine         | 0.04 |    |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Citrus Pulp**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 6.10  | 100   | -                | -     | 4.91             | 80.5  |
| Lysine, %                            | 0.23  | 3.77  | -                | -     | 0.18             | 77.0  |
| Methionine, %                        | 0.07  | 1.15  | -                | -     | 0.06             | 85.0  |
| Met + Cys, %                         | 0.15  | 2.46  | -                | -     | 0.13             | 85.5  |
| Threonine, %                         | 0.20  | 3.28  | -                | -     | 0.15             | 76.0  |
| Tryptophan, %                        | 0.06  | 0.98  | -                | -     | 0.05             | 77.0  |
| Arginine, %                          | 0.26  | 4.27  | -                | -     | 0.23             | 89.0  |
| Gly + Ser, %                         | 0.50  | 8.20  | -                | -     |                  |       |
| Valine, %                            | 0.26  | 4.27  | -                | -     | 0.20             | 78.0  |
| Isoleucine, %                        | 0.20  | 3.28  | -                | -     | 0.16             | 81.0  |
| Leucine, %                           | 0.34  | 5.58  | -                | -     | 0.28             | 83.0  |
| Histidine, %                         | 0.13  | 2.13  | -                | -     | 0.11             | 84.0  |
| Phenylalanine, %                     | 0.25  | 4.10  | -                | -     | 0.21             | 84.0  |
| Phe + Tyr, %                         | 0.42  | 6.89  | -                | -     | 0.35             | 83.6  |
| Alanine, %                           | 0.28  | 4.59  | -                | -     | 0.22             | 79.0  |
| Cysteine, %                          | 0.08  | 1.31  | -                | -     | 0.07             | 86.0  |
| Tyrosine, %                          | 0.17  | 2.79  | -                | -     | 0.14             | 83.0  |
| Glycine, %                           | 0.26  | 4.27  | -                | -     | 0.20             | 76.0  |
| Serine, %                            | 0.24  | 3.94  | -                | -     | 0.19             | 80.0  |
| Proline, %                           | 0.48  | 7.87  | -                | -     | 0.39             | 81.0  |
| Glutamine <sup>2</sup> , %           | 0.33  | 5.34  | -                | -     | 0.28             | 86.0  |
| Glutamic Acid <sup>2</sup> , %       | 0.20  | 3.35  | -                | -     | 0.18             | 86.0  |
| Asparagine <sup>2</sup> , %          | 0.27  | 4.42  | -                | -     | 0.20             | 73.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.33  | 5.43  | -                | -     | 0.24             | 73.0  |
| Total Nitrogen (PB/6.25), %          | 0.98  | 16.0  | -                | -     | 0.79             | 80.5  |
| Essential Nitrogen Poultry, %        | 0.39  | 40.2* | -                | -     |                  |       |
| Essential Nitrogen Swine, %          | 0.31  | 31.9* |                  |       | 0.25             | 81.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | -                   | -      | -           |             |           |
| <b>Practical Maximum</b>                                    | -                   | -      | -           |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | -                   | 3      | 4           | 5           | 2         |
| <b>Practical Maximum</b>                                    | 2                   | 5      | 6           | 8           | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Coconut, Meal**

| Main Components (%)       |      |   |      |                              |       |        |
|---------------------------|------|---|------|------------------------------|-------|--------|
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Dry Matter                | 90.5 | 6 | 1.40 | Organic Matter (OM)          | 84.1  |        |
| Crude Protein (CP)        | 22.0 | 7 | 1.14 | Coef. Dig. OM Swine          | 76.3  |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 64.2  |        |
| Crude Fiber (CF)          | 13.7 | 3 | 0.76 | Undig. OM Pigs               | 19.9  |        |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 2.92  | 3 0.27 |
| NDF                       | 50.7 | 4 | 0.80 | Coef. Dig. EE Poultry        | 92.0  |        |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 2.69  |        |
| ADF                       | 29.0 | 4 | 5.58 | Coef. Dig. EE Swine          | 65.0  |        |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 1.90  |        |
| N-Free Extract (NFE)      | 45.5 |   |      | Linoleic Acid                | 0.06  | 1 -    |
| Coef. Dig. NFE Poultry    | 49.0 |   |      | Linolenic Acid               | -     | - -    |
| Digestible NFE Poultry    | 22.3 |   |      |                              |       |        |
| Undig. NFE + CF Poultry   | 36.9 |   |      |                              |       |        |
| Energy (kcal/kg)          |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Gross Energy              | 4151 | 4 | 158  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3020  |        |
| Metabolizable Energy      | 1921 |   |      | Metabolizable Energy         | 2873  |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 1855  |        |
| Net Energy                | 1532 |   |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3160  |        |
| Metabolizable Energy      | 2033 |   |      | Metabolizable Energy         | 3017  |        |
| Net Energy                | 1643 |   |      | Net Energy                   | 1960  |        |
| Minerals                  |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Ash, %                    | 6.37 | 3 | 0.17 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 68.2  | 1 -    |
| Potassium (K)             | 0.61 | 1 | -    | Iron (Fe)                    | 423.0 | 1 -    |
| Sodium (Na)               | 1.63 | 4 | 0.17 | Copper (Cu)                  | 25.6  | 1 -    |
| Chlorine (Cl)             | 0.70 | 1 | -    | Zinc (Zn)                    | 62.3  | 1 -    |
| Sulfur (S)                | 0.30 | 3 | 0.01 | Selenium (Se)                | -     | - -    |
| Magnesium (Mg)            | 0.42 | 3 | 0.18 |                              |       |        |
| Total Calcium (Ca)        | 0.15 | 1 | -    |                              |       |        |
| Total Phosphorus (P)      | 0.63 | 4 | 0.25 |                              |       |        |
| Phytate P                 | 0.41 | 1 | -    |                              |       |        |
| Available P (Pav)         | 0.22 |   |      |                              |       |        |
| Coef. Dig. P Poultry      | -    |   |      |                              |       |        |
| Std. Dig. P Poultry       | -    |   |      |                              |       |        |
| Coef. Dig. P Swine        | 35.2 |   |      |                              |       |        |
| Std. Dig. P Swine         | 0.22 |   |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Coconut, Meal**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 22.0  | 100   | 17.4             | 79.0  | 13.4             | 60.8  |
| Lysine, %                            | 0.59  | 2.68  | 0.47             | 78.9  | 0.30             | 51.0  |
| Methionine, %                        | 0.34  | 1.55  | 0.30             | 87.8  | 0.23             | 67.0  |
| Met + Cys, %                         | 0.67  | 3.05  | 0.47             | 70.3  | 0.40             | 59.4  |
| Threonine, %                         | 0.65  | 2.95  | 0.42             | 65.1  | 0.33             | 51.0  |
| Tryptophan, %                        | 0.21  | 0.95  | 0.16             | 77.0  | 0.13             | 63.0  |
| Arginine, %                          | 2.48  | 11.3  | 2.14             | 86.4  | 2.01             | 81.0  |
| Gly + Ser, %                         | 1.79  | 8.14  | 1.32             | 73.7  |                  |       |
| Valine, %                            | 1.06  | 4.82  | 0.89             | 83.5  | 0.72             | 68.0  |
| Isoleucine, %                        | 0.71  | 3.23  | 0.59             | 83.6  | 0.45             | 64.0  |
| Leucine, %                           | 1.31  | 5.95  | 1.06             | 80.7  | 0.89             | 68.0  |
| Histidine, %                         | 0.41  | 1.86  | 0.31             | 74.4  | 0.26             | 63.0  |
| Phenylalanine, %                     | 0.88  | 4.00  | 0.76             | 86.6  | 0.62             | 71.0  |
| Phe + Tyr, %                         | 1.35  | 6.14  | 1.10             | 81.6  | 0.85             | 62.6  |
| Alanine, %                           | 0.86  | 3.91  | 0.67             | 78.0  | 0.46             | 53.0  |
| Cysteine, %                          | 0.33  | 1.50  | 0.17             | 52.2  | 0.17             | 51.5  |
| Tyrosine, %                          | 0.47  | 2.14  | 0.34             | 72.3  | 0.22             | 47.0  |
| Glycine, %                           | 0.89  | 4.05  | 0.66             | 73.7  | 0.44             | 49.0  |
| Serine, %                            | 0.90  | 4.09  | 0.66             | 73.7  | 0.46             | 51.0  |
| Proline, %                           | 0.72  | 3.27  | 0.53             | 73.1  | 0.42             | 58.8  |
| Glutamine <sup>2</sup> , %           | 2.32  | 10.5  | 1.86             | 80.4  | 1.27             | 55.0  |
| Glutamic Acid <sup>2</sup> , %       | 1.45  | 6.61  | 1.17             | 80.4  | 0.80             | 55.0  |
| Asparagine <sup>2</sup> , %          | 0.75  | 3.41  | 0.57             | 75.8  | 0.40             | 54.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.92  | 4.18  | 0.70             | 75.8  | 0.50             | 54.0  |
| Total Nitrogen (PB/6.25), %          | 3.52  | 16.0  | 2.78             | 79.0  | 2.14             | 60.8  |
| Essential Nitrogen Poultry, %        | 1.86  | 52.9* | 1.50             | 80.7  |                  |       |
| Essential Nitrogen Swine, %          | 1.58  | 44.8* |                  |       | 1.09             | 68.9  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
| Practical<br>Maximum                                        | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 3<br>6              | 4<br>8 | 5<br>8      |             |           |
| Practical<br>Maximum                                        | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 2<br>5              | 4<br>7 | 5<br>8      | 5<br>10     | 4<br>7    |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Coconut, Oil**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 99.3 | 1 | -  | Organic Matter (OM)          | 99.3 |      |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 92.8 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 92.2 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 7.14 |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 99.3 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 85.9 |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | 85.3 |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 88.2 |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | 87.6 |      |
| N-Free Extract (NFE)      | -    | - | -  | Linoleic Acid                | 1.79 | 1 -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    | - | -  |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 9229 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 8565 |      |
| Metabolizable Energy      | 7924 |   |    | Metabolizable Energy         | 8262 |      |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | 7332 |      |
| Net Energy                | 7132 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 8565 |      |
| Metabolizable Energy      | 7924 |   |    | Metabolizable Energy         | 8262 |      |
| Net Energy                | 7132 |   |    | Net Energy                   | 7332 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | -    | - | -  |                              |      |      |
| Total Phosphorus (P)      | -    | - | -  |                              |      |      |
| Phytate P                 | -    | - | -  |                              |      |      |
| Available P (Pav)         | -    | - | -  |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |      |      |
| Coef. Dig. P Swine        | -    | - | -  |                              |      |      |
| Std. Dig. P Swine         | -    | - | -  |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Coconut, Oil**

| Amino Acid Content and Digestibility |       |      |                  |       |                  |       |
|--------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                      | Total | % CP | Poultry          |       | Swine            |       |
|                                      |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | -     | -    | -                | -     | -                | -     |
| Lysine, %                            | -     | -    | -                | -     | -                | -     |
| Methionine, %                        | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                         | -     | -    | -                | -     | -                | -     |
| Threonine, %                         | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                        | -     | -    | -                | -     | -                | -     |
| Arginine, %                          | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                         | -     | -    | -                | -     | -                | -     |
| Valine, %                            | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                        | -     | -    | -                | -     | -                | -     |
| Leucine, %                           | -     | -    | -                | -     | -                | -     |
| Histidine, %                         | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                     | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                         | -     | -    | -                | -     | -                | -     |
| Alanine, %                           | -     | -    | -                | -     | -                | -     |
| Cysteine, %                          | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                          | -     | -    | -                | -     | -                | -     |
| Glycine, %                           | -     | -    | -                | -     | -                | -     |
| Serine, %                            | -     | -    | -                | -     | -                | -     |
| Proline, %                           | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %           | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %          | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %          | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %        | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 3                   | 3      | 3           |             |           |
| Practical Maximum                                           | 6                   | 7      | 7           |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 2                   | 2      | 2           | 0           | 2         |
| Practical Maximum                                           | 5                   | 5      | 5           | 4           | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Bran with Solubles<sup>#</sup>**

| Main Components (%)       |      |   |      |                              |      |   |      |
|---------------------------|------|---|------|------------------------------|------|---|------|
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Dry Matter                | 88.9 | 8 | 2.09 | Organic Matter (OM)          | 83.9 |   |      |
| Crude Protein (CP)        | 15.6 | 8 | 2.04 | Coef. Dig. OM Swine          | 63.7 |   |      |
| Starch                    | 5.10 | 1 | -    | Digestible OM Swine          | 53.5 |   |      |
| Crude Fiber (CF)          | 9.29 | 5 | 1.59 | Undig. OM Pigs               | 30.5 |   |      |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 8.64 | 7 | 1.12 |
| NDF                       | 40.7 | 5 | 3.41 | Coef. Dig. EE Poultry        | 79.0 |   |      |
| Coef. Dig. NDF Swine      | 48.9 |   |      | Digestible EE Poultry        | 6.83 |   |      |
| ADF                       | 11.6 | 4 | 1.52 | Coef. Dig. EE Swine          | 76.0 |   |      |
| Coef. Dig. ADF Swine      | 52.5 |   |      | Digestible EE Swine          | 6.57 |   |      |
| N-Free Extract (NFE)      | 50.4 |   |      | Linoleic Acid                | -    | - | -    |
| Coef. Dig. NFE Poultry    | 30.1 |   |      | Linolenic Acid               | -    | - | -    |
| Digestible NFE Poultry    | 15.2 |   |      |                              |      |   |      |
| Undig. NFE + CF Poultry   | 44.5 |   |      |                              |      |   |      |
|                           |      |   |      |                              |      |   |      |
| Energy (kcal/kg)          |      |   |      |                              |      |   |      |
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Gross Energy              | 4400 | 5 | 141  | <b>Swine</b>                 |      |   |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 2840 |   |      |
| Metabolizable Energy      | 1850 |   |      | Metabolizable Energy         | 2650 |   |      |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 1872 |   |      |
| Net Energy                | 1520 |   |      | <b>Sows</b>                  |      |   |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3023 |   |      |
| Metabolizable Energy      | 1982 |   |      | Metabolizable Energy         | 2875 |   |      |
| Net Energy                | 1652 |   |      | Net Energy                   | 2036 |   |      |
|                           |      |   |      |                              |      |   |      |
| Minerals                  |      |   |      |                              |      |   |      |
|                           | Mean | n | SD   |                              | Mean | N | SD   |
| Ash, %                    | 4.96 | 7 | 0.43 | <b>Trace Minerals, mg/kg</b> |      |   |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 17.2 | 3 | 0.55 |
| Potassium (K)             | 1.46 | 4 | 0.08 | Iron (Fe)                    | 67.0 | 3 | 18.2 |
| Sodium (Na)               | 0.19 | 4 | 0.07 | Copper (Cu)                  | 5.34 | 3 | 2.39 |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | 64.9 | 3 | 3.19 |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - | -    |
| Magnesium (Mg)            | 0.34 | 4 | 0.04 |                              |      |   |      |
| Total Calcium (Ca)        | 0.03 | 4 | 0.04 |                              |      |   |      |
| Total Phosphorus (P)      | 0.79 | 3 | 0.16 |                              |      |   |      |
| Phytate P                 | 0.32 | 1 | -    |                              |      |   |      |
| Available P (Pav)         | 0.47 |   |      |                              |      |   |      |
| Coef. Dig. P Poultry      | -    |   |      |                              |      |   |      |
| Std. Dig. P Poultry       | -    |   |      |                              |      |   |      |
| Coef. Dig. P Swine        | 46.0 |   |      |                              |      |   |      |
| Std. Dig. P Swine         | 0.36 |   |      |                              |      |   |      |

Pav = Non Phytate P (Total P – Phytate P). <sup>#</sup>Corn desilaria co-product.

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Bran with Solubles**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 15.6  | 100   | 13.6             | 87.2  | 10.2             | 65.4  |
| Lysine, %                            | 0.50  | 3.21  | 0.40             | 79.3  | 0.23             | 45.9  |
| Methionine, %                        | 0.15  | 0.96  | 0.14             | 91.5  | 0.11             | 73.2  |
| Met + Cys, %                         | 0.31  | 1.99  | 0.28             | 89.0  | 0.20             | 65.7  |
| Threonine, %                         | 0.46  | 2.95  | 0.36             | 78.9  | 0.25             | 54.0  |
| Tryptophan, %                        | 0.12  | 0.77  | 0.10             | 83.0  | 0.08             | 65.7  |
| Arginine, %                          | 0.65  | 4.17  | 0.60             | 92.3  | 0.48             | 74.2  |
| Gly + Ser, %                         | 1.15  | 7.38  | 0.88             | 76.7  |                  |       |
| Valine, %                            | 0.51  | 3.27  | 0.46             | 91.0  | 0.33             | 64.8  |
| Isoleucine, %                        | 0.35  | 2.25  | 0.33             | 93.4  | 0.23             | 65.2  |
| Leucine, %                           | 0.99  | 6.35  | 0.91             | 92.3  | 0.71             | 72.1  |
| Histidine, %                         | 0.37  | 2.37  | 0.32             | 87.5  | 0.25             | 68.8  |
| Phenylalanine, %                     | 0.46  | 2.95  | 0.41             | 88.8  | 0.30             | 64.3  |
| Phe + Tyr, %                         | 0.82  | 5.26  | 0.73             | 88.7  | 0.52             | 63.5  |
| Alanine, %                           | 0.84  | 5.39  | 0.74             | 87.9  | 0.67             | 79.2  |
| Cysteine, %                          | 0.16  | 1.03  | 0.14             | 86.7  | 0.09             | 58.7  |
| Tyrosine, %                          | 0.36  | 2.31  | 0.32             | 88.5  | 0.22             | 62.4  |
| Glycine, %                           | 0.60  | 3.85  | 0.47             | 78.4  | 0.48             | 80.3  |
| Serine, %                            | 0.55  | 3.53  | 0.41             | 74.9  | 0.35             | 63.0  |
| Proline, %                           | 1.00  | 6.42  | 0.87             | 87.3  | 0.52             | 52.2  |
| Glutamine <sup>2</sup> , %           | 1.09  | 7.02  | 1.00             | 91.1  | 0.76             | 69.4  |
| Glutamic Acid <sup>2</sup> , %       | 0.69  | 4.40  | 0.63             | 91.1  | 0.48             | 69.4  |
| Asparagine <sup>2</sup> , %          | 0.35  | 2.28  | 0.30             | 85.4  | 0.19             | 52.9  |
| Aspartic Acid <sup>2</sup> , %       | 0.44  | 2.80  | 0.37             | 85.4  | 0.23             | 52.9  |
| Total Nitrogen (PB/6.25), %          | 2.49  | 16.0  | 2.17             | 87.2  | 1.63             | 65.4  |
| Essential Nitrogen Poultry, %        | 0.92  | 36.8* | 0.79             | 86.1  |                  |       |
| Essential Nitrogen Swine, %          | 0.73  | 29.4* |                  |       | 0.48             | 65.2  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 5            |        | 9        | 10        |           |
| Practical Maximum                                           | 7            |        | 11       | 13        |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 8            | 10     | 12       | 14        | 14        |
| Practical Maximum                                           | 10           | 12     | 15       | 18        | 18        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Distillers Dried Grains with Solubles (DDGS) - 6 to 9% of EE**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 90.2 | 13 | 1.43 | Organic Matter (OM)          | 86.8  |         |
| Crude Protein (CP)        | 30.5 | 13 | 1.67 | Coef. Dig. OM Swine          | 66.7  |         |
| Starch                    | 3.09 | 2  | 0.80 | Digestible OM Swine          | 57.9  |         |
| Crude Fiber (CF)          | 7.90 | 7  | 1.99 | Undig. OM Pigs               | 28.9  |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 7.68  | 13 0.91 |
| NDF                       | 48.5 | 6  | 7.81 | Coef. Dig. EE Poultry        | 88.4  |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 6.79  |         |
| ADF                       | 11.9 | 2  | 3.43 | Coef. Dig. EE Swine          | 85.0  |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 6.53  |         |
| N-Free Extract (NFE)      | 40.7 |    |      | Linoleic Acid                | -     | - -     |
| Coef. Dig. NFE Poultry    | 42.0 |    |      | Linolenic Acid               | -     | - -     |
| Digestible NFE Poultry    | 17.1 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 31.5 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 4779 | 8  | 152  | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3123  |         |
| Metabolizable Energy      | 2410 |    |      | Metabolizable Energy         | 2930  |         |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 1970  |         |
| Net Energy                | 1948 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3381  |         |
| Metabolizable Energy      | 2504 |    |      | Metabolizable Energy         | 3148  |         |
| Net Energy                | 2042 |    |      | Net Energy                   | 2129  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | N SD    |
| Ash, %                    | 3.43 | 13 | 1.15 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 9.33  | 1 -     |
| Potassium (K)             | 0.17 | 1  | -    | Iron (Fe)                    | 402.7 | 1 -     |
| Sodium (Na)               | 0.03 | 2  | 0.01 | Copper (Cu)                  | 4.38  | 1 -     |
| Chlorine (Cl)             | 0.14 | 1  | -    | Zinc (Zn)                    | 36.9  | 1 -     |
| Sulfur (S)                | 0.29 | 2  | 0.02 | Selenium (Se)                | -     | - -     |
| Magnesium (Mg)            | 0.06 | 1  | -    |                              |       |         |
| Total Calcium (Ca)        | 0.04 | 3  | 0.05 |                              |       |         |
| Total Phosphorus (P)      | 0.38 | 3  | 0.14 |                              |       |         |
| Phytate P                 | 0.26 | 2  | 0.01 |                              |       |         |
| Available P (Pav)         | 0.12 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | -    |    |      |                              |       |         |
| Std. Dig. P Poultry       | -    |    |      |                              |       |         |
| Coef. Dig. P Swine        | -    |    |      |                              |       |         |
| Std. Dig. P Swine         | -    |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Distillers Dried Grains with Solubles (DDGS) - 6 to 9% of EE**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 30.5  | 100   | 24.9             | 81.4  | 23.1             | 75.6  |
| Lysine, %                                   | 0.77  | 2.51  | 0.53             | 69.6  | 0.45             | 59.1  |
| Methionine, %                               | 0.38  | 1.24  | 0.32             | 85.0  | 0.31             | 81.9  |
| Met + Cys, %                                | 0.76  | 2.49  | 0.68             | 89.8  | 0.63             | 83.5  |
| Threonine, %                                | 1.07  | 3.50  | 0.79             | 73.6  | 0.73             | 68.0  |
| Tryptophan, %                               | 0.16  | 0.51  | 0.13             | 85.3  | 0.11             | 73.6  |
| Arginine, %                                 | 1.19  | 3.88  | 0.99             | 83.3  | 0.95             | 80.2  |
| Gly + Ser, %                                | 2.48  | 8.12  | 1.93             | 77.8  |                  |       |
| Valine, %                                   | 1.51  | 4.93  | 1.19             | 79.1  | 1.10             | 73.2  |
| Isoleucine, %                               | 1.13  | 3.68  | 0.91             | 80.6  | 0.83             | 74.1  |
| Leucine, %                                  | 3.95  | 12.9  | 3.38             | 85.5  | 3.26             | 82.6  |
| Histidine, %                                | 0.83  | 2.70  | 0.65             | 78.8  | 0.60             | 73.2  |
| Phenylalanine, %                            | 1.55  | 5.06  | 1.29             | 83.5  | 1.24             | 80.4  |
| Phe + Tyr, %                                | 2.57  | 8.42  | 2.09             | 81.2  | 2.05             | 79.9  |
| Alanine, %                                  | 2.29  | 7.48  | 1.90             | 83.1  | 1.77             | 77.4  |
| Cysteine, %                                 | 0.47  | 1.54  | 0.36             | 76.5  | 0.32             | 68.8  |
| Tyrosine, %                                 | 1.02  | 3.32  | 0.80             | 78.5  | 0.81             | 80.0  |
| Glycine, %                                  | 1.10  | 3.60  | 0.81             | 73.2  | 0.68             | 61.6  |
| Serine, %                                   | 1.38  | 4.52  | 1.12             | 81.5  | 1.03             | 74.3  |
| Proline, %                                  | 2.80  | 9.16  | 2.28             | 81.5  | 2.09             | 74.8  |
| Glutamine <sup>2</sup> , %                  | 3.55  | 11.6  | 3.04             | 85.8  | 2.78             | 78.4  |
| Glutamic Acid <sup>2</sup> , %              | 2.23  | 7.29  | 1.91             | 85.8  | 1.74             | 78.4  |
| Asparagine <sup>2</sup> , %                 | 0.88  | 2.87  | 0.64             | 73.6  | 0.59             | 66.9  |
| Aspartic Acid <sup>2</sup> , %              | 1.08  | 3.52  | 0.79             | 73.6  | 0.72             | 66.9  |
| Total Nitrogen (PB/6.25), %                 | 4.88  | 16.0  | 3.98             | 81.4  | 3.69             | 75.6  |
| Essential Nitrogen Poultry, %               | 2.18  | 44.5* | 1.76             | 80.8  |                  |       |
| Essential Nitrogen Swine, %                 | 1.79  | 36.6* |                  |       | 1.37             | 76.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 5            | 9      |          | 10        |           |
|                                                             | 7            | 11     |          | 13        |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 8            | 10     | 12       | 14        | 14        |
|                                                             | 10           | 12     | 15       | 18        | 18        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, High-Protein Distillers Dried Grains (HP-DDG)**

| Main Components (%)                       |      |    |      |                              |       |    |      |
|-------------------------------------------|------|----|------|------------------------------|-------|----|------|
|                                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Dry Matter                                | 91.6 | 14 | 1.11 | Organic Matter (OM)          | 89.0  |    |      |
| Crude Protein (CP)                        | 42.1 | 14 | 1.01 | Coef. Dig. OM Swine          | 76.0  |    |      |
| Starch                                    | 1.62 | 1  | -    | Digestible OM Swine          | 67.6  |    |      |
| Crude Fiber (CF)                          | 6.87 | 8  | 1.07 | Undig. OM Pigs               | 21.3  |    |      |
| Coef. Dig. CF Swine                       | -    |    |      | Ether Extract (EE)           | 11.9  | 12 | 0.85 |
| NDF                                       | 30.1 | 4  | 5.44 | Coef. Dig. EE Poultry        | 88.4  |    |      |
| Coef. Dig. NDF Swine                      | 79.5 |    |      | Digestible EE Poultry        | 10.5  |    |      |
| ADF                                       | 17.0 | 4  | 1.40 | Coef. Dig. EE Swine          | 85.0  |    |      |
| Coef. Dig. ADF Swine                      | 83.5 |    |      | Digestible EE Swine          | 10.1  |    |      |
| N-Free Extract (NFE)                      | 28.0 |    |      | Linoleic Acid                | -     | -  | -    |
| Coef. Dig. NFE Poultry                    | 45.0 |    |      | Linolenic Acid               | -     | -  | -    |
| Digestible NFE Poultry                    | 12.6 |    |      |                              |       |    |      |
| Undig. NFE + CF Poultry                   | 22.3 |    |      |                              |       |    |      |
|                                           |      |    |      |                              |       |    |      |
| Energy (kcal/kg)                          |      |    |      |                              |       |    |      |
|                                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Gross Energy                              | 5313 | 6  | 37   | <b>Swine</b>                 |       |    |      |
| <b>Poultry</b>                            |      |    |      | Digestible Energy            | 4060  |    |      |
| Metabolizable Energy                      | 3060 |    |      | Metabolizable Energy         | 3620  |    |      |
| Std. Metab. Energy                        | -    |    |      | Net Energy                   | 2456  |    |      |
| Net Energy                                | 2484 |    |      | <b>Sows</b>                  |       |    |      |
| <b>Hens</b>                               |      |    |      | Digestible Energy            | 4079  |    |      |
| Metabolizable Energy                      | 3126 |    |      | Metabolizable Energy         | 3781  |    |      |
| Net Energy                                | 2550 |    |      | Net Energy                   | 2573  |    |      |
|                                           |      |    |      |                              |       |    |      |
| Minerals                                  |      |    |      |                              |       |    |      |
|                                           | Mean | n  | SD   |                              | Mean  | N  | SD   |
| Ash, %                                    | 2.62 | 8  | 0.20 | <b>Trace Minerals, mg/kg</b> |       |    |      |
| <b>Macro Minerals (%)</b>                 |      |    |      | Manganese (Mn)               | 7.23  | 5  | 1.61 |
| Potassium (K)                             | 0.51 | 5  | 0.10 | Iron (Fe)                    | 126.4 | 5  | 31.2 |
| Sodium (Na)                               | 0.07 | 5  | 0.02 | Copper (Cu)                  | 8.39  | 5  | 2.01 |
| Chlorine (Cl)                             | -    | -  | -    | Zinc (Zn)                    | 58.4  | 5  | 16.1 |
| Sulfur (S)                                | -    | -  | -    | Selenium (Se)                | -     | -  | -    |
| Magnesium (Mg)                            | 0.10 | 1  | -    |                              |       |    |      |
| Total Calcium (Ca)                        | 0.01 | 6  | 0.01 |                              |       |    |      |
| Total Phosphorus (P)                      | 0.48 | 6  | 0.10 |                              |       |    |      |
| Phytate P                                 | 0.21 | 1  | -    |                              |       |    |      |
| Available P (Pav)                         | 0.27 |    |      |                              |       |    |      |
| Coef. Dig. P Poultry                      | -    |    |      |                              |       |    |      |
| Std. Dig. P Poultry                       | -    |    |      |                              |       |    |      |
| Coef. Dig. P Swine                        | 48.0 |    |      |                              |       |    |      |
| Std. Dig. P Swine                         | 0.23 |    |      |                              |       |    |      |
| Pav = Non Phytate P (Total P – Phytate P) |      |    |      |                              |       |    |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, High-Protein Distillers Dried Grains (HP-DDG)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 42.1  | 100   | 36.1             | 85.8  | 32.6             | 83.2  |
| Lysine, %                            | 1.32  | 3.13  | 1.06             | 80.3  | 0.82             | 79.2  |
| Methionine, %                        | 0.79  | 1.86  | 0.71             | 90.5  | 0.68             | 89.6  |
| Met + Cys, %                         | 1.56  | 3.69  | 1.33             | 85.3  | 1.26             | 87.2  |
| Threonine, %                         | 1.56  | 3.69  | 1.18             | 75.6  | 1.14             | 78.3  |
| Tryptophan, %                        | 0.23  | 0.55  | 0.18             | 78.0  | 0.18             | 92.4  |
| Arginine, %                          | 1.74  | 4.13  | 1.56             | 89.6  | 1.42             | 86.4  |
| Gly + Ser, %                         | 3.48  | 8.25  | 2.72             | 78.2  |                  |       |
| Valine, %                            | 2.02  | 4.78  | 1.73             | 85.8  | 1.47             | 80.5  |
| Isoleucine, %                        | 1.49  | 3.54  | 1.29             | 86.4  | 1.08             | 80.6  |
| Leucine, %                           | 4.78  | 11.3  | 4.33             | 90.6  | 3.75             | 85.9  |
| Histidine, %                         | 1.19  | 2.81  | 1.01             | 84.9  | 0.89             | 83.1  |
| Phenylalanine, %                     | 2.06  | 4.89  | 1.83             | 88.7  | 1.53             | 84.8  |
| Phe + Tyr, %                         | 3.71  | 8.80  | 3.29             | 88.6  | 2.76             | 84.7  |
| Alanine, %                           | 3.04  | 7.20  | 2.67             | 88.0  | 2.45             | 83.8  |
| Cysteine, %                          | 0.77  | 1.83  | 0.61             | 79.3  | 0.58             | 84.9  |
| Tyrosine, %                          | 1.65  | 3.92  | 1.46             | 88.6  | 1.23             | 84.5  |
| Glycine, %                           | 1.56  | 3.69  | 1.17             | 75.4  | 1.41             | 75.3  |
| Serine, %                            | 1.92  | 4.56  | 1.55             | 80.5  | 1.54             | 83.1  |
| Proline, %                           | 3.60  | 8.54  | 3.13             | 87.0  | 1.95             | 81.0  |
| Glutamine <sup>2</sup> , %           | 4.40  | 10.4  | 3.91             | 88.9  | 3.43             | 85.0  |
| Glutamic Acid <sup>2</sup> , %       | 2.76  | 6.55  | 2.45             | 88.9  | 2.16             | 85.0  |
| Asparagine <sup>2</sup> , %          | 1.19  | 2.83  | 0.93             | 77.7  | 0.83             | 81.2  |
| Aspartic Acid <sup>2</sup> , %       | 1.47  | 3.48  | 1.14             | 77.7  | 1.02             | 81.2  |
| Total Nitrogen (PB/6.25), %          | 6.74  | 16.0  | 5.78             | 85.8  | 5.61             | 83.2  |
| Essential Nitrogen Poultry, %        | 3.05  | 45.3* | 2.60             | 85.2  |                  |       |
| Essential Nitrogen Swine, %          | 2.51  | 37.2* |                  |       | 2.09             | 83.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 7            |        | 10       | 12        |           |
| Practical                                                   | 8            |        | 12       | 15        |           |
| Maximum                                                     |              |        |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 8            | 10     | 12       | 14        | 15        |
| Practical                                                   | 10           | 12     | 15       | 18        | 20        |
| Maximum                                                     |              |        |          |           |           |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Germ**

| Main Components (%)       |      |   |      |                              |       |   |      |
|---------------------------|------|---|------|------------------------------|-------|---|------|
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Dry Matter                | 89.2 | 5 | 0.96 | Organic Matter (OM)          | 86.4  |   |      |
| Crude Protein (CP)        | 10.3 | 7 | 0.41 | Coef. Dig. OM Swine          | 77.5  |   |      |
| Starch                    | 48.6 | 1 | -    | Digestible OM Swine          | 66.9  |   |      |
| Crude Fiber (CF)          | 5.14 | 3 | 1.10 | Undig. OM Pigs               | 19.4  |   |      |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 10.1  | 4 | 1.45 |
| NDF                       | 27.8 | 4 | 1.74 | Coef. Dig. EE Poultry        | 82.5  |   |      |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 8.33  |   |      |
| ADF                       | 8.50 | 5 | 0.95 | Coef. Dig. EE Swine          | 79.5  |   |      |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 8.03  |   |      |
| N-Free Extract (NFE)      | 60.8 |   |      | Linoleic Acid                | 3.08  | 2 | 0.03 |
| Coef. Dig. NFE Poultry    | 79.0 |   |      | Linolenic Acid               | -     | - | -    |
| Digestible NFE Poultry    | 48.1 |   |      |                              |       |   |      |
| Undig. NFE + CF Poultry   | 17.9 |   |      |                              |       |   |      |
|                           |      |   |      |                              |       |   |      |
| Energy (kcal/kg)          |      |   |      |                              |       |   |      |
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Gross Energy              | 4276 | 4 | 87   | <b>Swine</b>                 |       |   |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3355  |   |      |
| Metabolizable Energy      | 3144 |   |      | Metabolizable Energy         | 3257  |   |      |
| Std. Metab. Energy        | 3396 |   |      | Net Energy                   | 2571  |   |      |
| Net Energy                | 2577 |   |      | <b>Sows</b>                  |       |   |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3501  |   |      |
| Metabolizable Energy      | 3199 |   |      | Metabolizable Energy         | 3401  |   |      |
| Net Energy                | 2632 |   |      | Net Energy                   | 2676  |   |      |
|                           |      |   |      |                              |       |   |      |
| Minerals                  |      |   |      |                              |       |   |      |
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Ash, %                    | 2.83 | 5 | 1.10 | <b>Trace Minerals, mg/kg</b> |       |   |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 19.6  | 1 | -    |
| Potassium (K)             | 0.62 | 1 | -    | Iron (Fe)                    | 116.0 | 1 | -    |
| Sodium (Na)               | 0.02 | 1 | -    | Copper (Cu)                  | 10.0  | 1 | -    |
| Chlorine (Cl)             | 0.08 | 1 | -    | Zinc (Zn)                    | 45.9  | 1 | -    |
| Sulfur (S)                | 0.22 | 1 | -    | Selenium (Se)                | 0.10  | 1 | -    |
| Magnesium (Mg)            | 0.31 | 1 | -    |                              |       |   |      |
| Total Calcium (Ca)        | 0.03 | 5 | 0.02 |                              |       |   |      |
| Total Phosphorus (P)      | 0.43 | 5 | 0.12 |                              |       |   |      |
| Phytate P                 | 0.19 | 1 | -    |                              |       |   |      |
| Available P (Pav)         | 0.24 |   |      |                              |       |   |      |
| Coef. Dig. P Poultry      | 30.0 |   |      |                              |       |   |      |
| Std. Dig. P Poultry       | 0.13 |   |      |                              |       |   |      |
| Coef. Dig. P Swine        | 25.0 |   |      |                              |       |   |      |
| Std. Dig. P Swine         | 0.11 |   |      |                              |       |   |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Germ**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 10.3  | 100   | 8.85             | 86.0  | 7.37             | 71.5  |
| Lysine, %                            | 0.47  | 4.56  | 0.40             | 85.6  | 0.29             | 62.3  |
| Methionine, %                        | 0.20  | 1.94  | 0.18             | 90.0  | 0.16             | 77.6  |
| Met + Cys, %                         | 0.42  | 4.08  | 0.35             | 83.6  | 0.30             | 71.2  |
| Threonine, %                         | 0.39  | 3.79  | 0.30             | 77.2  | 0.27             | 70.5  |
| Tryptophan, %                        | 0.11  | 1.07  | 0.09             | 83.1  | 0.08             | 68.5  |
| Arginine, %                          | 0.70  | 6.80  | 0.67             | 96.2  | 0.59             | 84.6  |
| Gly + Ser, %                         | 0.98  | 9.51  | 0.77             | 78.3  |                  |       |
| Valine, %                            | 0.51  | 4.95  | 0.43             | 85.0  | 0.37             | 72.5  |
| Isoleucine, %                        | 0.33  | 3.20  | 0.28             | 86.2  | 0.25             | 74.5  |
| Leucine, %                           | 0.89  | 8.64  | 0.82             | 91.7  | 0.69             | 77.0  |
| Histidine, %                         | 0.31  | 3.01  | 0.28             | 90.8  | 0.24             | 78.0  |
| Phenylalanine, %                     | 0.44  | 4.27  | 0.39             | 89.2  | 0.32             | 73.5  |
| Phe + Tyr, %                         | 0.70  | 6.80  | 0.64             | 91.0  | 0.51             | 73.2  |
| Alanine, %                           | 0.67  | 6.50  | 0.56             | 83.1  | 0.45             | 66.6  |
| Cysteine, %                          | 0.22  | 2.14  | 0.17             | 77.8  | 0.14             | 65.3  |
| Tyrosine, %                          | 0.26  | 2.52  | 0.24             | 93.9  | 0.19             | 72.6  |
| Glycine, %                           | 0.51  | 4.95  | 0.40             | 78.3  | 0.35             | 68.0  |
| Serine, %                            | 0.47  | 4.56  | 0.37             | 78.3  | 0.32             | 68.3  |
| Proline, %                           | 0.73  | 7.09  | 0.64             | 87.2  | 0.54             | 74.6  |
| Glutamine <sup>2</sup> , %           | 0.93  | 9.01  | 0.80             | 86.4  | 0.66             | 70.6  |
| Glutamic Acid <sup>2</sup> , %       | 0.58  | 5.65  | 0.50             | 86.4  | 0.41             | 70.6  |
| Asparagine <sup>2</sup> , %          | 0.35  | 3.40  | 0.28             | 80.6  | 0.22             | 61.6  |
| Aspartic Acid <sup>2</sup> , %       | 0.43  | 4.17  | 0.35             | 80.6  | 0.26             | 61.6  |
| Total Nitrogen (PB/6.25), %          | 1.65  | 16.0  | 1.42             | 86.0  | 1.18             | 71.5  |
| Essential Nitrogen Poultry, %        | 0.87  | 52.5* | 0.75             | 86.7  |                  |       |
| Essential Nitrogen Swine, %          | 0.71  | 42.9* |                  |       | 0.53             | 74.9  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 5                   | 10     | 10          |             |           |
| Practical Maximum                                           | 10                  | 15     | 20          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 10                  | 13     | 13          | 15          | 15        |
| Practical Maximum                                           | 15                  | 18     | 18          | 20          | 20        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Gluten Feed 21% CP**

| Main Components (%)       |      |    |      |                              |       |        |
|---------------------------|------|----|------|------------------------------|-------|--------|
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Dry Matter                | 89.8 | 9  | 1.38 | Organic Matter (OM)          | 84.3  |        |
| Crude Protein (CP)        | 21.0 | 10 | 1.85 | Coef. Dig. OM Swine          | 66.0  |        |
| Starch                    | 19.2 | 4  | 2.88 | Digestible OM Swine          | 55.6  |        |
| Crude Fiber (CF)          | 8.26 | 8  | 0.62 | Undig. OM Pigs               | 28.7  |        |
| Coef. Dig. CF Swine       | 51.1 |    |      | Ether Extract (EE)           | 3.20  | 8 0.55 |
| NDF                       | 36.9 | 5  | 2.56 | Coef. Dig. EE Poultry        | 56.0  |        |
| Coef. Dig. NDF Swine      | 55.7 |    |      | Digestible EE Poultry        | 1.79  |        |
| ADF                       | 10.7 | 5  | 1.12 | Coef. Dig. EE Swine          | 76.2  |        |
| Coef. Dig. ADF Swine      | 59.0 |    |      | Digestible EE Swine          | 2.44  |        |
| N-Free Extract (NFE)      | 51.8 |    |      | Linoleic Acid                | 1.46  | 1 -    |
| Coef. Dig. NFE Poultry    | 45.4 |    |      | Linolenic Acid               | 0.03  | 1 -    |
| Digestible NFE Poultry    | 23.5 |    |      |                              |       |        |
| Undig. NFE + CF Poultry   | 36.6 |    |      |                              |       |        |
| Energy (kcal/kg)          |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Gross Energy              | 3930 | 5  | 136  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2700  |        |
| Metabolizable Energy      | 1880 |    |      | Metabolizable Energy         | 2560  |        |
| Std. Metab. Energy        | 1895 |    |      | Net Energy                   | 1761  |        |
| Net Energy                | 1489 |    |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2963  |        |
| Metabolizable Energy      | 1998 |    |      | Metabolizable Energy         | 2778  |        |
| Net Energy                | 1607 |    |      | Net Energy                   | 1920  |        |
| Minerals                  |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Ash, %                    | 5.55 | 8  | 0.87 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 19.2  | 1 -    |
| Potassium (K)             | 0.98 | 4  | 0.60 | Iron (Fe)                    | 134.0 | 1 -    |
| Sodium (Na)               | 0.18 | 3  | 0.06 | Copper (Cu)                  | 16.9  | 1 -    |
| Chlorine (Cl)             | 0.21 | 2  | 0.01 | Zinc (Zn)                    | 72.9  | 1 -    |
| Sulfur (S)                | 0.28 | 1  | -    | Selenium (Se)                | 0.21  | 1 -    |
| Magnesium (Mg)            | 0.32 | 2  | 0.03 |                              |       |        |
| Total Calcium (Ca)        | 0.12 | 5  | 0.05 |                              |       |        |
| Total Phosphorus (P)      | 0.74 | 5  | 0.09 |                              |       |        |
| Phytate P                 | 0.45 | 2  | 0.28 |                              |       |        |
| Available P (Pav)         | 0.29 |    |      |                              |       |        |
| Coef. Dig. P Poultry      | 30.0 |    |      |                              |       |        |
| Std. Dig. P Poultry       | 0.22 |    |      |                              |       |        |
| Coef. Dig. P Swine        | 28.0 |    |      |                              |       |        |
| Std. Dig. P Swine         | 0.21 |    |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Gluten Feed 21% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 21.0  | 100   | 17.4             | 82.8  | 16.2             | 77.2  |
| Lysine, %                            | 0.52  | 2.48  | 0.38             | 72.8  | 0.34             | 65.6  |
| Methionine, %                        | 0.33  | 1.57  | 0.27             | 82.9  | 0.27             | 82.0  |
| Met + Cys, %                         | 0.82  | 3.90  | 0.61             | 74.3  | 0.59             | 72.1  |
| Threonine, %                         | 0.78  | 3.71  | 0.59             | 76.2  | 0.55             | 71.0  |
| Tryptophan, %                        | 0.13  | 0.62  | 0.10             | 77.2  | 0.08             | 63.5  |
| Arginine, %                          | 0.86  | 4.09  | 0.77             | 89.5  | 0.72             | 83.2  |
| Gly + Ser, %                         | 1.76  | 8.38  | 1.26             | 71.6  |                  |       |
| Valine, %                            | 1.06  | 5.05  | 0.88             | 83.3  | 0.79             | 74.6  |
| Isoleucine, %                        | 0.64  | 3.05  | 0.53             | 82.9  | 0.50             | 78.3  |
| Leucine, %                           | 1.87  | 8.90  | 1.68             | 90.0  | 1.57             | 83.8  |
| Histidine, %                         | 0.71  | 3.38  | 0.58             | 82.3  | 0.51             | 72.4  |
| Phenylalanine, %                     | 0.74  | 3.52  | 0.64             | 86.9  | 0.63             | 85.2  |
| Phe + Tyr, %                         | 1.09  | 5.19  | 0.94             | 86.3  | 0.92             | 84.7  |
| Alanine, %                           | 1.51  | 7.19  | 1.30             | 86.0  | 1.24             | 82.0  |
| Cysteine, %                          | 0.49  | 2.33  | 0.34             | 68.5  | 0.32             | 65.5  |
| Tyrosine, %                          | 0.35  | 1.67  | 0.30             | 84.9  | 0.29             | 83.5  |
| Glycine, %                           | 0.96  | 4.57  | 0.69             | 71.6  | 0.61             | 63.5  |
| Serine, %                            | 0.80  | 3.81  | 0.57             | 71.6  | 0.61             | 76.5  |
| Proline, %                           | 1.91  | 9.09  | 1.60             | 84.0  | 1.46             | 76.5  |
| Glutamine <sup>2</sup> , %           | 2.03  | 9.65  | 1.76             | 87.0  | 1.63             | 80.5  |
| Glutamic Acid <sup>2</sup> , %       | 1.27  | 6.06  | 1.11             | 87.0  | 1.02             | 80.5  |
| Asparagine <sup>2</sup> , %          | 0.48  | 2.29  | 0.36             | 76.0  | 0.34             | 71.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.59  | 2.81  | 0.45             | 76.0  | 0.42             | 71.0  |
| Total Nitrogen (PB/6.25), %          | 3.36  | 16.0  | 2.78             | 82.8  | 2.59             | 77.2  |
| Essential Nitrogen Poultry, %        | 1.45  | 43.2* | 1.19             | 81.9  |                  |       |
| Essential Nitrogen Swine, %          | 1.17  | 34.7* |                  |       | 0.91             | 78.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 3            | 8      | 4        | 4         | 12        |
| Practical Maximum                                           | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 3            | 4      | 5        | 5         | 4         |
|                                                             | 8            | 10     | 10       | 10        | 8         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Gluten Meal 60% CP**

| Main Components (%)       |      |    |      |                              |      |        |
|---------------------------|------|----|------|------------------------------|------|--------|
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Dry Matter                | 91.2 | 16 | 1.32 | Organic Matter (OM)          | 89.4 |        |
| Crude Protein (CP)        | 61.7 | 15 | 1.71 | Coef. Dig. OM Swine          | 91.7 |        |
| Starch                    | 13.4 | 4  | 2.72 | Digestible OM Swine          | 81.9 |        |
| Crude Fiber (CF)          | 1.23 | 6  | 0.22 | Undig. OM Pigs               | 7.42 |        |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 1.98 | 6 0.66 |
| NDF                       | 6.28 | 5  | 1.28 | Coef. Dig. EE Poultry        | 95.0 |        |
| Coef. Dig. NDF Swine      | 73.5 |    |      | Digestible EE Poultry        | 1.88 |        |
| ADF                       | 6.18 | 5  | 2.56 | Coef. Dig. EE Swine          | 69.0 |        |
| Coef. Dig. ADF Swine      | 44.7 |    |      | Digestible EE Swine          | 1.37 |        |
| N-Free Extract (NFE)      | 24.5 |    |      | Linoleic Acid                | 1.21 | 1 -    |
| Coef. Dig. NFE Poultry    | 98.0 |    |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | 24.0 |    |      |                              |      |        |
| Undig. NFE + CF Poultry   | 1.72 |    |      |                              |      |        |
| Energy (kcal/kg)          |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Gross Energy              | 4977 | 6  | 60   | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 4341 |        |
| Metabolizable Energy      | 3705 |    |      | Metabolizable Energy         | 3929 |        |
| Std. Metab. Energy        | 3868 |    |      | Net Energy                   | 2518 |        |
| Net Energy                | 2891 |    |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 4389 |        |
| Metabolizable Energy      | 3665 |    |      | Metabolizable Energy         | 3977 |        |
| Net Energy                | 2851 |    |      | Net Energy                   | 2553 |        |
| Minerals                  |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Ash, %                    | 1.86 | 6  | 0.41 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 3.1  | 1 -    |
| Potassium (K)             | 0.30 | 3  | 0.16 | Iron (Fe)                    | 113  | 1 -    |
| Sodium (Na)               | 0.02 | 3  | 0.01 | Copper (Cu)                  | 19.1 | 1 -    |
| Chlorine (Cl)             | 0.05 | 1  | -    | Zinc (Zn)                    | 25.3 | 1 -    |
| Sulfur (S)                | 0.53 | 1  | -    | Selenium (Se)                | 0.20 | 1 -    |
| Magnesium (Mg)            | 0.08 | 3  | 0.02 |                              |      |        |
| Total Calcium (Ca)        | 0.03 | 6  | 0.01 |                              |      |        |
| Total Phosphorus (P)      | 0.52 | 7  | 0.14 |                              |      |        |
| Phytate P                 | 0.47 | 3  | 0.07 |                              |      |        |
| Available P (Pav)         | 0.05 |    |      |                              |      |        |
| Coef. Dig. P Poultry      | 30.0 |    |      |                              |      |        |
| Std. Dig. P Poultry       | 0.16 |    |      |                              |      |        |
| Coef. Dig. P Swine        | 30.0 |    |      |                              |      |        |
| Std. Dig. P Swine         | 0.16 |    |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Gluten Meal 60% CP**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 61.7  | 100   | 57.9             | 93.8  | 56.4             | 91.4  |
| Lysine, %                                   | 1.05  | 1.70  | 0.95             | 90.7  | 0.92             | 87.6  |
| Methionine, %                               | 1.48  | 2.40  | 1.41             | 95.0  | 1.38             | 93.1  |
| Met + Cys, %                                | 2.41  | 3.91  | 2.19             | 90.8  | 2.18             | 90.6  |
| Threonine, %                                | 2.10  | 3.40  | 1.94             | 92.6  | 1.89             | 90.1  |
| Tryptophan, %                               | 0.30  | 0.49  | 0.27             | 90.5  | 0.24             | 80.5  |
| Arginine, %                                 | 2.00  | 3.24  | 1.89             | 94.7  | 1.88             | 94.2  |
| Gly + Ser, %                                | 4.98  | 8.07  | 4.50             | 90.4  |                  |       |
| Valine, %                                   | 2.90  | 4.69  | 2.72             | 93.8  | 2.61             | 90.1  |
| Isoleucine, %                               | 2.55  | 4.13  | 2.37             | 93.3  | 2.30             | 90.2  |
| Leucine, %                                  | 10.2  | 16.6  | 9.85             | 96.2  | 9.49             | 92.7  |
| Histidine, %                                | 1.32  | 2.14  | 1.19             | 90.5  | 1.22             | 92.1  |
| Phenylalanine, %                            | 3.94  | 6.39  | 3.48             | 88.2  | 3.64             | 92.5  |
| Phe + Tyr, %                                | 7.07  | 11.5  | 6.48             | 91.6  | 6.47             | 91.5  |
| Alanine, %                                  | 5.71  | 9.26  | 5.46             | 95.6  | 5.31             | 93.0  |
| Cysteine, %                                 | 0.93  | 1.51  | 0.78             | 84.0  | 0.80             | 86.5  |
| Tyrosine, %                                 | 3.13  | 5.07  | 3.00             | 95.9  | 2.83             | 90.3  |
| Glycine, %                                  | 1.64  | 2.66  | 1.35             | 82.1  | 1.42             | 86.5  |
| Serine, %                                   | 3.34  | 5.41  | 3.16             | 94.5  | 3.14             | 94.0  |
| Proline, %                                  | 4.29  | 6.95  | 4.04             | 94.2  | 3.54             | 82.5  |
| Glutamine <sup>2</sup> , %                  | 8.32  | 13.5  | 7.93             | 95.4  | 7.78             | 93.5  |
| Glutamic Acid <sup>2</sup> , %              | 5.22  | 8.46  | 4.98             | 95.4  | 4.88             | 93.5  |
| Asparagine <sup>2</sup> , %                 | 1.65  | 2.67  | 1.50             | 91.0  | 1.50             | 91.0  |
| Aspartic Acid <sup>2</sup> , %              | 2.02  | 3.28  | 1.84             | 91.0  | 1.84             | 91.0  |
| Total Nitrogen (PB/6.25), %                 | 9.87  | 16.0  | 9.26             | 93.8  | 9.02             | 91.4  |
| Essential Nitrogen Poultry, %               | 4.42  | 44.8* | 4.12             | 93.1  |                  |       |
| Essential Nitrogen Swine, %                 | 3.67  | 37.2* |                  |       | 3.37             | 91.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 4                   | 4      | 4           |             |           |
| Practical Maximum                                                  | 8                   | 8      | 10          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 3                   | 4      | 5           | 5           | 4         |
| Practical Maximum                                                  | 8                   | 10     | 10          | 12          | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Grain (Mean – 1 SD of Dry Matter)**

| Main Components (%)                       |      |   |    |                              |      |   |    |
|-------------------------------------------|------|---|----|------------------------------|------|---|----|
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                                | 86.8 | - | -  | Organic Matter (OM)          | 85.7 |   |    |
| Crude Protein (CP)                        | 7.65 | - | -  | Coef. Dig. OM Swine          | 86.4 |   |    |
| Starch                                    | 62.1 | - | -  | Digestible OM Swine          | 74.0 |   |    |
| Crude Fiber (CF)                          | 1.69 | - | -  | Undig. OM Pigs               | 11.7 |   |    |
| Coef. Dig. CF Swine                       | 41.4 |   |    | Ether Extract (EE)           | 3.65 | - | -  |
| NDF                                       | 13.5 | - | -  | Coef. Dig. EE Poultry        | 92.0 |   |    |
| Coef. Dig. NDF Swine                      | 66.4 |   |    | Digestible EE Poultry        | 3.36 |   |    |
| ADF                                       | 3.10 | - | -  | Coef. Dig. EE Swine          | 90.0 |   |    |
| Coef. Dig. ADF Swine                      | 68.2 |   |    | Digestible EE Swine          | 3.29 |   |    |
| N-Free Extract (NFE)                      | 72.7 |   |    | Linoleic Acid                | 1.87 | - | -  |
| Coef. Dig. NFE Poultry                    | 89.2 |   |    | Linolenic Acid               | 0.03 | - | -  |
| Digestible NFE Poultry                    | 64.9 |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry                   | 9.54 |   |    |                              |      |   |    |
|                                           |      |   |    |                              |      |   |    |
| Energy (kcal/kg)                          |      |   |    |                              |      |   |    |
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy                              | 3850 | - | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>                            |      |   |    | Digestible Energy            | 3373 |   |    |
| Metabolizable Energy                      | 3296 |   |    | Metabolizable Energy         | 3292 |   |    |
| Std. Metab. Energy                        | 3411 |   |    | Net Energy                   | 2613 |   |    |
| Net Energy                                | 2656 |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>                               |      |   |    | Digestible Energy            | 3455 |   |    |
| Metabolizable Energy                      | 3324 |   |    | Metabolizable Energy         | 3379 |   |    |
| Net Energy                                | 2684 |   |    | Net Energy                   | 2677 |   |    |
|                                           |      |   |    |                              |      |   |    |
| Minerals                                  |      |   |    |                              |      |   |    |
|                                           | Mean | n | SD |                              | Mean | N | SD |
| Ash, %                                    | 1.10 | - | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b>                 |      |   |    | Manganese (Mn)               | 6.75 | - | -  |
| Potassium (K)                             | 0.31 | - | -  | Iron (Fe)                    | 22.3 | - | -  |
| Sodium (Na)                               | 0.01 | - | -  | Copper (Cu)                  | 2.18 | - | -  |
| Chlorine (Cl)                             | 0.09 | - | -  | Zinc (Zn)                    | 21.1 | - | -  |
| Sulfur (S)                                | 0.08 | - | -  | Selenium (Se)                | 0.07 | - | -  |
| Magnesium (Mg)                            | 0.11 | - | -  |                              |      |   |    |
| Total Calcium (Ca)                        | 0.01 | - | -  |                              |      |   |    |
| Total Phosphorus (P)                      | 0.22 | - | -  |                              |      |   |    |
| Phytate P                                 | 0.18 | - | -  |                              |      |   |    |
| Available P (Pav)                         | 0.05 |   |    |                              |      |   |    |
| Coef. Dig. P Poultry                      | 40.8 |   |    |                              |      |   |    |
| Std. Dig. P Poultry                       | 0.09 |   |    |                              |      |   |    |
| Coef. Dig. P Swine                        | 44.0 |   |    |                              |      |   |    |
| Std. Dig. P Swine                         | 0.10 |   |    |                              |      |   |    |
| Pav = Non Phytate P (Total P – Phytate P) |      |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Grain (Mean – 1 SD of Dry Matter)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 7.65  | 100   | 6.88             | 89.9  | 6.58             | 86.0  |
| Lysine, %                            | 0.25  | 3.23  | 0.20             | 82.5  | 0.20             | 78.9  |
| Methionine, %                        | 0.15  | 2.02  | 0.14             | 93.4  | 0.13             | 86.4  |
| Met + Cys, %                         | 0.32  | 4.19  | 0.28             | 88.3  | 0.28             | 88.1  |
| Threonine, %                         | 0.30  | 3.87  | 0.28             | 93.9  | 0.23             | 78.8  |
| Tryptophan, %                        | 0.06  | 0.81  | 0.06             | 95.2  | 0.05             | 75.7  |
| Arginine, %                          | 0.38  | 5.03  | 0.35             | 91.0  | 0.34             | 89.6  |
| Gly + Ser, %                         | 0.71  | 9.22  | 0.56             | 78.9  |                  |       |
| Valine, %                            | 0.39  | 5.06  | 0.34             | 87.3  | 0.34             | 88.5  |
| Isoleucine, %                        | 0.27  | 3.52  | 0.25             | 94.0  | 0.24             | 89.9  |
| Leucine, %                           | 0.94  | 12.2  | 0.89             | 95.4  | 0.84             | 89.5  |
| Histidine, %                         | 0.23  | 3.01  | 0.21             | 93.3  | 0.20             | 86.5  |
| Phenylalanine, %                     | 0.36  | 4.64  | 0.32             | 90.5  | 0.32             | 89.7  |
| Phe + Tyr, %                         | 0.64  | 8.36  | 0.59             | 92.7  | 0.58             | 91.0  |
| Alanine, %                           | 0.59  | 7.72  | 0.48             | 81.0  | 0.51             | 85.6  |
| Cysteine, %                          | 0.17  | 2.18  | 0.14             | 83.6  | 0.15             | 89.7  |
| Tyrosine, %                          | 0.28  | 3.71  | 0.27             | 95.4  | 0.26             | 92.6  |
| Glycine, %                           | 0.31  | 4.10  | 0.24             | 76.0  | 0.25             | 79.2  |
| Serine, %                            | 0.39  | 5.12  | 0.32             | 81.2  | 0.33             | 83.8  |
| Proline, %                           | 0.75  | 9.80  | 0.71             | 94.5  | 0.62             | 82.7  |
| Glutamine <sup>2</sup> , %           | 0.89  | 11.6  | 0.84             | 94.4  | 0.78             | 87.6  |
| Glutamic Acid <sup>2</sup> , %       | 0.56  | 7.27  | 0.53             | 94.4  | 0.49             | 87.6  |
| Asparagine <sup>2</sup> , %          | 0.27  | 3.52  | 0.22             | 82.4  | 0.22             | 81.7  |
| Aspartic Acid <sup>2</sup> , %       | 0.33  | 4.33  | 0.27             | 82.4  | 0.27             | 81.7  |
| Total Nitrogen (PB/6.25), %          | 1.22  | 16.0  | 1.10             | 89.9  | 1.05             | 86.0  |
| Essential Nitrogen Poultry, %        | 0.61  | 49.6* | 0.54             | 89.7  |                  |       |
| Essential Nitrogen Swine, %          | 0.50  | 40.6* |                  |       | 0.43             | 87.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 65           | 65     | 65       | 65        | 65        |
| Practical Maximum                                           | 65           | 65     | 65       | 65        | 65        |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 60           | 65     | 70       | 65        | 70        |
| Practical Maximum                                           | 60           | 65     | 70       | 65        | 70        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Grain (Average)**

| Main Components (%)                       |      |     |      |                              |      |     |      |
|-------------------------------------------|------|-----|------|------------------------------|------|-----|------|
|                                           | Mean | n   | SD   |                              | Mean | n   | SD   |
| Dry Matter                                | 88.6 | 351 | 1.85 | Organic Matter (OM)          | 87.5 |     |      |
| Crude Protein (CP)                        | 7.81 | 508 | 0.86 | Coef. Dig. OM Swine          | 86.4 |     |      |
| Starch                                    | 63.4 | 148 | 2.51 | Digestible OM Swine          | 75.6 |     |      |
| Crude Fiber (CF)                          | 1.72 | 121 | 0.20 | Undig. OM Pigs               | 11.9 |     |      |
| Coef. Dig. CF Swine                       | 41.4 |     |      | Ether Extract (EE)           | 3.73 | 233 | 0.29 |
| NDF                                       | 13.8 | 3   | 1.20 | Coef. Dig. EE Poultry        | 92.0 |     |      |
| Coef. Dig. NDF Swine                      | 66.4 |     |      | Digestible EE Poultry        | 3.43 |     |      |
| ADF                                       | 3.16 | 3   | 0.29 | Coef. Dig. EE Swine          | 90.0 |     |      |
| Coef. Dig. ADF Swine                      | 68.2 |     |      | Digestible EE Swine          | 3.36 |     |      |
| N-Free Extract (NFE)                      | 74.2 |     |      | Linoleic Acid                | 1.91 | 1   | -    |
| Coef. Dig. NFE Poultry                    | 89.2 |     |      | Linolenic Acid               | 0.03 | 1   | -    |
| Digestible NFE Poultry                    | 66.2 |     |      |                              |      |     |      |
| Undig. NFE + CF Poultry                   | 9.74 |     |      |                              |      |     |      |
|                                           |      |     |      |                              |      |     |      |
| Energy (kcal/kg)                          |      |     |      |                              |      |     |      |
|                                           | Mean | n   | SD   |                              | Mean | n   | SD   |
| Gross Energy                              | 3929 | 18  | 38   | <b>Swine</b>                 |      |     |      |
| <b>Poultry</b>                            |      |     |      | Digestible Energy            | 3442 |     |      |
| Metabolizable Energy                      | 3364 |     |      | Metabolizable Energy         | 3360 |     |      |
| Std. Metab. Energy                        | 3481 |     |      | Net Energy                   | 2667 |     |      |
| Net Energy                                | 2711 |     |      | <b>Sows</b>                  |      |     |      |
| <b>Hens</b>                               |      |     |      | Digestible Energy            | 3529 |     |      |
| Metabolizable Energy                      | 3391 |     |      | Metabolizable Energy         | 3452 |     |      |
| Net Energy                                | 2738 |     |      | Net Energy                   | 2734 |     |      |
|                                           |      |     |      |                              |      |     |      |
| Minerals                                  |      |     |      |                              |      |     |      |
|                                           | Mean | n   | SD   |                              | Mean | N   | SD   |
| Ash, %                                    | 1.12 | 40  | 0.19 | <b>Trace Minerals, mg/kg</b> |      |     |      |
| <b>Macro Minerals (%)</b>                 |      |     |      | Manganese (Mn)               | 6.89 | 2   | 2.24 |
| Potassium (K)                             | 0.32 | 4   | 0.04 | Iron (Fe)                    | 22.8 | 2   | 1.00 |
| Sodium (Na)                               | 0.01 | 4   | 0.01 | Copper (Cu)                  | 2.23 | 2   | 0.18 |
| Chlorine (Cl)                             | 0.09 | 3   | 0.04 | Zinc (Zn)                    | 21.5 | 1   | -    |
| Sulfur (S)                                | 0.08 | 2   | 0.04 | Selenium (Se)                | 0.07 | 1   | -    |
| Magnesium (Mg)                            | 0.11 | 4   | 0.02 |                              |      |     |      |
| Total Calcium (Ca)                        | 0.02 | 37  | 0.01 |                              |      |     |      |
| Total Phosphorus (P)                      | 0.23 | 30  | 0.09 |                              |      |     |      |
| Phytate P                                 | 0.18 | 70  | 0.03 |                              |      |     |      |
| Available P (Pav)                         | 0.05 |     |      |                              |      |     |      |
| Coef. Dig. P Poultry                      | 40.8 |     |      |                              |      |     |      |
| Std. Dig. P Poultry                       | 0.09 |     |      |                              |      |     |      |
| Coef. Dig. P Swine                        | 44.0 |     |      |                              |      |     |      |
| Std. Dig. P Swine                         | 0.10 |     |      |                              |      |     |      |
| Pav = Non Phytate P (Total P – Phytate P) |      |     |      |                              |      |     |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Grain (Average)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 7.81  | 100   | 7.02             | 89.9  | 6.72             | 86.0  |
| Lysine, %                            | 0.25  | 3.23  | 0.21             | 82.5  | 0.20             | 78.9  |
| Methionine, %                        | 0.16  | 2.02  | 0.15             | 93.4  | 0.14             | 86.4  |
| Met + Cys, %                         | 0.33  | 4.19  | 0.29             | 88.3  | 0.29             | 88.1  |
| Threonine, %                         | 0.30  | 3.87  | 0.28             | 93.9  | 0.24             | 78.8  |
| Tryptophan, %                        | 0.06  | 0.81  | 0.06             | 95.2  | 0.05             | 75.7  |
| Arginine, %                          | 0.39  | 5.03  | 0.36             | 91.0  | 0.35             | 89.6  |
| Gly + Ser, %                         | 0.72  | 9.22  | 0.57             | 78.9  |                  |       |
| Valine, %                            | 0.40  | 5.06  | 0.34             | 87.3  | 0.35             | 88.5  |
| Isoleucine, %                        | 0.28  | 3.52  | 0.26             | 94.0  | 0.25             | 89.9  |
| Leucine, %                           | 0.96  | 12.2  | 0.91             | 95.4  | 0.85             | 89.5  |
| Histidine, %                         | 0.24  | 3.01  | 0.22             | 93.3  | 0.20             | 86.5  |
| Phenylalanine, %                     | 0.36  | 4.64  | 0.33             | 90.5  | 0.33             | 89.7  |
| Phe + Tyr, %                         | 0.65  | 8.36  | 0.60             | 92.7  | 0.59             | 91.0  |
| Alanine, %                           | 0.60  | 7.72  | 0.49             | 81.0  | 0.52             | 85.6  |
| Cysteine, %                          | 0.17  | 2.18  | 0.14             | 83.6  | 0.15             | 89.7  |
| Tyrosine, %                          | 0.29  | 3.71  | 0.28             | 95.4  | 0.27             | 92.6  |
| Glycine, %                           | 0.32  | 4.10  | 0.24             | 76.0  | 0.25             | 79.2  |
| Serine, %                            | 0.40  | 5.12  | 0.32             | 81.2  | 0.34             | 83.8  |
| Proline, %                           | 0.77  | 9.80  | 0.72             | 94.5  | 0.63             | 82.7  |
| Glutamine <sup>2</sup> , %           | 0.90  | 11.6  | 0.85             | 94.4  | 0.79             | 87.6  |
| Glutamic Acid <sup>2</sup> , %       | 0.57  | 7.27  | 0.54             | 94.4  | 0.50             | 87.6  |
| Asparagine <sup>2</sup> , %          | 0.27  | 3.52  | 0.23             | 82.4  | 0.22             | 81.7  |
| Aspartic Acid <sup>2</sup> , %       | 0.34  | 4.33  | 0.28             | 82.4  | 0.28             | 81.7  |
| Total Nitrogen (PB/6.25), %          | 1.25  | 16.0  | 1.12             | 89.9  | 1.07             | 86.0  |
| Essential Nitrogen Poultry, %        | 0.62  | 49.6* | 0.56             | 89.7  |                  |       |
| Essential Nitrogen Swine, %          | 0.51  | 40.9* |                  |       | 0.44             | 87.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 65           | 65     | 65       | 65        | 65        |
| Practical Maximum                                           | 65           | 65     | 65       | 65        | 65        |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 60           | 65     | 70       | 65        | 70        |
| Practical Maximum                                           | 60           | 65     | 70       | 65        | 70        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Grain (Mean + 1 SD of Dry Matter)**

| Main Components (%)                       |      |   |    |                              |      |   |    |
|-------------------------------------------|------|---|----|------------------------------|------|---|----|
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                                | 90.5 | - | -  | Organic Matter (OM)          | 89.4 |   |    |
| Crude Protein (CP)                        | 7.98 | - | -  | Coef. Dig. OM Swine          | 86.4 |   |    |
| Starch                                    | 64.8 | - | -  | Digestible OM Swine          | 77.2 |   |    |
| Crude Fiber (CF)                          | 1.76 | - | -  | Undig. OM Pigs               | 12.2 |   |    |
| Coef. Dig. CF Swine                       | 41.4 |   |    | Ether Extract (EE)           | 3.81 | - | -  |
| NDF                                       | 14.1 | - | -  | Coef. Dig. EE Poultry        | 92.0 |   |    |
| Coef. Dig. NDF Swine                      | 66.4 |   |    | Digestible EE Poultry        | 3.50 |   |    |
| ADF                                       | 3.23 | - | -  | Coef. Dig. EE Swine          | 90.0 |   |    |
| Coef. Dig. ADF Swine                      | 68.2 |   |    | Digestible EE Swine          | 3.43 |   |    |
| N-Free Extract (NFE)                      | 75.8 |   |    | Linoleic Acid                | 1.95 | - | -  |
| Coef. Dig. NFE Poultry                    | 89.2 |   |    | Linolenic Acid               | 0.03 | - | -  |
| Digestible NFE Poultry                    | 67.6 |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry                   | 9.95 |   |    |                              |      |   |    |
|                                           |      |   |    |                              |      |   |    |
| Energy (kcal/kg)                          |      |   |    |                              |      |   |    |
|                                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy                              | 4014 | - | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>                            |      |   |    | Digestible Energy            | 3517 |   |    |
| Metabolizable Energy                      | 3437 |   |    | Metabolizable Energy         | 3433 |   |    |
| Std. Metab. Energy                        | 3556 |   |    | Net Energy                   | 2725 |   |    |
| Net Energy                                | 2766 |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>                               |      |   |    | Digestible Energy            | 3604 |   |    |
| Metabolizable Energy                      | 3463 |   |    | Metabolizable Energy         | 3525 |   |    |
| Net Energy                                | 2796 |   |    | Net Energy                   | 2793 |   |    |
|                                           |      |   |    |                              |      |   |    |
| Minerals                                  |      |   |    |                              |      |   |    |
|                                           | Mean | n | SD |                              | Mean | N | SD |
| Ash, %                                    | 1.14 | - | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b>                 |      |   |    | Manganese (Mn)               | 7.03 | - | -  |
| Potassium (K)                             | 0.33 | - | -  | Iron (Fe)                    | 23.3 | - | -  |
| Sodium (Na)                               | 0.01 | - | -  | Copper (Cu)                  | 2.27 | - | -  |
| Chlorine (Cl)                             | 0.09 | - | -  | Zinc (Zn)                    | 22.0 | - | -  |
| Sulfur (S)                                | 0.08 | - | -  | Selenium (Se)                | 0.07 | - | -  |
| Magnesium (Mg)                            | 0.11 | - | -  |                              |      |   |    |
| Total Calcium (Ca)                        | 0.02 | - | -  |                              |      |   |    |
| Total Phosphorus (P)                      | 0.23 | - | -  |                              |      |   |    |
| Phytate P                                 | 0.18 | - | -  |                              |      |   |    |
| Available P (Pav)                         | 0.05 |   |    |                              |      |   |    |
| Coef. Dig. P Poultry                      | 40.8 |   |    |                              |      |   |    |
| Std. Dig. P Poultry                       | 0.09 |   |    |                              |      |   |    |
| Coef. Dig. P Swine                        | 44.0 |   |    |                              |      |   |    |
| Std. Dig. P Swine                         | 0.10 |   |    |                              |      |   |    |
| Pav = Non Phytate P (Total P – Phytate P) |      |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Grain (Mean + 1 SD of Dry Matter)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 7.98  | 100   | 7.17             | 89.9  | 6.86             | 86.0  |
| Lysine, %                            | 0.26  | 3.23  | 0.21             | 82.5  | 0.20             | 78.9  |
| Methionine, %                        | 0.16  | 2.02  | 0.15             | 93.4  | 0.14             | 86.4  |
| Met + Cys, %                         | 0.33  | 4.19  | 0.30             | 88.3  | 0.29             | 88.1  |
| Threonine, %                         | 0.31  | 3.87  | 0.29             | 93.9  | 0.24             | 78.8  |
| Tryptophan, %                        | 0.06  | 0.81  | 0.06             | 95.2  | 0.05             | 75.7  |
| Arginine, %                          | 0.40  | 5.03  | 0.36             | 91.0  | 0.36             | 89.6  |
| Gly + Ser, %                         | 0.74  | 9.22  | 0.58             | 78.9  |                  |       |
| Valine, %                            | 0.40  | 5.06  | 0.35             | 87.3  | 0.36             | 88.5  |
| Isoleucine, %                        | 0.28  | 3.52  | 0.26             | 94.0  | 0.25             | 89.9  |
| Leucine, %                           | 0.98  | 12.2  | 0.93             | 95.4  | 0.87             | 89.5  |
| Histidine, %                         | 0.24  | 3.01  | 0.22             | 93.3  | 0.21             | 86.5  |
| Phenylalanine, %                     | 0.37  | 4.64  | 0.34             | 90.5  | 0.33             | 89.7  |
| Phe + Tyr, %                         | 0.67  | 8.36  | 0.62             | 92.7  | 0.61             | 91.0  |
| Alanine, %                           | 0.62  | 7.72  | 0.50             | 81.0  | 0.53             | 85.6  |
| Cysteine, %                          | 0.17  | 2.18  | 0.15             | 83.6  | 0.16             | 89.7  |
| Tyrosine, %                          | 0.30  | 3.71  | 0.28             | 95.4  | 0.27             | 92.6  |
| Glycine, %                           | 0.33  | 4.10  | 0.25             | 76.0  | 0.26             | 79.2  |
| Serine, %                            | 0.41  | 5.12  | 0.33             | 81.2  | 0.34             | 83.8  |
| Proline, %                           | 0.78  | 9.80  | 0.74             | 94.5  | 0.65             | 82.7  |
| Glutamine <sup>2</sup> , %           | 0.92  | 11.6  | 0.87             | 94.4  | 0.81             | 87.6  |
| Glutamic Acid <sup>2</sup> , %       | 0.58  | 7.27  | 0.55             | 94.4  | 0.51             | 87.6  |
| Asparagine <sup>2</sup> , %          | 0.28  | 3.52  | 0.23             | 82.4  | 0.23             | 81.7  |
| Aspartic Acid <sup>2</sup> , %       | 0.34  | 4.33  | 0.28             | 82.4  | 0.28             | 81.7  |
| Total Nitrogen (PB/6.25), %          | 1.28  | 16.0  | 1.15             | 89.9  | 1.10             | 86.0  |
| Essential Nitrogen Poultry, %        | 0.63  | 49.6* | 0.57             | 89.7  |                  |       |
| Essential Nitrogen Swine, %          | 0.52  | 40.6* |                  |       | 0.45             | 87.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 65           | 65     | 65       | 65        | 65        |
| Practical Maximum                                           | 65           | 65     | 65       | 65        | 65        |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 60           | 65     | 70       | 65        | 70        |
| Practical Maximum                                           | 60           | 65     | 70       | 65        | 70        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, High-lysine Gran**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 88.4 | 1 | -  | Organic Matter (OM)          | 87.3 |      |
| Crude Protein (CP)        | 8.26 | 1 | -  | Coef. Dig. OM Swine          | 88.0 |      |
| Starch                    | 65.4 | 1 | -  | Digestible OM Swine          | 76.8 |      |
| Crude Fiber (CF)          | 1.52 | 1 | -  | Undig. OM Pigs               | 10.5 |      |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 3.66 | 1 -  |
| NDF                       | 10.8 | 1 | -  | Coef. Dig. EE Poultry        | 92.0 |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 3.37 |      |
| ADF                       | 3.35 | 1 | -  | Coef. Dig. EE Swine          | 90.0 |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 3.29 |      |
| N-Free Extract (NFE)      | 73.8 |   |    | Linoleic Acid                | 1.92 | 1 -  |
| Coef. Dig. NFE Poultry    | 90.8 |   |    | Linolenic Acid               | 0.03 | 1 -  |
| Digestible NFE Poultry    | 67.1 |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | 8.31 |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 3907 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3508 |      |
| Metabolizable Energy      | 3405 |   |    | Metabolizable Energy         | 3409 |      |
| Std. Metab. Energy        | 3579 |   |    | Net Energy                   | 2708 |      |
| Net Energy                | 2743 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3569 |      |
| Metabolizable Energy      | 3428 |   |    | Metabolizable Energy         | 3492 |      |
| Net Energy                | 2766 |   |    | Net Energy                   | 2769 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 1.12 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 10.3 | 1 -  |
| Potassium (K)             | 0.21 | 1 | -  | Iron (Fe)                    | 53.4 | 1 -  |
| Sodium (Na)               | 0.01 | 1 | -  | Copper (Cu)                  | 2.60 | 1 -  |
| Chlorine (Cl)             | 0.05 | 1 | -  | Zinc (Zn)                    | 17.6 | 1 -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | 0.05 | 1 -  |
| Magnesium (Mg)            | 0.05 | 1 | -  |                              |      |      |
| Total Calcium (Ca)        | 0.04 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.20 | 1 | -  |                              |      |      |
| Phytate P                 | 0.15 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.05 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | 40.8 |   |    |                              |      |      |
| Std. Dig. P Poultry       | 0.08 |   |    |                              |      |      |
| Coef. Dig. P Swine        | 44.0 |   |    |                              |      |      |
| Std. Dig. P Swine         | 0.09 |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, High-lysine Gran**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 8.26  | 100  | 7.30             | 88.3  | 7.26             | 87.9  |
| Lysine, %                                   | 0.35  | 4.24 | 0.30             | 86.8  | 0.27             | 78.4  |
| Methionine, %                               | 0.15  | 1.82 | 0.13             | 89.9  | 0.14             | 93.8  |
| Met + Cys, %                                | 0.33  | 4.00 | 0.28             | 85.6  | 0.30             | 91.2  |
| Threonine, %                                | 0.34  | 4.12 | 0.26             | 77.8  | 0.27             | 80.0  |
| Tryptophan, %                               | 0.11  | 1.33 | 0.10             | 90.9  | 0.09             | 81.8  |
| Arginine, %                                 | 0.51  | 6.17 | 0.47             | 92.2  | 0.47             | 92.9  |
| Gly + Ser, %                                | 0.82  | 9.93 | 0.72             | 87.8  |                  |       |
| Valine, %                                   | 0.45  | 5.45 | 0.38             | 85.4  | 0.39             | 86.4  |
| Isoleucine, %                               | 0.26  | 3.15 | 0.22             | 84.6  | 0.22             | 84.6  |
| Leucine, %                                  | 0.73  | 8.84 | 0.66             | 90.9  | 0.67             | 92.2  |
| Histidine, %                                | 0.31  | 3.75 | 0.29             | 95.1  | 0.28             | 90.0  |
| Phenylalanine, %                            | 0.34  | 4.12 | 0.31             | 91.0  | 0.31             | 91.7  |
| Phe + Tyr, %                                | 0.57  | 6.90 | 0.52             | 90.4  | 0.51             | 89.4  |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | 0.18  | 2.18 | 0.15             | 82.1  | 0.16             | 89.0  |
| Tyrosine, %                                 | 0.23  | 2.78 | 0.21             | 89.4  | 0.20             | 86.1  |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | 1.32  | 16.0 | 1.17             | 88.3  | 1.16             | 87.9  |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |                          |             |           |
|--------------------------------------------------------------------|---------------------|--------|--------------------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Poedeira Produção</b> |             |           |
|                                                                    | Starter             | Grower |                          |             |           |
|                                                                    | 65                  | 65     | 65                       |             |           |
| <b>Practical Maximum</b>                                           | 65                  | 65     | 65                       |             |           |
|                                                                    | <b>Growing Pigs</b> |        |                          | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher                 | Gestation   | Lactation |
|                                                                    | 60                  | 65     | 70                       | 65          | 70        |
| <b>Practical Maximum</b>                                           | 60                  | 65     | 70                       | 65          | 70        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, High-oil Gran**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 87.7 | 1 | -  | Organic Matter (OM)          | 86.5 |      |
| Crude Protein (CP)        | 8.21 | 1 | -  | Coef. Dig. OM Swine          | 90.0 |      |
| Starch                    | 59.0 | 1 | -  | Digestible OM Swine          | 77.9 |      |
| Crude Fiber (CF)          | 2.60 | 1 | -  | Undig. OM Pigs               | 8.65 |      |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 6.30 | 1 -  |
| NDF                       | 10.8 | 1 | -  | Coef. Dig. EE Poultry        | 93.0 |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 5.86 |      |
| ADF                       | 3.35 | 1 | -  | Coef. Dig. EE Swine          | 90.0 |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 5.67 |      |
| N-Free Extract (NFE)      | 69.4 |   |    | Linoleic Acid                | 3.30 | 1 -  |
| Coef. Dig. NFE Poultry    | 94.0 |   |    | Linolenic Acid               | 0.04 | 1 -  |
| Digestible NFE Poultry    | 65.3 |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | 6.76 |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 4216 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3630 |      |
| Metabolizable Energy      | 3560 |   |    | Metabolizable Energy         | 3582 |      |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | 2835 |      |
| Net Energy                | 2890 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3720 |      |
| Metabolizable Energy      | 3579 |   |    | Metabolizable Energy         | 3649 |      |
| Net Energy                | 2909 |   |    | Net Energy                   | 2884 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 1.18 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 4.30 | 1 -  |
| Potassium (K)             | 0.35 | 1 | -  | Iron (Fe)                    | 93.0 | 1 -  |
| Sodium (Na)               | 0.01 | 1 | -  | Copper (Cu)                  | 3.00 | 1 -  |
| Chlorine (Cl)             | 0.05 | 1 | -  | Zinc (Zn)                    | 21.5 | 1 -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | 0.19 | 1 -  |
| Magnesium (Mg)            | 0.10 | 1 | -  |                              |      |      |
| Total Calcium (Ca)        | 0.02 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.27 | 1 | -  |                              |      |      |
| Phytate P                 | 0.20 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.07 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | 40.8 |   |    |                              |      |      |
| Std. Dig. P Poultry       | 0.11 |   |    |                              |      |      |
| Coef. Dig. P Swine        | 44.0 |   |    |                              |      |      |
| Std. Dig. P Swine         | 0.12 |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, High-oil Gran**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 8.21  | 100   | 7.26             | 88.5  | 7.05             | 85.8  |
| Lysine, %                            | 0.26  | 3.17  | 0.21             | 81.8  | 0.21             | 79.8  |
| Methionine, %                        | 0.18  | 2.19  | 0.16             | 91.4  | 0.14             | 76.9  |
| Met + Cys, %                         | 0.39  | 4.75  | 0.34             | 86.3  | 0.33             | 83.8  |
| Threonine, %                         | 0.31  | 3.78  | 0.27             | 87.4  | 0.26             | 84.2  |
| Tryptophan, %                        | 0.07  | 0.85  | 0.06             | 81.5  | 0.06             | 82.8  |
| Arginine, %                          | 0.40  | 4.87  | 0.37             | 93.3  | 0.37             | 91.4  |
| Gly + Ser, %                         | 0.79  | 9.62  | 0.62             | 78.8  |                  |       |
| Valine, %                            | 0.41  | 4.99  | 0.34             | 82.6  | 0.36             | 86.7  |
| Isoleucine, %                        | 0.32  | 3.90  | 0.27             | 84.7  | 0.28             | 87.8  |
| Leucine, %                           | 1.03  | 12.6  | 0.95             | 92.1  | 0.90             | 87.1  |
| Histidine, %                         | 0.27  | 3.29  | 0.25             | 91.4  | 0.24             | 89.0  |
| Phenylalanine, %                     | 0.42  | 5.12  | 0.37             | 88.1  | 0.38             | 90.9  |
| Phe + Tyr, %                         | 0.71  | 8.65  | 0.65             | 91.1  | 0.64             | 90.2  |
| Alanine, %                           | 0.64  | 7.80  | 0.52             | 81.0  | 0.55             | 85.6  |
| Cysteine, %                          | 0.21  | 2.56  | 0.17             | 82.0  | 0.19             | 89.7  |
| Tyrosine, %                          | 0.29  | 3.53  | 0.28             | 95.4  | 0.26             | 89.3  |
| Glycine, %                           | 0.37  | 4.51  | 0.28             | 76.0  | 0.29             | 79.2  |
| Serine, %                            | 0.42  | 5.12  | 0.34             | 81.2  | 0.35             | 83.8  |
| Proline, %                           | 0.84  | 10.2  | 0.79             | 94.5  | 0.69             | 82.7  |
| Glutamine <sup>2</sup> , %           | 0.98  | 11.9  | 0.92             | 94.4  | 0.86             | 87.6  |
| Glutamic Acid <sup>2</sup> , %       | 0.61  | 7.47  | 0.58             | 94.4  | 0.54             | 87.6  |
| Asparagine <sup>2</sup> , %          | 0.25  | 3.06  | 0.21             | 82.4  | 0.21             | 81.7  |
| Aspartic Acid <sup>2</sup> , %       | 0.31  | 3.76  | 0.25             | 82.4  | 0.25             | 81.7  |
| Total Nitrogen (PB/6.25), %          | 1.31  | 16.0  | 1.16             | 88.5  | 1.13             | 85.8  |
| Essential Nitrogen Poultry, %        | 0.67  | 50.9* | 0.58             | 86.9  |                  |       |
| Essential Nitrogen Swine, %          | 0.54  | 41.4* |                  |       | 0.47             | 86.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |                   |           |           |
|-------------------------------------------------------------|--------------|--------|-------------------|-----------|-----------|
|                                                             | Broilers     |        | Poedeira Produção |           |           |
|                                                             | Starter      | Grower |                   |           |           |
|                                                             | 60           | 55     | 60                |           |           |
| Practical                                                   | 60           | 55     | 60                |           |           |
| Maximum                                                     | 65           | 65     | 65                |           |           |
|                                                             | Growing Pigs |        |                   | Sows      |           |
|                                                             | Starter      | Grower | Finisher          | Gestation | Lactation |
|                                                             | 50           | 65     | 70                | 50        | 70        |
| Practical                                                   | 50           | 65     | 70                | 50        | 70        |
| Maximum                                                     | 60           | 65     | 70                | 65        | 70        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Pre-cooked**

| Main Components (%)       |      |   |      |                              |      |   |      |
|---------------------------|------|---|------|------------------------------|------|---|------|
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Dry Matter                | 88.6 | 3 | 0.54 | Organic Matter (OM)          | 87.7 |   |      |
| Crude Protein (CP)        | 7.94 | 3 | 0.57 | Coef. Dig. OM Swine          | 91.0 |   |      |
| Starch                    | 62.0 | 3 | 1.73 | Digestible OM Swine          | 79.8 |   |      |
| Crude Fiber (CF)          | 1.34 | 3 | 0.19 | Undig. OM Pigs               | 7.89 |   |      |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 1.64 | 3 | 0.12 |
| NDF                       | 10.1 | 3 | 0.87 | Coef. Dig. EE Poultry        | 92.0 |   |      |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 1.51 |   |      |
| ADF                       | 2.33 | 3 | 0.08 | Coef. Dig. EE Swine          | 90.0 |   |      |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 1.48 |   |      |
| N-Free Extract (NFE)      | 76.8 |   |      | Linoleic Acid                | 0.62 | 1 | -    |
| Coef. Dig. NFE Poultry    | 94.0 |   |      | Linolenic Acid               | -    | - | -    |
| Digestible NFE Poultry    | 72.2 |   |      |                              |      |   |      |
| Undig. NFE + CF Poultry   | 5.95 |   |      |                              |      |   |      |
| Energy (kcal/kg)          |      |   |      |                              |      |   |      |
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Gross Energy              | 3987 | 1 | -    | <b>Swine</b>                 |      |   |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3519 |   |      |
| Metabolizable Energy      | 3429 |   |      | Metabolizable Energy         | 3444 |   |      |
| Std. Metab. Energy        | 3514 |   |      | Net Energy                   | 2699 |   |      |
| Net Energy                | 2744 |   |      | <b>Sows</b>                  |      |   |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3565 |   |      |
| Metabolizable Energy      | 3451 |   |      | Metabolizable Energy         | 3498 |   |      |
| Net Energy                | 2766 |   |      | Net Energy                   | 2738 |   |      |
| Minerals                  |      |   |      |                              |      |   |      |
|                           | Mean | n | SD   |                              | Mean | n | SD   |
| Ash, %                    | 0.92 | 3 | 0.12 | <b>Trace Minerals, mg/kg</b> |      |   |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 11.4 | 1 | -    |
| Potassium (K)             | 0.23 | 3 | 0.03 | Iron (Fe)                    | 43.9 | 1 | -    |
| Sodium (Na)               | 0.02 | 2 | 0.00 | Copper (Cu)                  | 2.70 | 1 | -    |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | 26.5 | 1 | -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | 0.16 | 1 | -    |
| Magnesium (Mg)            | 0.04 | 1 | -    |                              |      |   |      |
| Total Calcium (Ca)        | 0.02 | 3 | 0.01 |                              |      |   |      |
| Total Phosphorus (P)      | 0.19 | 3 | 0.02 |                              |      |   |      |
| Phytate P                 | 0.16 | 1 | -    |                              |      |   |      |
| Available P (Pav)         | 0.03 |   |      |                              |      |   |      |
| Coef. Dig. P Poultry      | 40.8 |   |      |                              |      |   |      |
| Std. Dig. P Poultry       | 0.08 |   |      |                              |      |   |      |
| Coef. Dig. P Swine        | 44.0 |   |      |                              |      |   |      |
| Std. Dig. P Swine         | 0.08 |   |      |                              |      |   |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Pre-cooked**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 7.94  | 100   | 7.11             | 89.5  | 6.90             | 86.9  |
| Lysine, %                                   | 0.25  | 3.15  | 0.21             | 85.0  | 0.22             | 86.0  |
| Methionine, %                               | 0.18  | 2.27  | 0.16             | 90.9  | 0.16             | 89.9  |
| Met + Cys, %                                | 0.34  | 4.28  | 0.30             | 89.5  | 0.31             | 91.0  |
| Threonine, %                                | 0.31  | 3.90  | 0.26             | 83.5  | 0.27             | 85.9  |
| Tryptophan, %                               | 0.07  | 0.88  | 0.06             | 86.4  | 0.06             | 85.0  |
| Arginine, %                                 | 0.34  | 4.28  | 0.31             | 91.3  | 0.32             | 93.5  |
| Gly + Ser, %                                | 0.64  | 8.06  | 0.50             | 78.8  |                  |       |
| Valine, %                                   | 0.40  | 5.04  | 0.35             | 86.4  | 0.35             | 88.1  |
| Isoleucine, %                               | 0.31  | 3.90  | 0.29             | 93.8  | 0.28             | 90.3  |
| Leucine, %                                  | 1.02  | 12.9  | 0.95             | 93.5  | 0.92             | 90.2  |
| Histidine, %                                | 0.26  | 3.27  | 0.24             | 92.4  | 0.23             | 89.5  |
| Phenylalanine, %                            | 0.40  | 5.04  | 0.37             | 92.0  | 0.37             | 91.9  |
| Phe + Tyr, %                                | 0.67  | 8.44  | 0.61             | 91.4  | 0.59             | 88.6  |
| Alanine, %                                  | 0.63  | 7.93  | 0.51             | 81.0  | 0.54             | 85.6  |
| Cysteine, %                                 | 0.16  | 2.02  | 0.14             | 87.9  | 0.15             | 92.2  |
| Tyrosine, %                                 | 0.27  | 3.40  | 0.24             | 90.6  | 0.23             | 83.7  |
| Glycine, %                                  | 0.29  | 3.65  | 0.22             | 76.0  | 0.23             | 79.2  |
| Serine, %                                   | 0.35  | 4.41  | 0.28             | 81.2  | 0.29             | 83.8  |
| Proline, %                                  | 0.89  | 11.2  | 0.84             | 94.5  | 0.74             | 82.7  |
| Glutamine <sup>2</sup> , %                  | 0.97  | 12.2  | 0.92             | 94.4  | 0.85             | 87.6  |
| Glutamic Acid <sup>2</sup> , %              | 0.61  | 7.67  | 0.58             | 94.4  | 0.53             | 87.6  |
| Asparagine <sup>2</sup> , %                 | 0.22  | 2.77  | 0.18             | 82.4  | 0.18             | 81.7  |
| Aspartic Acid <sup>2</sup> , %              | 0.27  | 3.40  | 0.22             | 82.4  | 0.22             | 81.7  |
| Total Nitrogen (PB/6.25), %                 | 1.27  | 16.0  | 1.14             | 89.5  | 1.10             | 86.9  |
| Essential Nitrogen Poultry, %               | 0.62  | 48.4* | 0.55             | 88.7  |                  |       |
| Essential Nitrogen Swine, %                 | 0.51  | 40.5* |                  |       | 0.46             | 89.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | -                   | -      |             |             |           |
| <b>Practical Maximum</b>                                           | -                   | -      |             |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical Maximum</b>                                           | -                   | -      | -           | -           | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Oil**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 99.3 | 1 | -  | Organic Matter (OM)          | 99.3 |      |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 91.8 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 91.1 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 8.18 |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 99.3 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 95.1 |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | 94.4 |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 88.8 |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | 88.2 |      |
| N-Free Extract (NFE)      | -    | - | -  | Linoleic Acid                | 51.9 | 1 -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | 0.69 | 1 -  |
| Digestible NFE Poultry    | -    | - | -  |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 9350 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Energy Dig.                  | 8580 |      |
| Energy Met.               | 8773 |   |    | Energy Met.                  | 8280 |      |
| Std. Metab. Energy        | 9250 |   |    | Net Energy                   | 7345 |      |
| Net Energy                | 7896 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Energy Dig.                  | 8580 |      |
| Energy Met.               | 8773 |   |    | Energy Met.                  | 8280 |      |
| Net Energy                | 7896 |   |    | Net Energy                   | 7345 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | -    | - | -  |                              |      |      |
| Total Phosphorus (P)      | -    | - | -  |                              |      |      |
| Phytate P                 | -    | - | -  |                              |      |      |
| Available P (Pav)         | -    | - | -  |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |      |      |
| Coef. Dig. P Swine        | -    | - | -  |                              |      |      |
| Std. Dig. P Swine         | -    | - | -  |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Corn, Oil**

|                                | Amino Acid Content and Digestibility |      |                  |       |                  |       |
|--------------------------------|--------------------------------------|------|------------------|-------|------------------|-------|
|                                | Total                                | % CP | Poultry          |       | Swine            |       |
|                                |                                      |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | -                                    | -    | -                | -     | -                | -     |
| Lysine, %                      | -                                    | -    | -                | -     | -                | -     |
| Methionine, %                  | -                                    | -    | -                | -     | -                | -     |
| Met + Cys, %                   | -                                    | -    | -                | -     | -                | -     |
| Threonine, %                   | -                                    | -    | -                | -     | -                | -     |
| Tryptophan, %                  | -                                    | -    | -                | -     | -                | -     |
| Arginine, %                    | -                                    | -    | -                | -     | -                | -     |
| Gly + Ser, %                   | -                                    | -    | -                | -     | -                | -     |
| Valine, %                      | -                                    | -    | -                | -     | -                | -     |
| Isoleucine, %                  | -                                    | -    | -                | -     | -                | -     |
| Leucine, %                     | -                                    | -    | -                | -     | -                | -     |
| Histidine, %                   | -                                    | -    | -                | -     | -                | -     |
| Phenylalanine, %               | -                                    | -    | -                | -     | -                | -     |
| Phe + Tyr, %                   | -                                    | -    | -                | -     | -                | -     |
| Alanine, %                     | -                                    | -    | -                | -     | -                | -     |
| Cysteine, %                    | -                                    | -    | -                | -     | -                | -     |
| Tyrosine, %                    | -                                    | -    | -                | -     | -                | -     |
| Glycine, %                     | -                                    | -    | -                | -     | -                | -     |
| Serine, %                      | -                                    | -    | -                | -     | -                | -     |
| Proline, %                     | -                                    | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | -                                    | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %    | -                                    | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %    | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %  | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | -                                    | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 3      | 3        |           |           |
| Practical Maximum                                           | 6            | 7      | 7        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 2      | 2        | 0         | 2         |
| Practical Maximum                                           | 5            | 5      | 5        | 4         | 5         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cottonseed, Meal 28% CP**

| Main Components (%)       |      |    |      |                              |      |        |
|---------------------------|------|----|------|------------------------------|------|--------|
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Dry Matter                | 90.6 | 12 | 2.67 | Organic Matter (OM)          | 85.6 |        |
| Crude Protein (CP)        | 28.3 | 12 | 2.37 | Coef. Dig. OM Swine          | 50.0 |        |
| Starch                    | 3.08 | 4  | 0.95 | Digestible OM Swine          | 42.8 |        |
| Crude Fiber (CF)          | 23.7 | 6  | 2.98 | Undig. OM Pigs               | 42.8 |        |
| Coef. Dig. CF Swine       | 31.9 |    |      | Ether Extract (EE)           | 1.28 | 4 0.57 |
| NDF                       | 42.7 | 5  | 3.69 | Coef. Dig. EE Poultry        | 85.0 |        |
| Coef. Dig. NDF Swine      | 43.8 |    |      | Digestible EE Poultry        | 1.09 |        |
| ADF                       | 33.1 | 5  | 2.94 | Coef. Dig. EE Swine          | 75.3 |        |
| Coef. Dig. ADF Swine      | 47.7 |    |      | Digestible EE Swine          | 0.96 |        |
| N-Free Extract (NFE)      | 32.7 |    |      | Linoleic Acid                | 0.84 | 1 -    |
| Coef. Dig. NFE Poultry    | 43.0 |    |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | 13.9 |    |      |                              |      |        |
| Undig. NFE + CF Poultry   | 42.2 |    |      |                              |      |        |
| Energy (kcal/kg)          |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Gross Energy              | 4173 | 3  | 12   | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2222 |        |
| Metabolizable Energy      | 1622 |    |      | Metabolizable Energy         | 1996 |        |
| Std. Metab. Energy        | 1768 |    |      | Net Energy                   | 1066 |        |
| Net Energy                | 1270 |    |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2577 |        |
| Energy Met. Hens          | 1749 |    |      | Metabolizable Energy         | 2319 |        |
| Net Energy                | 1397 |    |      | Net Energy                   | 1302 |        |
| Minerals                  |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Ash, %                    | 4.98 | 8  | 0.25 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 9.70 | 1 -    |
| Potassium (K)             | 0.83 | 3  | 0.42 | Iron (Fe)                    | 53.9 | 1 -    |
| Sodium (Na)               | 0.04 | 3  | 0.00 | Copper (Cu)                  | 6.70 | 1 -    |
| Chlorine (Cl)             | -    | -  | -    | Zinc (Zn)                    | 23.9 | 1 -    |
| Sulfur (S)                | 0.34 | 1  | -    | Selenium (Se)                | 0.31 | 1 -    |
| Magnesium (Mg)            | 0.52 | 1  | -    |                              |      |        |
| Total Calcium (Ca)        | 0.22 | 5  | 0.01 |                              |      |        |
| Total Phosphorus (P)      | 0.75 | 5  | 0.05 |                              |      |        |
| Phytate P                 | 0.56 | 1  | -    |                              |      |        |
| Available P (Pav)         | 0.19 |    |      |                              |      |        |
| Coef. Dig. P Poultry      | 37.8 |    |      |                              |      |        |
| Std. Dig. P Poultry       | 0.29 |    |      |                              |      |        |
| Coef. Dig. P Swine        | 39.2 |    |      |                              |      |        |
| Std. Dig. P Swine         | 0.30 |    |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cottonseed, Meal 28% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 28.3  | 100.0 | 22.0             | 77.6  | 21.6             | 76.4  |
| Lysine, %                            | 1.27  | 4.49  | 0.93             | 73.3  | 0.74             | 58.0  |
| Methionine, %                        | 0.46  | 1.63  | 0.35             | 75.5  | 0.32             | 69.7  |
| Met + Cys, %                         | 0.96  | 3.40  | 0.68             | 70.9  | 0.69             | 72.2  |
| Threonine, %                         | 0.94  | 3.32  | 0.68             | 71.9  | 0.60             | 63.9  |
| Tryptophan, %                        | 0.51  | 1.80  | 0.37             | 73.3  | 0.33             | 63.9  |
| Arginine, %                          | 3.35  | 11.9  | 2.41             | 72.0  | 2.96             | 88.4  |
| Gly + Ser, %                         | 2.50  | 8.84  | 1.82             | 72.7  |                  |       |
| Valine, %                            | 1.33  | 4.70  | 1.00             | 75.2  | 0.87             | 65.7  |
| Isoleucine, %                        | 0.96  | 3.40  | 0.82             | 85.4  | 0.61             | 63.1  |
| Leucine, %                           | 1.79  | 6.33  | 1.41             | 79.0  | 1.19             | 66.6  |
| Histidine, %                         | 0.77  | 2.72  | 0.56             | 72.8  | 0.63             | 82.1  |
| Phenylalanine, %                     | 1.54  | 5.45  | 1.17             | 76.1  | 1.20             | 78.2  |
| Phe + Tyr, %                         | 2.33  | 8.24  | 1.80             | 77.2  | 1.81             | 77.8  |
| Alanine, %                           | 1.15  | 4.07  | 0.82             | 71.0  | 0.80             | 69.5  |
| Cysteine, %                          | 0.50  | 1.77  | 0.33             | 66.7  | 0.37             | 74.5  |
| Tyrosine, %                          | 0.79  | 2.79  | 0.63             | 79.4  | 0.61             | 77.0  |
| Glycine, %                           | 1.16  | 4.10  | 0.85             | 72.9  | 0.81             | 70.0  |
| Serine, %                            | 1.34  | 4.74  | 0.97             | 72.5  | 1.01             | 75.0  |
| Proline, %                           | 1.26  | 4.46  | 0.94             | 74.7  | 1.06             | 84.0  |
| Glutamine <sup>2</sup> , %           | 2.71  | 9.58  | 2.35             | 86.9  | 2.29             | 84.5  |
| Glutamic Acid <sup>2</sup> , %       | 3.12  | 11.0  | 2.71             | 86.9  | 2.64             | 84.5  |
| Asparagine <sup>2</sup> , %          | 1.18  | 4.18  | 0.94             | 79.9  | 0.91             | 77.0  |
| Aspartic Acid <sup>2</sup> , %       | 1.46  | 5.16  | 1.17             | 79.9  | 1.12             | 77.0  |
| Total Nitrogen (PB/6.25), %          | 4.52  | 16.0  | 3.51             | 77.6  | 3.45             | 76.4  |
| Essential Nitrogen Poultry, %        | 2.73  | 60.4* | 2.04             | 74.7  |                  |       |
| Essential Nitrogen Swine, %          | 2.34  | 51.6* |                  |       | 1.71             | 73.2  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 2            | 3      | 3        |           |           |
| Practical                                                   |              |        |          |           |           |
| Maximum                                                     | 4            | 5      | 5        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 4      | 5        | 5         | 3         |
| Practical                                                   |              |        |          |           |           |
| Maximum                                                     | 4            | 7      | 8        | 8         | 6         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cottonseed, Meal 38% CP**

| Main Components (%)       |      |    |      |                              |       |        |
|---------------------------|------|----|------|------------------------------|-------|--------|
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Dry Matter                | 90.0 | 15 | 0.68 | Organic Matter (OM)          | 83.9  |        |
| Crude Protein (CP)        | 38.1 | 15 | 1.94 | Coef. Dig. OM Swine          | 60.0  |        |
| Starch                    | 3.96 | 6  | 1.98 | Digestible OM Swine          | 50.4  |        |
| Crude Fiber (CF)          | 15.4 | 10 | 2.13 | Undig. OM Pigs               | 33.6  |        |
| Coef. Dig. CF Swine       | 19.1 |    |      | Ether Extract (EE)           | 2.65  | 8 2.07 |
| NDF                       | 29.6 | 8  | 2.76 | Coef. Dig. EE Poultry        | 85.0  |        |
| Coef. Dig. NDF Swine      | 17.9 |    |      | Digestible EE Poultry        | 2.25  |        |
| ADF                       | 17.4 | 7  | 7.22 | Coef. Dig. EE Swine          | 78.7  |        |
| Coef. Dig. ADF Swine      | 17.3 |    |      | Digestible EE Swine          | 2.09  |        |
| N-Free Extract (NFE)      | 27.8 |    |      | Linoleic Acid                | 0.84  | 3 0.20 |
| Coef. Dig. NFE Poultry    | 40.0 |    |      | Linolenic Acid               | 0.01  | 1 -    |
| Digestible NFE Poultry    | 11.1 |    |      |                              |       |        |
| Undig. NFE + CF Poultry   | 32.0 |    |      |                              |       |        |
| Energy (kcal/kg)          |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Gross Energy              | 4254 | 5  | 112  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2634  |        |
| Energy Met. Poultry       | 1951 |    |      | Metabolizable Energy         | 2432  |        |
| Std. Metab. Energy        | 2173 |    |      | Net Energy                   | 1425  |        |
| Net Energy                | 1530 |    |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2982  |        |
| Metabolizable Energy      | 2050 |    |      | Metabolizable Energy         | 2691  |        |
| Net Energy                | 1629 |    |      | Net Energy                   | 1609  |        |
| Minerals                  |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Ash, %                    | 6.10 | 11 | 0.21 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 14.3  | 1 -    |
| Potassium (K)             | 1.41 | 4  | 0.11 | Iron (Fe)                    | 157.9 | 1 -    |
| Sodium (Na)               | 0.09 | 4  | 0.03 | Copper (Cu)                  | 10.5  | 1 -    |
| Chlorine (Cl)             | 0.05 | 4  | 0.01 | Zinc (Zn)                    | 56.7  | 1 -    |
| Sulfur (S)                | 0.34 | 1  | -    | Selenium (Se)                | 0.58  | 1 -    |
| Magnesium (Mg)            | 0.53 | 2  | 0.04 | Iodine (I)                   | 14.3  | 1 -    |
| Total Calcium (Ca)        | 0.30 | 6  | 0.06 |                              |       |        |
| Total Phosphorus (P)      | 1.03 | 6  | 0.06 |                              |       |        |
| Phytate P                 | 0.65 | 2  | 0.08 |                              |       |        |
| Available P (Pav)         | 0.38 |    |      |                              |       |        |
| Coef. Dig. P Poultry      | -    |    |      |                              |       |        |
| Std. Dig. P Poultry       | -    |    |      |                              |       |        |
| Coef. Dig. P Swine        | 40.8 |    |      |                              |       |        |
| Std. Dig. P Swine         | 0.42 |    |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cottonseed, Meal 38% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 38.1  | 100.0 | 29.82            | 78.2  | 29.7             | 77.9  |
| Lysine, %                            | 1.57  | 4.12  | 1.15             | 73.5  | 0.97             | 62.1  |
| Methionine, %                        | 0.58  | 1.52  | 0.46             | 78.9  | 0.42             | 72.8  |
| Met + Cys, %                         | 1.22  | 3.20  | 0.87             | 71.1  | 0.90             | 73.7  |
| Threonine, %                         | 1.26  | 3.30  | 0.92             | 73.2  | 0.86             | 68.5  |
| Tryptophan, %                        | 0.51  | 1.34  | 0.36             | 70.6  | 0.35             | 68.1  |
| Arginine, %                          | 4.14  | 10.9  | 3.62             | 87.5  | 3.68             | 88.8  |
| Gly + Ser, %                         | 3.26  | 8.55  | 2.32             | 71.5  |                  |       |
| Valine, %                            | 1.71  | 4.48  | 1.25             | 73.1  | 1.25             | 73.1  |
| Isoleucine, %                        | 1.21  | 3.17  | 0.85             | 70.1  | 0.86             | 71.1  |
| Leucine, %                           | 2.19  | 5.74  | 1.71             | 78.2  | 1.61             | 73.5  |
| Histidine, %                         | 1.08  | 2.83  | 0.85             | 78.6  | 0.81             | 75.1  |
| Phenylalanine, %                     | 2.00  | 5.25  | 1.68             | 84.2  | 1.62             | 81.3  |
| Phe + Tyr, %                         | 3.03  | 7.95  | 2.42             | 79.8  | 2.42             | 79.8  |
| Alanine, %                           | 1.51  | 3.96  | 0.98             | 64.9  | 1.05             | 69.5  |
| Cysteine, %                          | 0.64  | 1.68  | 0.41             | 64.0  | 0.48             | 74.5  |
| Tyrosine, %                          | 1.03  | 2.70  | 0.73             | 71.2  | 0.79             | 77.0  |
| Glycine, %                           | 1.60  | 4.20  | 1.14             | 71.4  | 1.12             | 70.0  |
| Serine, %                            | 1.66  | 4.35  | 1.19             | 71.6  | 1.25             | 75.0  |
| Proline, %                           | 1.47  | 3.86  | 1.04             | 70.9  | 1.23             | 84.0  |
| Glutamine <sup>2</sup> , %           | 3.34  | 8.76  | 2.88             | 86.1  | 2.82             | 84.5  |
| Glutamic Acid <sup>2</sup> , %       | 3.85  | 10.1  | 3.31             | 86.1  | 3.25             | 84.5  |
| Asparagine <sup>2</sup> , %          | 1.54  | 4.04  | 1.19             | 77.3  | 1.18             | 77.0  |
| Aspartic Acid <sup>2</sup> , %       | 1.90  | 4.99  | 1.47             | 77.3  | 1.46             | 77.0  |
| Total Nitrogen (PB/6.25), %          | 6.10  | 16.0  | 4.77             | 78.2  | 4.75             | 77.9  |
| Essential Nitrogen Poultry, %        | 3.45  | 56.6* | 2.69             | 77.9  |                  |       |
| Essential Nitrogen Swine, %          | 2.93  | 48.1* |                  |       | 2.25             | 76.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 5      | 5        |           |           |
| Practical                                                   |              |        |          |           |           |
| Maximum                                                     | 7            | 8      | 8        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 3            | 5      | 6        | 6         | 5         |
| Practical                                                   |              |        |          |           |           |
| Maximum                                                     | 5            | 8      | 10       | 10        | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cottonseed, Meal 43% CP**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 89.9 | 5 | 1.20 | Organic Matter (OM)          | 84.1 |        |
| Crude Protein (CP)        | 42.9 | 5 | 1.76 | Coef. Dig. OM Swine          | 63.5 |        |
| Starch                    | 2.55 | 2 | 0.20 | Digestible OM Swine          | 53.4 |        |
| Crude Fiber (CF)          | 12.6 | 3 | 2.74 | Undig. OM Pigs               | 30.7 |        |
| Coef. Dig. CF Swine       | 19.1 |   |      | Ether Extract (EE)           | 3.26 | 4 2.07 |
| NDF                       | 28.7 | 2 | 5.56 | Coef. Dig. EE Poultry        | 75.7 |        |
| Coef. Dig. NDF Swine      | 17.9 |   |      | Digestible EE Poultry        | 2.47 |        |
| ADF                       | 17.9 | 2 | 1.94 | Coef. Dig. EE Swine          | 80.0 |        |
| Coef. Dig. ADF Swine      | 17.3 |   |      | Digestible EE Swine          | 2.61 |        |
| N-Free Extract (NFE)      | 25.3 |   |      | Linoleic Acid                | 1.12 | 1 -    |
| Coef. Dig. NFE Poultry    | 33.0 |   |      | Linolenic Acid               | 0.01 | 1 -    |
| Digestible NFE Poultry    | 8.35 |   |      |                              |      |        |
| Undig. NFE + CF Poultry   | 29.5 |   |      |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 4346 | 2 | 169  | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 2877 |        |
| Metabolizable Energy      | 2000 |   |      | Metabolizable Energy         | 2630 |        |
| Std. Metab. Energy        | 2204 |   |      | Net Energy                   | 1595 |        |
| Net Energy                | 1565 |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3174 |        |
| Metabolizable Energy      | 2093 |   |      | Metabolizable Energy         | 2858 |        |
| Net Energy                | 1658 |   |      | Net Energy                   | 1761 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 5.85 | 3 | 1.19 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 1.56 | 2 | 0.01 | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.13 | 2 | 0.17 | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.03 | 1 | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.48 | 2 | 0.18 |                              |      |        |
| Total Calcium (Ca)        | 0.23 | 2 | 0.03 |                              |      |        |
| Total Phosphorus (P)      | 1.07 | 2 | 0.14 |                              |      |        |
| Phytate P                 | 0.61 | 1 | -    |                              |      |        |
| Available P (Pav)         | 0.46 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | 37.8 |   |      |                              |      |        |
| Std. Dig. P Poultry       | 0.40 |   |      |                              |      |        |
| Coef. Dig. P Swine        | 38.0 |   |      |                              |      |        |
| Std. Dig. P Swine         | 0.41 |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Cottonseed, Meal 43% CP**

| Amino Acid Content and Digestibility |       |       |                  |      |                  |      |
|--------------------------------------|-------|-------|------------------|------|------------------|------|
|                                      | Total | % CP  | Poultry          |      | Swine            |      |
|                                      |       |       | SID <sup>1</sup> | Coef | SID <sup>1</sup> | Coef |
| Crude Protein, %                     | 42.9  | 100.0 | 33.2             | 77.4 | 34.3             | 80.0 |
| Lysine, %                            | 1.73  | 4.03  | 1.11             | 64.0 | 1.18             | 68.0 |
| Methionine, %                        | 0.54  | 1.26  | 0.40             | 73.5 | 0.40             | 74.0 |
| Met + Cys, %                         | 1.34  | 3.12  | 0.93             | 69.6 | 1.00             | 74.3 |
| Threonine, %                         | 1.37  | 3.19  | 0.94             | 68.5 | 1.04             | 76.0 |
| Tryptophan, %                        | 0.52  | 1.21  | 0.40             | 77.5 | 0.41             | 79.0 |
| Arginine, %                          | 4.64  | 10.8  | 3.99             | 86.0 | 4.22             | 91.0 |
| Gly + Ser, %                         | 3.59  | 8.37  | 2.49             | 69.3 |                  |      |
| Valine, %                            | 1.90  | 4.43  | 1.42             | 74.5 | 1.50             | 79.0 |
| Isoleucine, %                        | 1.32  | 3.08  | 0.94             | 71.0 | 1.02             | 77.0 |
| Leucine, %                           | 2.41  | 5.62  | 1.77             | 73.5 | 1.88             | 78.0 |
| Histidine, %                         | 1.14  | 2.66  | 0.86             | 75.5 | 0.91             | 80.0 |
| Phenylalanine, %                     | 2.23  | 5.20  | 1.84             | 82.5 | 1.90             | 85.0 |
| Phe + Tyr, %                         | 3.43  | 8.00  | 2.81             | 82.0 | 2.82             | 82.2 |
| Alanine, %                           | 1.77  | 4.13  | 1.15             | 64.9 | 1.23             | 69.5 |
| Cysteine, %                          | 0.80  | 1.86  | 0.54             | 67.0 | 0.60             | 74.5 |
| Tyrosine, %                          | 1.20  | 2.80  | 0.97             | 81.0 | 0.92             | 77.0 |
| Glycine, %                           | 1.76  | 4.10  | 1.26             | 71.6 | 1.23             | 70.0 |
| Serine, %                            | 1.83  | 4.27  | 1.23             | 67.0 | 1.37             | 75.0 |
| Proline, %                           | 1.53  | 3.57  | 1.13             | 74.0 | 1.29             | 84.0 |
| Glutamine <sup>2</sup> , %           | 3.78  | 8.80  | 3.25             | 86.1 | 3.19             | 84.5 |
| Glutamic Acid <sup>2</sup> , %       | 4.35  | 10.2  | 3.75             | 86.1 | 3.68             | 84.5 |
| Asparagine <sup>2</sup> , %          | 1.77  | 4.13  | 1.37             | 77.3 | 1.36             | 77.0 |
| Aspartic Acid <sup>2</sup> , %       | 2.19  | 5.10  | 1.69             | 77.3 | 1.69             | 77.0 |
| Total Nitrogen (PB/6.25), %          | 6.86  | 16.0  | 5.31             | 77.4 | 5.49             | 80.0 |
| Essential Nitrogen Poultry, %        | 3.80  | 55.4* | 2.87             | 75.5 |                  |      |
| Essential Nitrogen Swine, %          | 3.23  | 47.1* |                  |      | 2.62             | 81.2 |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 3                   | 5      | 5           |             |           |
| Practical Maximum                                           | 7                   | 8      | 8           |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 3                   | 5      | 6           | 6           | 5         |
| Practical Maximum                                           | 5                   | 8      | 10          | 10          | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Dendê Palm, Oil**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 99.5 | 1 | -  | Organic Matter (OM)          | 99.5 |      |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 85.2 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 84.8 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 14.7 |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 99.5 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 95.5 |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | 95.0 |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 84.7 |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | 84.3 |      |
| N-Free Extract (NFE)      | -    | - | -  | Linoleic Acid                | 10.3 | - -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    | - | -  |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 9400 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 8010 |      |
| Metabolizable Energy      | 8817 |   |    | Metabolizable Energy         | 7690 |      |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | 6917 |      |
| Net Energy                | 7935 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 8010 |      |
| Metabolizable Energy      | 8817 |   |    | Metabolizable Energy         | 7690 |      |
| Net Energy                | 7935 |   |    | Net Energy                   | 6917 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | -    | - | -  |                              |      |      |
| Total Phosphorus (P)      | -    | - | -  |                              |      |      |
| Phytate P                 | -    | - | -  |                              |      |      |
| Available P (Pav)         | -    | - | -  |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |      |      |
| Coef. Dig. P Swine        | -    | - | -  |                              |      |      |
| Std. Dig. P Swine         | -    | - | -  |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Dendê Palm, Oil**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | -     | -    | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 3                   | 3      | 3           |             |           |
| Practical Maximum                                                  | 6                   | 7      | 7           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 2                   | 2      | 2           | 0           | 2         |
| Practical Maximum                                                  | 5                   | 5      | 5           | 4           | 5         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Feather, Meal 76% CP**

| Main Components (%)       |      |    |      |                              |       |    |      |
|---------------------------|------|----|------|------------------------------|-------|----|------|
|                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Dry Matter                | 90.4 | 54 | 0.11 | Organic Matter (OM)          | 87.3  |    |      |
| Crude Protein (CP)        | 76.3 | 54 | 0.17 | Coef. Dig. OM Swine          | 61.7  |    |      |
| Starch                    | -    | -  | -    | Digestible OM Swine          | 53.9  |    |      |
| Crude Fiber (CF)          | -    | -  | -    | Undig. OM Pigs               | 33.4  |    |      |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 7.41  | 34 | 0.79 |
| NDF                       | -    | -  | -    | Coef. Dig. EE Poultry        | 45.0  |    |      |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 3.33  |    |      |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 48.0  |    |      |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 3.56  |    |      |
| N-Free Extract (NFE)      | 3.55 |    |      | Linoleic Acid                | -     | -  | -    |
| Coef. Dig. NFE Poultry    | -    |    |      | Linolenic Acid               | -     | -  | -    |
| Digestible NFE Poultry    | -    |    |      |                              |       |    |      |
| Undig. NFE + CF Poultry   | -    |    |      |                              |       |    |      |
|                           |      |    |      |                              |       |    |      |
| Energy (kcal/kg)          |      |    |      |                              |       |    |      |
|                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Gross Energy              | 5137 | 3  | 119  | <b>Swine</b>                 |       |    |      |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3170  |    |      |
| Metabolizable Energy      | 2656 |    |      | Metabolizable Energy         | 2805  |    |      |
| Std. Metab. Energy        | 2766 |    |      | Net Energy                   | 1634  |    |      |
| Net Energy                | 2061 |    |      | <b>Sows</b>                  |       |    |      |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3170  |    |      |
| Metabolizable Energy      | 2656 |    |      | Metabolizable Energy         | 2805  |    |      |
| Net Energy                | 2061 |    |      | Net Energy                   | 1634  |    |      |
|                           |      |    |      |                              |       |    |      |
| Minerals                  |      |    |      |                              |       |    |      |
|                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Ash, %                    | 3.10 | 34 | 0.08 | <b>Trace Minerals, mg/kg</b> |       |    |      |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 3.30  | 1  | -    |
| Potassium (K)             | 0.16 | 1  | -    | Iron (Fe)                    | 568.0 | 1  | -    |
| Sodium (Na)               | 0.22 | 1  | -    | Copper (Cu)                  | 20.9  | 1  | -    |
| Chlorine (Cl)             | 0.19 | 1  | -    | Zinc (Zn)                    | 72.4  | 1  | -    |
| Sulfur (S)                | 0.14 | 1  | -    | Selenium (Se)                | 0.29  | 1  | -    |
| Magnesium (Mg)            | 0.03 | 1  | -    |                              |       |    |      |
| Total Calcium (Ca)        | 0.34 | 6  | 0.01 |                              |       |    |      |
| Total Phosphorus (P)      | 0.67 | 7  | 0.03 |                              |       |    |      |
| Phytate P                 | -    | -  | -    |                              |       |    |      |
| Available P (Pav)         | 0.67 |    |      |                              |       |    |      |
| Coef. Dig. P Poultry      | 0.56 |    |      |                              |       |    |      |
| Std. Dig. P Poultry       | 0.38 |    |      |                              |       |    |      |
| Coef. Dig. P Swine        | 0.56 |    |      |                              |       |    |      |
| Std. Dig. P Swine         | 0.38 |    |      |                              |       |    |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Feather, Meal 76% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 76.3  | 100   | 54.6             | 71.5  | 52.7             | 69.0  |
| Lysine, %                            | 2.41  | 3.16  | 1.73             | 71.6  | 1.84             | 76.3  |
| Methionine, %                        | 0.73  | 0.96  | 0.57             | 77.4  | 0.55             | 74.9  |
| Met + Cys, %                         | 3.98  | 5.21  | 2.35             | 59.1  | 2.66             | 66.8  |
| Threonine, %                         | 3.42  | 4.48  | 2.34             | 68.3  | 2.69             | 78.8  |
| Tryptophan, %                        | 0.62  | 0.81  | 0.46             | 74.6  | 0.45             | 71.8  |
| Arginine, %                          | 5.07  | 6.64  | 4.04             | 79.7  | 4.46             | 87.9  |
| Gly + Ser, %                         | 13.4  | 17.5  | 10.8             | 80.7  |                  |       |
| Valine, %                            | 5.27  | 6.91  | 3.96             | 75.2  | 4.13             | 78.3  |
| Isoleucine, %                        | 3.22  | 4.22  | 2.58             | 80.0  | 2.62             | 81.5  |
| Leucine, %                           | 6.20  | 8.12  | 4.81             | 77.5  | 4.91             | 79.2  |
| Histidine, %                         | 1.10  | 1.44  | 0.78             | 71.1  | 0.82             | 74.4  |
| Phenylalanine, %                     | 3.54  | 4.64  | 2.87             | 81.1  | 2.91             | 82.2  |
| Phe + Tyr, %                         | 5.69  | 7.46  | 4.46             | 78.3  | 4.49             | 78.9  |
| Alanine, %                           | 3.72  | 4.87  | 2.98             | 80.1  | 2.94             | 79.0  |
| Cysteine, %                          | 3.25  | 4.26  | 1.79             | 55.0  | 2.11             | 65.0  |
| Tyrosine, %                          | 2.15  | 2.82  | 1.59             | 73.8  | 1.58             | 73.5  |
| Glycine, %                           | 6.13  | 8.03  | 4.80             | 78.3  | 4.97             | 81.0  |
| Serine, %                            | 7.26  | 9.51  | 6.01             | 82.8  | 5.95             | 82.0  |
| Proline, %                           | 7.26  | 9.51  | 6.43             | 88.6  | 5.59             | 77.0  |
| Glutamine <sup>2</sup> , %           | 2.97  | 3.89  | 2.67             | 89.7  | 2.17             | 73.0  |
| Glutamic Acid <sup>2</sup> , %       | 5.02  | 6.57  | 4.50             | 89.7  | 3.66             | 73.0  |
| Asparagine <sup>2</sup> , %          | 1.86  | 2.44  | 1.33             | 71.6  | 1.17             | 63.0  |
| Aspartic Acid <sup>2</sup> , %       | 3.19  | 4.18  | 2.29             | 71.6  | 2.01             | 63.0  |
| Total Nitrogen (PB/6.25), %          | 12.2  | 16.0  | 8.73             | 71.5  | 8.43             | 69.0  |
| Essential Nitrogen Poultry, %        | 6.99  | 57.3* | 5.43             | 77.7  |                  |       |
| Essential Nitrogen Swine, %          | 4.88  | 40.0* |                  |       | 3.92             | 80.3  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 1            | 2      | 2        |           |           |
| Practical                                                   | 1            | 2      | 2        |           |           |
| Maximum                                                     | 2            | 4      | 4        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 1            | 2      | 2        | 2         | 2         |
| Practical                                                   | 1            | 2      | 2        | 2         | 2         |
| Maximum                                                     | 2            | 4      | 5        | 5         | 4         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Feather, Meal 84% CP**

| Main Components (%)       |      |    |      |                              |      |        |
|---------------------------|------|----|------|------------------------------|------|--------|
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Dry Matter                | 91.8 | 30 | 2.19 | Organic Matter (OM)          | 89.0 |        |
| Crude Protein (CP)        | 83.1 | 31 | 2.01 | Coef. Dig. OM Swine          | 64.3 |        |
| Starch                    | -    | -  | -    | Digestible OM Swine          | 57.3 |        |
| Crude Fiber (CF)          | -    | -  | -    | Undig. OM Pigs               | 31.8 |        |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 6.83 | 7 1.23 |
| NDF                       | -    | -  | -    | Coef. Dig. EE Poultry        | 30.0 |        |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 2.05 |        |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 35.0 |        |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 2.39 |        |
| N-Free Extract (NFE)      | -    |    |      | Linoleic Acid                | 0.70 | 1 -    |
| Coef. Dig. NFE Poultry    | -    |    |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    |    |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |    |      |                              |      |        |
| Energy (kcal/kg)          |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Gross Energy              | 5256 | 7  | 25   | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3380 |        |
| Metabolizable Energy      | 2666 |    |      | Metabolizable Energy         | 2922 |        |
| Std. Metab. Energy        | 2849 |    |      | Net Energy                   | 1666 |        |
| Net Energy                | 2039 |    |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3380 |        |
| Metabolizable Energy      | 2666 |    |      | Metabolizable Energy         | 2922 |        |
| Net Energy                | 2039 |    |      | Net Energy                   | 1666 |        |
| Minerals                  |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Ash, %                    | 2.72 | 19 | 0.35 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.27 | 1  | -    | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.25 | 1  | -    | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | -    | -  | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | -    | -  | -    |                              |      |        |
| Total Calcium (Ca)        | 0.33 | 5  | 0.05 |                              |      |        |
| Total Phosphorus (P)      | 0.47 | 6  | 0.18 |                              |      |        |
| Phytate P                 | -    | -  | -    |                              |      |        |
| Available P (Pav)         | 0.47 |    |      |                              |      |        |
| Coef. Dig. P Poultry      | 56.0 |    |      |                              |      |        |
| Std. Dig. P Poultry       | 0.26 |    |      |                              |      |        |
| Coef. Dig. P Swine        | 56.0 |    |      |                              |      |        |
| Std. Dig. P Swine         | 0.26 |    |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Feather, Meal 84% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 83.1  | 100   | 58.8             | 70.7  | 55.7             | 67.0  |
| Lysine, %                            | 2.45  | 2.95  | 1.72             | 70.2  | 1.83             | 74.7  |
| Methionine, %                        | 0.71  | 0.85  | 0.54             | 76.6  | 0.57             | 80.5  |
| Met + Cys, %                         | 4.63  | 5.57  | 2.71             | 58.6  | 3.03             | 65.4  |
| Threonine, %                         | 3.79  | 4.56  | 2.78             | 73.3  | 3.09             | 81.6  |
| Tryptophan, %                        | 0.66  | 0.79  | 0.49             | 74.2  | 0.43             | 65.8  |
| Arginine, %                          | 5.62  | 6.76  | 4.54             | 80.8  | 4.83             | 85.9  |
| Gly + Ser, %                         | 16.1  | 19.3  | 13.2             | 82.1  |                  |       |
| Valine, %                            | 5.86  | 7.05  | 4.64             | 79.1  | 4.93             | 84.2  |
| Isoleucine, %                        | 3.61  | 4.35  | 2.89             | 80.0  | 3.17             | 87.8  |
| Leucine, %                           | 6.95  | 8.37  | 5.32             | 76.6  | 5.85             | 84.2  |
| Histidine, %                         | 1.16  | 1.40  | 0.89             | 76.6  | 0.93             | 80.3  |
| Phenylalanine, %                     | 3.96  | 4.77  | 3.18             | 80.3  | 3.39             | 85.6  |
| Phe + Tyr, %                         | 6.46  | 7.78  | 5.26             | 81.5  | 5.32             | 82.3  |
| Alanine, %                           | 4.33  | 5.21  | 3.42             | 79.0  | 3.42             | 79.0  |
| Cysteine, %                          | 3.92  | 4.72  | 2.17             | 55.3  | 2.46             | 62.7  |
| Tyrosine, %                          | 2.50  | 3.01  | 2.09             | 83.5  | 1.93             | 77.1  |
| Glycine, %                           | 6.69  | 8.05  | 5.42             | 81.0  | 5.27             | 78.8  |
| Serine, %                            | 9.37  | 11.3  | 7.76             | 82.8  | 8.54             | 91.1  |
| Proline, %                           | 7.12  | 8.57  | 6.31             | 88.6  | 5.27             | 74.0  |
| Glutamine <sup>2</sup> , %           | 3.39  | 4.08  | 3.04             | 89.7  | 2.58             | 76.0  |
| Glutamic Acid <sup>2</sup> , %       | 5.72  | 6.89  | 5.13             | 89.7  | 4.35             | 76.0  |
| Asparagine <sup>2</sup> , %          | 2.16  | 2.60  | 1.55             | 71.6  | 1.42             | 65.8  |
| Aspartic Acid <sup>2</sup> , %       | 3.72  | 4.47  | 2.66             | 71.6  | 2.45             | 65.8  |
| Total Nitrogen (PB/6.25), %          | 13.3  | 16.0  | 9.40             | 70.7  | 8.91             | 67.0  |
| Essential Nitrogen Poultry, %        | 7.86  | 59.1* | 6.21             | 79.0  |                  |       |
| Essential Nitrogen Swine, %          | 5.36  | 40.3* |                  |       | 4.47             | 83.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 1            | 2      | 2        |           |           |
| Practical                                                   | 1            | 2      | 2        |           |           |
| Maximum                                                     | 2            | 4      | 4        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 1            | 2      | 2        | 2         | 2         |
| Practical                                                   | 1            | 2      | 2        | 2         | 2         |
| Maximum                                                     | 2            | 4      | 5        | 5         | 4         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Fish, Meal 54% CP**

| Main Components (%)       |      |    |      |                              |      |   |      |
|---------------------------|------|----|------|------------------------------|------|---|------|
|                           | Mean | n  | SD   |                              | Mean | n | SD   |
| Dry Matter                | 92.2 | 14 | 1.63 | Organic Matter (OM)          | 71.5 |   |      |
| Crude Protein (CP)        | 54.9 | 15 | 1.73 | Coef. Dig. OM Swine          | 75.5 |   |      |
| Starch                    | -    | -  | -    | Digestible OM Swine          | 53.9 |   |      |
| Crude Fiber (CF)          | -    | -  | -    | Undig. OM Pigs               | 17.5 |   |      |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 8.06 | 5 | 1.75 |
| NDF                       | -    | -  | -    | Coef. Dig. EE Poultry        | 87.0 |   |      |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 7.01 |   |      |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 91.0 |   |      |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 7.33 |   |      |
| N-Free Extract (NFE)      | 8.53 |    |      | Linoleic Acid                | 0.11 | 1 | -    |
| Coef. Dig. NFE Poultry    | -    |    |      | Linolenic Acid               | 0.08 | 1 | -    |
| Digestible NFE Poultry    | -    |    |      |                              |      |   |      |
| Undig. NFE + CF Poultry   | -    |    |      |                              |      |   |      |
|                           |      |    |      |                              |      |   |      |
| Energy (kcal/kg)          |      |    |      |                              |      |   |      |
|                           | Mean | n  | SD   |                              | Mean | n | SD   |
| Gross Energy              | 4040 | 4  | 61   | <b>Swine</b>                 |      |   |      |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3050 |   |      |
| Metabolizable Energy      | 2851 |    |      | Metabolizable Energy         | 2740 |   |      |
| Std. Metab. Energy        | 3065 |    |      | Net Energy                   | 1738 |   |      |
| Net Energy                | 2293 |    |      | <b>Sows</b>                  |      |   |      |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3050 |   |      |
| Metabolizable Energy      | 2851 |    |      | Metabolizable Energy         | 2740 |   |      |
| Net Energy                | 2293 |    |      | Net Energy                   | 1738 |   |      |
|                           |      |    |      |                              |      |   |      |
| Minerals                  |      |    |      |                              |      |   |      |
|                           | Mean | n  | SD   |                              | Mean | n | SD   |
| Ash, %                    | 21.7 | 8  | 1.25 | <b>Trace Minerals, mg/kg</b> |      |   |      |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 41.4 | 1 | -    |
| Potassium (K)             | 0.68 | 3  | 0.13 | Iron (Fe)                    | 444  | 1 | -    |
| Sodium (Na)               | 0.86 | 3  | 0.31 | Copper (Cu)                  | 12.0 | 1 | -    |
| Chlorine (Cl)             | 0.90 | 1  | -    | Zinc (Zn)                    | 84.3 | 1 | -    |
| Sulfur (S)                | 0.64 | 1  | -    | Selenium (Se)                | 0.79 | 1 | -    |
| Magnesium (Mg)            | 0.16 | 1  | -    |                              |      |   |      |
| Total Calcium (Ca)        | 5.72 | 7  | 0.24 |                              |      |   |      |
| Total Phosphorus (P)      | 2.92 | 7  | 0.17 |                              |      |   |      |
| Phytate P                 | -    | -  | -    |                              |      |   |      |
| Available P (Pav)         | 2.92 |    |      |                              |      |   |      |
| Coef. Dig. P Poultry      | 75.0 |    |      |                              |      |   |      |
| Std. Dig. P Poultry       | 2.19 |    |      |                              |      |   |      |
| Coef. Dig. P Swine        | 80.7 |    |      |                              |      |   |      |
| Std. Dig. P Swine         | 2.36 |    |      |                              |      |   |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Fish, Meal 54% CP**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 54.9  | 100   | 47.6             | 86.8  | 41.7             | 76.0  |
| Lysine, %                                   | 3.33  | 6.07  | 2.89             | 86.9  | 2.57             | 77.1  |
| Methionine, %                               | 1.29  | 2.35  | 1.15             | 89.1  | 0.96             | 74.3  |
| Met + Cys, %                                | 2.25  | 4.10  | 1.92             | 85.3  | 1.45             | 64.4  |
| Threonine, %                                | 2.20  | 4.01  | 1.86             | 84.7  | 1.49             | 67.6  |
| Tryptophan, %                               | 0.44  | 0.80  | 0.38             | 87.0  | 0.32             | 73.5  |
| Arginine, %                                 | 3.25  | 5.92  | 2.90             | 89.3  | 2.70             | 83.1  |
| Gly + Ser, %                                | 7.68  | 14.1  | 6.60             | 85.9  |                  |       |
| Valine, %                                   | 2.59  | 4.72  | 2.22             | 85.6  | 1.82             | 70.1  |
| Isoleucine, %                               | 2.08  | 3.79  | 1.91             | 91.6  | 1.59             | 76.5  |
| Leucine, %                                  | 3.52  | 6.42  | 3.06             | 87.0  | 2.57             | 73.1  |
| Histidine, %                                | 1.03  | 1.88  | 0.85             | 82.3  | 0.75             | 73.2  |
| Phenylalanine, %                            | 2.05  | 3.74  | 1.79             | 87.3  | 1.51             | 73.7  |
| Phe + Tyr, %                                | 3.58  | 6.53  | 3.00             | 83.7  | 2.80             | 78.3  |
| Alanine, %                                  | 3.51  | 6.40  | 3.12             | 89.0  | -                | -     |
| Cysteine, %                                 | 0.96  | 1.75  | 0.77             | 80.3  | 0.49             | 51.0  |
| Tyrosine, %                                 | 1.53  | 2.79  | 1.21             | 78.8  | 1.29             | 84.4  |
| Glycine, %                                  | 5.01  | 9.13  | 4.19             | 83.6  | -                | -     |
| Serine, %                                   | 2.67  | 4.87  | 2.41             | 90.1  | -                | -     |
| Proline, %                                  | 3.87  | 7.05  | 3.42             | 88.5  | -                | -     |
| Glutamine <sup>2</sup> , %                  | 2.47  | 4.50  | 2.21             | 89.7  | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | 3.76  | 6.86  | 3.38             | 89.7  | -                | -     |
| Asparagine <sup>2</sup> , %                 | 1.73  | 3.15  | 1.44             | 83.1  | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | 2.57  | 4.69  | 2.14             | 83.1  | -                | -     |
| Total Nitrogen (PB/6.25), %                 | 8.78  | 16.0  | 7.62             | 86.8  | 6.67             | 76.0  |
| Essential Nitrogen Poultry, %               | 4.77  | 54.4* | 4.15             | 86.9  |                  |       |
| Essential Nitrogen Swine, %                 | 3.48  | 39.7* |                  |       | 2.60             | 74.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 3                   | 2      | 2           |             |           |
| <b>Practical Maximum</b>                                           | 7                   | 5      | 5           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 5                   | 5      | 5           | 5           | 5         |
| <b>Practical Maximum</b>                                           | 10                  | 10     | 5           | 10          | 10        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Fish, Meal 62% CP**

| Main Components (%)       |       |    |      |                              |       |        |
|---------------------------|-------|----|------|------------------------------|-------|--------|
|                           | Means | n  | SD   |                              | Means | n SD   |
| Dry Matter                | 93.5  | 19 | 1.89 | Organic Matter (OM)          | 72.4  |        |
| Crude Protein (CP)        | 62.5  | 20 | 2.98 | Coef. Dig. OM Swine          | 79.0  |        |
| Starch                    | -     | -  | -    | Digestible OM Swine          | 57.3  |        |
| Crude Fiber (CF)          | -     | -  | -    | Undig. OM Pigs               | 15.2  |        |
| Coef. Dig. CF Swine       | -     | -  | -    | Ether Extract (EE)           | 6.68  | 8 1.57 |
| NDF                       | -     | -  | -    | Coef. Dig. EE Poultry        | 87.0  |        |
| Coef. Dig. NDF Swine      | -     | -  | -    | Digestible EE Poultry        | 5.81  |        |
| ADF                       | -     | -  | -    | Coef. Dig. EE Swine          | 91.0  |        |
| Coef. Dig. ADF Swine      | -     | -  | -    | Digestible EE Swine          | 6.08  |        |
| N-Free Extract (NFE)      | 3.26  |    |      | Linoleic Acid                | 0.13  | 1 -    |
| Coef. Dig. NFE Poultry    | -     |    |      | Linolenic Acid               | 0.10  | 1 -    |
| Digestible NFE Poultry    | -     |    |      |                              |       |        |
| Undig. NFE + CF Poultry   | -     |    |      |                              |       |        |
| Energy (kcal/kg)          |       |    |      |                              |       |        |
|                           | Means | n  | SD   |                              | Means | n SD   |
| Gross Energy              | 4413  | 3  | 177  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |       |    |      | Digestible Energy            | 3488  |        |
| Metabolizable Energy      | 2949  |    |      | Metabolizable Energy         | 3136  |        |
| Std. Metab. Energy        | -     |    |      | Net Energy                   | 1958  |        |
| Net Energy                | 2333  |    |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |       |    |      | Digestible Energy            | 3488  |        |
| Metabolizable Energy      | 2949  |    |      | Metabolizable Energy         | 3136  |        |
| Net Energy                | 2333  |    |      | Net Energy                   | 1958  |        |
| Minerals                  |       |    |      |                              |       |        |
|                           | Mean  | n  | SD   |                              | Mean  | n SD   |
| Ash, %                    | 21.0  | 17 | 2.31 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |       |    |      | Manganese (Mn)               | -     | - -    |
| Potassium (K)             | 0.58  | 1  | -    | Iron (Fe)                    | -     | - -    |
| Sodium (Na)               | 0.50  | 1  | -    | Copper (Cu)                  | -     | - -    |
| Chlorine (Cl)             | -     | -  | -    | Zinc (Zn)                    | -     | - -    |
| Sulfur (S)                | -     | -  | -    | Selenium (Se)                | -     | - -    |
| Magnesium (Mg)            | -     | -  | -    |                              |       |        |
| Total Calcium (Ca)        | 5.86  | 15 | 1.11 |                              |       |        |
| Total Phosphorus (P)      | 3.46  | 15 | 0.42 |                              |       |        |
| Phytate P                 | -     | -  | -    |                              |       |        |
| Available P (Pav)         | 3.46  |    |      |                              |       |        |
| Coef. Dig. P Poultry      | 75.0  |    |      |                              |       |        |
| Std. Dig. P Poultry       | 2.60  |    |      |                              |       |        |
| Coef. Dig. P Swine        | 80.7  |    |      |                              |       |        |
| Std. Dig. P Swine         | 2.79  |    |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Fish, Meal 62% CP**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 62.5  | 100   | 54.4             | 87.0  | 55.6             | 88.9  |
| Lysine, %                                   | 4.65  | 7.43  | 4.11             | 88.4  | 4.09             | 88.1  |
| Methionine, %                               | 1.74  | 2.78  | 1.57             | 90.7  | 1.51             | 87.2  |
| Met + Cys, %                                | 2.44  | 3.90  | 1.12             | 86.9  | 2.06             | 84.6  |
| Threonine, %                                | 2.67  | 4.27  | 2.33             | 87.3  | 2.27             | 84.9  |
| Tryptophan, %                               | 0.61  | 0.98  | 0.53             | 86.4  | 0.51             | 84.4  |
| Arginine, %                                 | 3.90  | 6.24  | 3.54             | 90.7  | 3.45             | 88.5  |
| Gly + Ser, %                                | 8.55  | 13.7  | 7.01             | 82.0  |                  |       |
| Valine, %                                   | 3.03  | 4.85  | 2.68             | 88.3  | 2.60             | 85.9  |
| Isoleucine, %                               | 2.55  | 4.07  | 2.32             | 91.3  | 2.24             | 88.2  |
| Leucine, %                                  | 4.35  | 6.96  | 3.91             | 89.8  | 3.79             | 87.1  |
| Histidine, %                                | 1.53  | 2.45  | 1.34             | 87.3  | 1.30             | 85.0  |
| Phenylalanine, %                            | 2.43  | 3.89  | 2.19             | 90.2  | 2.10             | 86.3  |
| Phe + Tyr, %                                | 4.32  | 6.91  | 3.82             | 88.4  | 3.73             | 86.3  |
| Alanine, %                                  | 4.37  | 6.98  | 3.84             | 88.0  | 4.02             | 92.0  |
| Cysteine, %                                 | 0.70  | 1.11  | 0.55             | 78.7  | 0.54             | 77.0  |
| Tyrosine, %                                 | 1.89  | 3.02  | 1.63             | 86.3  | 1.63             | 86.3  |
| Glycine, %                                  | 5.57  | 8.90  | 4.56             | 82.0  | 4.95             | 89.0  |
| Serine, %                                   | 2.98  | 4.77  | 2.44             | 82.0  | 2.71             | 91.0  |
| Proline, %                                  | 3.86  | 6.17  | 3.20             | 83.0  | 3.59             | 93.0  |
| Glutamine <sup>2</sup> , %                  | 2.87  | 4.58  | 2.58             | 90.0  | 2.69             | 94.0  |
| Glutamic Acid <sup>2</sup> , %              | 4.37  | 6.99  | 3.93             | 90.0  | 4.11             | 94.0  |
| Asparagine <sup>2</sup> , %                 | 2.02  | 3.23  | 1.66             | 82.0  | 1.78             | 88.0  |
| Aspartic Acid <sup>2</sup> , %              | 3.00  | 4.81  | 2.46             | 82.0  | 2.64             | 88.0  |
| Total Nitrogen (PB/6.25), %                 | 10.0  | 16.0  | 8.70             | 87.0  | 8.89             | 88.9  |
| Essential Nitrogen Poultry, %               | 5.86  | 58.6* | 5.13             | 87.6  |                  |       |
| Essential Nitrogen Swine, %                 | 4.42  | 44.2* |                  |       | 3.85             | 87.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 3                   | 2      | 2           |             |           |
| <b>Practical Maximum</b>                                           | 7                   | 5      | 5           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 5                   | 5      | 5           | 5           | 5         |
| <b>Practical Maximum</b>                                           | 12                  | 10     | 5           | 10          | 10        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Glucose**

| Main Components (%)     |      |   |    |                       |      |   |    |
|-------------------------|------|---|----|-----------------------|------|---|----|
|                         | Mean | n | SD |                       | Mean | n | SD |
| Dry Matter              | 90.4 | 1 | -  | Organic Matter (OM)   | 90.4 |   |    |
| Crude Protein (CP)      | -    | - | -  | Coef. Dig. OM Swine   | 95.5 |   |    |
| Starch                  | -    | - | -  | Digestible OM Swine   | 86.3 |   |    |
| Crude Fiber (CF)        | -    | - | -  | Undig. OM Pigs        | 4.07 |   |    |
| Coef. Dig. CF Swine     | -    |   |    | Ether Extract (EE)    | -    | - | -  |
| NDF                     | -    | - | -  | Coef. Dig. EE Poultry | -    |   |    |
| Coef. Dig. NDF Swine    | -    | - | -  | Digestible EE Poultry | -    |   |    |
| ADF                     | -    | - | -  | Coef. Dig. EE Swine   | -    |   |    |
| Coef. Dig. ADF Swine    | -    |   |    | Digestible EE Swine   | -    |   |    |
| N-Free Extract (NFE)    | 90.4 |   |    | Linoleic Acid         | -    | - | -  |
| Coef. Dig. NFE Poultry  | 90.7 |   |    | Linolenic Acid        | -    | - | -  |
| Digestible NFE Poultry  | 82.0 |   |    |                       |      |   |    |
| Undig. NFE + CF Poultry | 8.40 |   |    |                       |      |   |    |

| Energy (kcal/kg)     |      |   |    |                      |      |   |    |
|----------------------|------|---|----|----------------------|------|---|----|
|                      | Mean | n | SD |                      | Mean | n | SD |
| Gross Energy         | 4017 | 1 | -  | <b>Swine</b>         |      |   |    |
| <b>Poultry</b>       |      |   |    | Digestible Energy    | 3652 |   |    |
| Metabolizable Energy | 3393 |   |    | Metabolizable Energy | 3579 |   |    |
| Std. Metab. Energy   | -    |   |    | Net Energy           | 2613 |   |    |
| Net Energy           | 2714 |   |    | <b>Sows</b>          |      |   |    |
| <b>Hens</b>          |      |   |    | Digestible Energy    | 3614 |   |    |
| Metabolizable Energy | 3420 |   |    | Metabolizable Energy | 3604 |   |    |
| Net Energy           | 2741 |   |    | Net Energy           | 2631 |   |    |

| Minerals                  |      |   |    |                              |      |   |    |
|---------------------------|------|---|----|------------------------------|------|---|----|
|                           | Mean | n | SD |                              | Mean | n | SD |
| Ash, %                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - | -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |   |    |
| Total Calcium (Ca)        | -    | - | -  |                              |      |   |    |
| Total Phosphorus (P)      | -    | - | -  |                              |      |   |    |
| Phytate P                 | -    | - | -  |                              |      |   |    |
| Available P (Pav)         | -    |   |    |                              |      |   |    |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |   |    |
| Std. Dig. P Poultry       | -    |   |    |                              |      |   |    |
| Coef. Dig. P Swine        | -    |   |    |                              |      |   |    |
| Std. Dig. P Swine         | -    |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Glucose**

|                                | Amino Acid Content and Digestibility |      |                  |       |                  |       |
|--------------------------------|--------------------------------------|------|------------------|-------|------------------|-------|
|                                | Total                                | % CP | Poultry          |       | Swine            |       |
|                                |                                      |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | -                                    | -    | -                | -     | -                | -     |
| Lysine, %                      | -                                    | -    | -                | -     | -                | -     |
| Methionine, %                  | -                                    | -    | -                | -     | -                | -     |
| Met + Cys, %                   | -                                    | -    | -                | -     | -                | -     |
| Threonine, %                   | -                                    | -    | -                | -     | -                | -     |
| Tryptophan, %                  | -                                    | -    | -                | -     | -                | -     |
| Arginine, %                    | -                                    | -    | -                | -     | -                | -     |
| Gly + Ser, %                   | -                                    | -    | -                | -     | -                | -     |
| Valine, %                      | -                                    | -    | -                | -     | -                | -     |
| Isoleucine, %                  | -                                    | -    | -                | -     | -                | -     |
| Leucine, %                     | -                                    | -    | -                | -     | -                | -     |
| Histidine, %                   | -                                    | -    | -                | -     | -                | -     |
| Phenylalanine, %               | -                                    | -    | -                | -     | -                | -     |
| Phe + Tyr, %                   | -                                    | -    | -                | -     | -                | -     |
| Alanine, %                     | -                                    | -    | -                | -     | -                | -     |
| Cysteine, %                    | -                                    | -    | -                | -     | -                | -     |
| Tyrosine, %                    | -                                    | -    | -                | -     | -                | -     |
| Glycine, %                     | -                                    | -    | -                | -     | -                | -     |
| Serine, %                      | -                                    | -    | -                | -     | -                | -     |
| Proline, %                     | -                                    | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | -                                    | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %    | -                                    | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %    | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %  | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | -                                    | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             |              |        |          |           |           |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             |              |        |          |           |           |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Lactose**

| Main Components (%)                       |      |   |      |                              |       |   |    |
|-------------------------------------------|------|---|------|------------------------------|-------|---|----|
|                                           | Mean | n | SD   |                              | Mean  | n | SD |
| Dry Matter                                | 96.4 | 2 | 3.15 | Organic Matter (OM)          | 96.2  |   |    |
| Crude Protein (CP)                        | -    | - | -    | Coef. Dig. OM Swine          | 88.5  |   |    |
| Starch                                    | -    | - | -    | Digestible OM Swine          | 85.2  |   |    |
| Crude Fiber (CF)                          | -    | - | -    | Undig. OM Pigs               | 11.0  |   |    |
| Coef. Dig. CF Swine                       | -    |   |      | Ether Extract (EE)           | -     | - | -  |
| NDF                                       | -    | - | -    | Coef. Dig. EE Poultry        | -     |   |    |
| Coef. Dig. NDF Swine                      | -    |   |      | Digestible EE Poultry        | -     |   |    |
| ADF                                       | -    | - | -    | Coef. Dig. EE Swine          | -     |   |    |
| Coef. Dig. ADF Swine                      | -    |   |      | Digestible EE Swine          | -     |   |    |
| N-Free Extract (NFE)                      | -    |   |      | Linoleic Acid                | -     | - | -  |
| Coef. Dig. NFE Poultry                    | -    |   |      | Linolenic Acid               | -     | - | -  |
| Digestible NFE Poultry                    | -    |   |      |                              |       |   |    |
| Undig. NFE + CF Poultry                   | -    |   |      |                              |       |   |    |
|                                           |      |   |      |                              |       |   |    |
| Energy (kcal/kg)                          |      |   |      |                              |       |   |    |
|                                           | Mean | n | SD   |                              | Mean  | N | SD |
| Gross Energy                              | 4026 | 2 | 88   | <b>Swine</b>                 |       |   |    |
| <b>Poultry</b>                            |      |   |      | Digestible Energy            | 3565  |   |    |
| Metabolizable Energy                      | -    |   |      | Metabolizable Energy         | 3518  |   |    |
| Std. Metab. Energy                        | -    |   |      | Net Energy                   | 2568  |   |    |
| Net Energy                                | -    |   |      | <b>Sows</b>                  |       |   |    |
| <b>Hens</b>                               |      |   |      | Digestible Energy            | 3637  |   |    |
| Metabolizable Energy                      | -    |   |      | Metabolizable Energy         | 3610  |   |    |
| Net Energy                                | -    |   |      | Net Energy                   | 2635  |   |    |
|                                           |      |   |      |                              |       |   |    |
| Minerals                                  |      |   |      |                              |       |   |    |
|                                           | Mean | n | SD   |                              | Means | n | SD |
| Ash, %                                    | 0.17 | 1 | -    | <b>Trace Minerals, mg/kg</b> |       |   |    |
| <b>Macro Minerals (%)</b>                 |      |   |      | Manganese (Mn)               | -     | - | -  |
| Potassium (K)                             | -    | - | -    | Iron (Fe)                    | -     | - | -  |
| Sodium (Na)                               | -    | - | -    | Copper (Cu)                  | -     | - | -  |
| Chlorine (Cl)                             | -    | - | -    | Zinc (Zn)                    | -     | - | -  |
| Sulfur (S)                                | -    | - | -    | Selenium (Se)                | -     | - | -  |
| Magnesium (Mg)                            | -    | - | -    |                              |       |   |    |
| Total Calcium (Ca)                        | -    | - | -    |                              |       |   |    |
| Total Phosphorus (P)                      | -    | - | -    |                              |       |   |    |
| Phytate P                                 | -    | - | -    |                              |       |   |    |
| Available P (Pav)                         | -    |   |      |                              |       |   |    |
| Coef. Dig. P Poultry                      | -    |   |      |                              |       |   |    |
| Std. Dig. P Poultry                       | -    |   |      |                              |       |   |    |
| Coef. Dig. P Swine                        | -    |   |      |                              |       |   |    |
| Std. Dig. P Swine                         | -    |   |      |                              |       |   |    |
| Pav = Non Phytate P (Total P – Phytate P) |      |   |      |                              |       |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Lactose**

|                                | Amino Acid Content and Digestibility |      |                  |       |                  |       |
|--------------------------------|--------------------------------------|------|------------------|-------|------------------|-------|
|                                | Total                                | % CP | Poultry          |       | Swine            |       |
|                                |                                      |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | -                                    | -    | -                | -     | -                | -     |
| Lysine, %                      | -                                    | -    | -                | -     | -                | -     |
| Methionine, %                  | -                                    | -    | -                | -     | -                | -     |
| Met + Cys, %                   | -                                    | -    | -                | -     | -                | -     |
| Threonine, %                   | -                                    | -    | -                | -     | -                | -     |
| Tryptophan, %                  | -                                    | -    | -                | -     | -                | -     |
| Arginine, %                    | -                                    | -    | -                | -     | -                | -     |
| Gly + Ser, %                   | -                                    | -    | -                | -     | -                | -     |
| Valine, %                      | -                                    | -    | -                | -     | -                | -     |
| Isoleucine, %                  | -                                    | -    | -                | -     | -                | -     |
| Leucine, %                     | -                                    | -    | -                | -     | -                | -     |
| Histidine, %                   | -                                    | -    | -                | -     | -                | -     |
| Phenylalanine, %               | -                                    | -    | -                | -     | -                | -     |
| Phe + Tyr, %                   | -                                    | -    | -                | -     | -                | -     |
| Alanine, %                     | -                                    | -    | -                | -     | -                | -     |
| Cysteine, %                    | -                                    | -    | -                | -     | -                | -     |
| Tyrosine, %                    | -                                    | -    | -                | -     | -                | -     |
| Glycine, %                     | -                                    | -    | -                | -     | -                | -     |
| Serine, %                      | -                                    | -    | -                | -     | -                | -     |
| Proline, %                     | -                                    | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | -                                    | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %    | -                                    | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %    | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %  | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | -                                    | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             |              |        |          |           |           |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             |              |        |          |           |           |
| Practical                                                   | 12           | -      | -        | -         | -         |
| Maximum                                                     | 20           | -      | -        | -         | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Lard**

| Main Components (%)       |       |   |    |                              |       |      |
|---------------------------|-------|---|----|------------------------------|-------|------|
|                           | Mean  | n | SD |                              | Mean  | n SD |
| Dry Matter                | 99.6  | 1 | -  | Organic Matter (OM)          | 99.6  |      |
| Crude Protein (CP)        | -     | - | -  | Coef. Dig. OM Swine          | 87.3  |      |
| Starch                    | -     | - | -  | Digestible OM Swine          | 87.0  |      |
| Crude Fiber (CF)          | -     | - | -  | Undig. OM Pigs               | 12.6  |      |
| Coef. Dig. CF Swine       | -     |   |    | Ether Extract (EE)           | 99.6  | 1 -  |
| NDF                       | -     | - | -  | Coef. Dig. EE Poultry        | 87.3  |      |
| Coef. Dig. NDF Swine      | -     |   |    | Digestible EE Poultry        | 87.0  |      |
| ADF                       | -     | - | -  | Coef. Dig. EE Swine          | 84.6  |      |
| Coef. Dig. ADF Swine      | -     |   |    | Digestible EE Swine          | 84.3  |      |
| N-Free Extract (NFE)      | -     |   |    | Linoleic Acid                | 9.63  | 1 -  |
| Coef. Dig. NFE Poultry    | -     |   |    | Linolenic Acid               | 0.94  | 1 -  |
| Digestible NFE Poultry    | -     |   |    |                              |       |      |
| Undig. NFE + CF Poultry   | -     |   |    |                              |       |      |
| Energy (kcal/kg)          |       |   |    |                              |       |      |
|                           | Mean  | n | SD |                              | Mean  | n SD |
| Gross Energy              | 9369  | 1 | -  | <b>Swine</b>                 |       |      |
| <b>Poultry</b>            |       |   |    | Digestible Energy            | 8180  |      |
| Metabolizable Energy      | 8080  |   |    | Metabolizable Energy         | 7939  |      |
| Std. Metab. Energy        | -     |   |    | Net Energy                   | 7100  |      |
| Net Energy                | 7272  |   |    | <b>Sows</b>                  |       |      |
| <b>Hens</b>               |       |   |    | Digestible Energy            | 8180  |      |
| Metabolizable Energy      | 8080  |   |    | Metabolizable Energy         | 7939  |      |
| Net Energy                | 7272  |   |    | Net Energy                   | 7100  |      |
| Minerals                  |       |   |    |                              |       |      |
|                           | Means | n | SD |                              | Means | n SD |
| Ash, %                    | -     | - | -  | <b>Trace Minerals, mg/kg</b> |       |      |
| <b>Macro Minerals (%)</b> |       |   |    | Manganese (Mn)               | -     | - -  |
| Potassium (K)             | -     | - | -  | Iron (Fe)                    | -     | - -  |
| Sodium (Na)               | -     | - | -  | Copper (Cu)                  | -     | - -  |
| Chlorine (Cl)             | -     | - | -  | Zinc (Zn)                    | -     | - -  |
| Sulfur (S)                | -     | - | -  | Selenium (Se)                | -     | - -  |
| Magnesium (Mg)            | -     | - | -  |                              |       |      |
| Total Calcium (Ca)        | -     | - | -  |                              |       |      |
| Total Phosphorus (P)      | -     | - | -  |                              |       |      |
| Phytate P                 | -     | - | -  |                              |       |      |
| Available P (Pav)         | -     |   |    |                              |       |      |
| Coef. Dig. P Poultry      | -     |   |    |                              |       |      |
| Std. Dig. P Poultry       | -     |   |    |                              |       |      |
| Coef. Dig. P Swine        | -     |   |    |                              |       |      |
| Std. Dig. P Swine         | -     |   |    |                              |       |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Lard**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | -     | -    | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 3      |          | 3         |           |
|                                                             | 6            | 7      |          | 7         |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 2      | 2        | 0         | 2         |
|                                                             | 5            | 5      | 5        | 4         | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Lecithin**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 99.4 | 1 | -  | Organic Matter (OM)          | 93.3 |      |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 71.2 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 66.4 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 26.9 |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 92.8 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 70.0 |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | 65.0 |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 73.7 |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | 68.4 |      |
| N-Free Extract (NFE)      | 0.49 |   |    | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    | - | -  |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 8188 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 6615 |      |
| Metabolizable Energy      | 6036 |   |    | Metabolizable Energy         | 6375 |      |
| Std. Metab. Energy        | 6240 |   |    | Net Energy                   | 5869 |      |
| Net Energy                | 5433 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 6615 |      |
| Metabolizable Energy      | 6036 |   |    | Metabolizable Energy         | 6375 |      |
| Net Energy                | 5433 |   |    | Net Energy                   | 5869 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 6.11 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | -    | - | -  |                              |      |      |
| Total Phosphorus (P)      | -    | - | -  |                              |      |      |
| Phytate P                 | -    | - | -  |                              |      |      |
| Available P (Pav)         | -    | - | -  |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |      |      |
| Coef. Dig. P Swine        | -    | - | -  |                              |      |      |
| Std. Dig. P Swine         | -    | - | -  |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Lecithin**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | -     | -    | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |          |             |           |
|--------------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                                    | Starter             | Grower |          |             |           |
|                                                                    | 3                   | 3      |          | 3           |           |
| <b>Practical Maximum</b>                                           | 6                   | 7      |          | 7           |           |
|                                                                    | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                                    | 2                   | 2      | 2        | 0           | 2         |
| <b>Practical Maximum</b>                                           | 5                   | 5      | 5        | 4           | 5         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Skimmed, Powder**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 94.1 | 7 | 0.78 | Organic Matter (OM)          | 86.0 |        |
| Crude Protein (CP)        | 33.4 | 9 | 2.72 | Coef. Dig. OM Swine          | 94.3 |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 81.1 |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 4.90 |        |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 0.79 | 3 0.10 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | -    |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 95.0 |        |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 0.75 |        |
| N-Free Extract (NFE)      | 51.8 |   |      | Linoleic Acid                | 0.02 | 2 0.00 |
| Coef. Dig. NFE Poultry    | -    |   |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    |   |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |   |      |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 4238 | 5 | 128  | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3876 |        |
| Metabolizable Energy      | 2736 |   |      | Metabolizable Energy         | 3646 |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 2448 |        |
| Net Energy                | -    |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3901 |        |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | 3678 |        |
| Net Energy                | -    |   |      | Net Energy                   | 2472 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 8.10 | 5 | 0.38 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 1.53 | 4 | 0.07 | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.47 | 4 | 0.08 | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.94 | 4 | 0.05 | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | 0.00 | 1 | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.11 | 1 | -    |                              |      |        |
| Total Calcium (Ca)        | 1.30 | 5 | 0.13 |                              |      |        |
| Total Phosphorus (P)      | 0.90 | 5 | 0.18 |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | 0.90 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | -    |   |      |                              |      |        |
| Std. Dig. P Poultry       | -    |   |      |                              |      |        |
| Coef. Dig. P Swine        | 90.0 |   |      |                              |      |        |
| Std. Dig. P Swine         | 0.81 |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Skimmed, Powder**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 33.4  | 100   | -                | -     | 30.1             | 90.1  |
| Lysine, %                            | 2.61  | 7.81  | -                | -     | 2.43             | 93.0  |
| Methionine, %                        | 0.84  | 2.51  | -                | -     | 0.80             | 95.2  |
| Met + Cys, %                         | 1.12  | 3.35  | -                | -     | 1.04             | 92.7  |
| Threonine, %                         | 1.51  | 4.52  | -                | -     | 1.35             | 89.3  |
| Tryptophan, %                        | 0.37  | 1.11  | -                | -     | 0.34             | 91.0  |
| Arginine, %                          | 1.19  | 3.56  | -                | -     | 1.13             | 95.3  |
| Gly + Ser, %                         | 2.41  | 7.22  | -                | -     | -                | -     |
| Valine, %                            | 2.17  | 6.50  | -                | -     | 1.91             | 88.1  |
| Isoleucine, %                        | 1.84  | 5.51  | -                | -     | 1.62             | 87.8  |
| Leucine, %                           | 3.21  | 9.61  | -                | -     | 3.01             | 93.7  |
| Histidine, %                         | 0.94  | 2.81  | -                | -     | 0.88             | 93.1  |
| Phenylalanine, %                     | 1.66  | 4.97  | -                | -     | 1.58             | 95.4  |
| Phe + Tyr, %                         | 3.04  | 9.10  | -                | -     | 2.86             | 94.1  |
| Alanine, %                           | 1.09  | 3.26  | -                | -     | 0.92             | 84.5  |
| Cysteine, %                          | 0.28  | 0.84  | -                | -     | 0.24             | 85.0  |
| Tyrosine, %                          | 1.38  | 4.13  | -                | -     | 1.28             | 92.5  |
| Glycine, %                           | 0.66  | 1.98  | -                | -     | 0.52             | 78.5  |
| Serine, %                            | 1.75  | 5.24  | -                | -     | 1.40             | 80.0  |
| Proline, %                           | 3.25  | 9.73  | -                | -     | 3.12             | 96.0  |
| Glutamine <sup>2</sup> , %           | 3.68  | 11.0  | -                | -     | 3.22             | 87.5  |
| Glutamic Acid <sup>2</sup> , %       | 3.09  | 9.24  | -                | -     | 2.70             | 87.5  |
| Asparagine <sup>2</sup> , %          | 0.99  | 2.98  | -                | -     | 0.88             | 88.5  |
| Aspartic Acid <sup>2</sup> , %       | 1.51  | 4.51  | -                | -     | 1.33             | 88.5  |
| Total Nitrogen (PB/6.25), %          | 5.34  | 16.0  | -                | -     | 4.81             | 90.1  |
| Essential Nitrogen Poultry, %        | 2.74  | 51.3* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | 2.38  | 44.6* | -                | -     | 2.19             | 92.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             |              |        |          |           |           |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             |              |        |          |           |           |
| Practical                                                   | 7            | -      | -        | -         | -         |
| Maximum                                                     | 20           | -      | -        | -         | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Whey, Powder**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 95.2 | 2 | 0.28 | Organic Matter (OM)          | 86.5 |        |
| Crude Protein (CP)        | 12.3 | 3 | 0.44 | Coef. Dig. OM Swine          | 90.5 |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 78.2 |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 8.21 |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 0.93 | 2 0.04 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | -    |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 95.0 |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 0.88 |        |
| N-Free Extract (NFE)      | 73.2 |   |      | Linoleic Acid                | 0.02 | 1 -    |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    | - | -    |                              |      |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 3703 | 1 | -    | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Energy Dig.                  | 3486 |        |
| Energy Met.               | 1947 |   |      | Energy Met.                  | 3371 |        |
| Std. Metab. Energy        | -    | - | -    | Net Energy                   | 2391 |        |
| Net Energy                | -    | - | -    | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Energy Dig.                  | 3530 |        |
| Energy Met.               | -    | - | -    | Energy Met.                  | 3434 |        |
| Net Energy                | -    | - | -    | Net Energy                   | 2437 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 8.74 | 2 | 0.41 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 3.00 | 1 -    |
| Potassium (K)             | 2.08 | 1 | -    | Iron (Fe)                    | 12.3 | 1 -    |
| Sodium (Na)               | 0.79 | 1 | -    | Copper (Cu)                  | 16.5 | 1 -    |
| Chlorine (Cl)             | 1.34 | 1 | -    | Zinc (Zn)                    | 115  | 1 -    |
| Sulfur (S)                | 0.30 | 1 | -    | Selenium (Se)                | 0.21 | 1 -    |
| Magnesium (Mg)            | 0.11 | 1 | -    |                              |      |        |
| Total Calcium (Ca)        | 0.75 | 1 | -    |                              |      |        |
| Total Phosphorus (P)      | 0.68 | 1 | -    |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | 0.68 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | -    | - | -    |                              |      |        |
| Std. Dig. P Poultry       | -    | - | -    |                              |      |        |
| Coef. Dig. P Swine        | 90.0 |   |      |                              |      |        |
| Std. Dig. P Swine         | 0.61 |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Whey, Powder**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 12.3  | 100   | -                | -     | 10.9             | 88.2  |
| Lysine, %                                   | 0.95  | 7.72  | -                | -     | 0.87             | 91.4  |
| Methionine, %                               | 0.22  | 1.79  | -                | -     | 0.20             | 90.5  |
| Met + Cys, %                                | 0.44  | 3.58  | -                | -     | 0.39             | 89.3  |
| Threonine, %                                | 0.72  | 5.85  | -                | -     | 0.62             | 86.1  |
| Tryptophan, %                               | 0.19  | 1.54  | -                | -     | 0.16             | 83.6  |
| Arginine, %                                 | 0.35  | 2.85  | -                | -     | 0.32             | 91.9  |
| Gly + Ser, %                                | 1.15  | 9.35  | -                | -     | -                | -     |
| Valine, %                                   | 0.65  | 5.28  | -                | -     | 0.57             | 87.2  |
| Isoleucine, %                               | 0.66  | 5.37  | -                | -     | 0.59             | 89.5  |
| Leucine, %                                  | 1.08  | 8.78  | -                | -     | 1.00             | 92.5  |
| Histidine, %                                | 0.24  | 1.95  | -                | -     | 0.22             | 91.7  |
| Phenylalanine, %                            | 0.40  | 3.25  | -                | -     | 0.36             | 90.5  |
| Phe + Tyr, %                                | 0.65  | 5.28  | -                | -     | 0.58             | 89.5  |
| Alanine, %                                  | 0.51  | 4.15  | -                | -     | 0.43             | 84.0  |
| Cysteine, %                                 | 0.22  | 1.79  | -                | -     | 0.19             | 88.0  |
| Tyrosine, %                                 | 0.25  | 2.03  | -                | -     | 0.22             | 88.0  |
| Glycine, %                                  | 0.65  | 5.28  | -                | -     | 0.49             | 75.0  |
| Serine, %                                   | 0.50  | 4.07  | -                | -     | 0.41             | 81.0  |
| Proline, %                                  | 0.47  | 3.82  | -                | -     | 0.41             | 87.0  |
| Glutamine <sup>2</sup> , %                  | 0.97  | 7.88  | -                | -     | 0.88             | 91.0  |
| Glutamic Acid <sup>2</sup> , %              | 0.81  | 6.60  | -                | -     | 0.74             | 91.0  |
| Asparagine <sup>2</sup> , %                 | 0.41  | 3.33  | -                | -     | 0.36             | 89.0  |
| Aspartic Acid <sup>2</sup> , %              | 0.62  | 5.05  | -                | -     | 0.55             | 89.0  |
| Total Nitrogen (PB/6.25), %                 | 1.97  | 16.0  | -                | -     | 1.74             | 88.2  |
| Essential Nitrogen Poultry, %               | 0.98  | 49.6* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | 0.79  | 40.1* | -                | -     | 0.71             | 89.9  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
| <b>Practical</b>                                                   | -                   | -      | -           |             |           |
| <b>Maximum</b>                                                     | -                   | -      | -           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                                   | 10                  | -      | -           | -           | -         |
| <b>Maximum</b>                                                     | 20                  | -      | -           | -           | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Whey, Permeate**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 94.5 | 1 | -  | Organic Matter (OM)          | 88.8 |      |
| Crude Protein (CP)        | 3.00 | 1 | -  | Coef. Dig. OM Swine          | 96.1 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 85.3 |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 3.48 |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 0.20 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -    |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | -    |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -    |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | -    |      |
| N-Free Extract (NFE)      | 85.6 |   |    | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    | - | -  |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 3446 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3311 |      |
| Metabolizable Energy      | -    | - | -  | Metabolizable Energy         | 3225 |      |
| Std. Metab. Energy        | -    | - | -  | Net Energy                   | -    |      |
| Net Energy                | -    | - | -  | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -    |      |
| Metabolizable Energy      | -    | - | -  | Metabolizable Energy         | -    |      |
| Net Energy                | -    | - | -  | Net Energy                   | -    |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 5.70 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | 2.10 | 1 | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | 1.00 | 1 | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | 2.00 | 1 | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | 0.57 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.50 | 1 | -  |                              |      |      |
| Phytate P                 | -    | - | -  |                              |      |      |
| Available P (Pav)         | 0.50 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |      |      |
| Coef. Dig. P Swine        | 90.0 |   |    |                              |      |      |
| Std. Dig. P Swine         | 0.45 |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Whey, Permeate**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 3.00  | 100   | -                | -     | -                | -     |
| Lysine, %                            | 0.14  | 4.67  | -                | -     | -                | -     |
| Methionine, %                        | 0.02  | 0.67  | -                | -     | -                | -     |
| Met + Cys, %                         | 0.06  | 2.00  | -                | -     | -                | -     |
| Threonine, %                         | 0.11  | 3.67  | -                | -     | -                | -     |
| Tryptophan, %                        | 0.02  | 0.67  | -                | -     | -                | -     |
| Arginine, %                          | 0.05  | 1.67  | -                | -     | -                | -     |
| Gly + Ser, %                         | -     | -     | -                | -     | -                | -     |
| Valine, %                            | 0.10  | 3.33  | -                | -     | -                | -     |
| Isoleucine, %                        | 0.13  | 4.33  | -                | -     | -                | -     |
| Leucine, %                           | 0.17  | 5.67  | -                | -     | -                | -     |
| Histidine, %                         | 0.04  | 1.33  | -                | -     | -                | -     |
| Phenylalanine, %                     | 0.05  | 1.67  | -                | -     | -                | -     |
| Phe + Tyr, %                         | 0.07  | 2.33  | -                | -     | -                | -     |
| Alanine, %                           | -     | -     | -                | -     | -                | -     |
| Cysteine, %                          | 0.04  | 1.33  | -                | -     | -                | -     |
| Tyrosine, %                          | 0.02  | 0.67  | -                | -     | -                | -     |
| Glycine, %                           | -     | -     | -                | -     | -                | -     |
| Serine, %                            | -     | -     | -                | -     | -                | -     |
| Proline, %                           | -     | -     | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %           | -     | -     | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | -     | -     | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %          | -     | -     | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | -     | -     | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %          | 0.48  | 16.0  | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %        | 0.12  | 25.0* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | 0.12  | 25.0* | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | -            | -      |          |           |           |
| Practical Maximum                                           | -            | -      |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 10           | -      | -        | -         | -         |
| Practical Maximum                                           | 20           | -      | -        | -         | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Whole, Powder**

| Main Components (%)       |      |   |      |                              |      |   |    |
|---------------------------|------|---|------|------------------------------|------|---|----|
|                           | Mean | n | SD   |                              | Mean | n | SD |
| Dry Matter                | 95.9 | 5 | 0.12 | Organic Matter (OM)          | 89.5 |   |    |
| Crude Protein (CP)        | 24.6 | 5 | 2.70 | Coef. Dig. OM Swine          | 94.5 |   |    |
| Starch                    | -    | - | -    | Digestible OM Swine          | 84.5 |   |    |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 4.92 |   |    |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 26.0 | 1 | -  |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | -    |   |    |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 92.0 |   |    |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 23.9 |   |    |
| N-Free Extract (NFE)      | 38.9 |   |      | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry    | -    |   |      | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry    | -    |   |      |                              |      |   |    |
| Undig. NFE + CF Poultry   | -    |   |      |                              |      |   |    |
| Energy (kcal/kg)          |      |   |      |                              |      |   |    |
|                           | Mean | n | SD   |                              | Mean | n | SD |
| Gross Energy              | 5431 | 1 | -    | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 5137 |   |    |
| Metabolizable Energy      | 2635 |   |      | Metabolizable Energy         | 4948 |   |    |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 3788 |   |    |
| Net Energy                | -    |   |      | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 5161 |   |    |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | 4990 |   |    |
| Net Energy                | -    |   |      | Net Energy                   | 3819 |   |    |
| Minerals                  |      |   |      |                              |      |   |    |
|                           | Mean | n | SD   |                              | Mean | n | SD |
| Ash, %                    | 6.41 | 5 | 0.69 | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - | -  |
| Potassium (K)             | 1.17 | 1 | -    | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)               | 0.32 | 1 | -    | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)             | 0.71 | 1 | -    | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)            | -    | - | -    |                              |      |   |    |
| Total Calcium (Ca)        | 0.83 | 4 | 0.13 |                              |      |   |    |
| Total Phosphorus (P)      | 0.65 | 4 | 0.04 |                              |      |   |    |
| Phytate P                 | -    | - | -    |                              |      |   |    |
| Available P (Pav)         | 0.65 |   |      |                              |      |   |    |
| Coef. Dig. P Poultry      | -    |   |      |                              |      |   |    |
| Std. Dig. P Poultry       | -    |   |      |                              |      |   |    |
| Coef. Dig. P Swine        | 90.0 |   |      |                              |      |   |    |
| Std. Dig. P Swine         | 0.59 |   |      |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Milk Whole, Powder**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 24.6  | 100   | -                | -     | 22.8             | 92.5  |
| Lysine, %                            | 1.95  | 7.93  | -                | -     | 1.80             | 92.3  |
| Methionine, %                        | 0.61  | 2.48  | -                | -     | 0.59             | 96.0  |
| Met + Cys, %                         | 0.84  | 3.42  | -                | -     | 0.79             | 93.5  |
| Threonine, %                         | 1.14  | 4.64  | -                | -     | 1.06             | 92.6  |
| Tryptophan, %                        | 0.31  | 1.26  | -                | -     | 0.30             | 95.8  |
| Arginine, %                          | 0.91  | 3.70  | -                | -     | 0.83             | 91.1  |
| Gly + Ser, %                         | 1.66  | 6.75  | -                | -     |                  |       |
| Valine, %                            | 1.56  | 6.34  | -                | -     | 1.43             | 91.6  |
| Isoleucine, %                        | 1.33  | 5.41  | -                | -     | 1.19             | 89.6  |
| Leucine, %                           | 2.44  | 9.92  | -                | -     | 2.36             | 96.9  |
| Histidine, %                         | 0.71  | 2.89  | -                | -     | 0.68             | 95.9  |
| Phenylalanine, %                     | 1.22  | 4.96  | -                | -     | 1.19             | 97.7  |
| Phe + Tyr, %                         | 2.20  | 8.95  | -                | -     | 2.10             | 95.5  |
| Alanine, %                           | 0.70  | 2.85  |                  |       | 0.63             | 90.0  |
| Cysteine, %                          | 0.23  | 0.94  | -                | -     | 0.20             | 86.9  |
| Tyrosine, %                          | 0.98  | 3.99  | -                | -     | 0.91             | 92.8  |
| Glycine, %                           | 0.45  | 1.83  | -                | -     | 0.44             | 97.3  |
| Serine, %                            | 1.21  | 4.92  | -                | -     | 0.97             | 80.0  |
| Proline, %                           | 1.38  | 5.61  | -                | -     | 1.32             | 96.0  |
| Glutamine <sup>2</sup> , %           | 2.51  | 10.2  | -                | -     | 2.29             | 91.0  |
| Glutamic Acid <sup>2</sup> , %       | 2.11  | 8.56  | -                | -     | 1.92             | 91.0  |
| Asparagine <sup>2</sup> , %          | 0.64  | 2.60  | -                | -     | 0.60             | 94.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.97  | 3.94  | -                | -     | 0.91             | 94.0  |
| Total Nitrogen (PB/6.25), %          | 3.93  | 16.0  | -                | -     | 3.64             | 92.5  |
| Essential Nitrogen Poultry, %        | 2.03  | 51.6* | -                | -     |                  |       |
| Essential Nitrogen Swine, %          | 1.79  | 45.4* |                  |       | 1.67             | 93.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | -            | -      | -        |           |           |
| Practical Maximum                                           | -            | -      | -        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 7            | -      | -        | -         | -         |
| Practical Maximum                                           | 20           | -      | -        | -         | -         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Millet, Grain**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 89.3 | 30 | 0.89 | Organic Matter (OM)          | 87.6 |         |
| Crude Protein (CP)        | 11.6 | 30 | 0.93 | Coef. Dig. OM Swine          | 77.0 |         |
| Starch                    | 62.4 | 5  | 1.75 | Digestible OM Swine          | 67.4 |         |
| Crude Fiber (CF)          | 2.36 | 25 | 1.17 | Undig. OM Pigs               | 20.1 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 4.59 | 25 0.62 |
| NDF                       | 20.5 | 6  | 3.34 | Coef. Dig. EE Poultry        | 72.0 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 3.30 |         |
| ADF                       | 6.66 | 6  | 2.27 | Coef. Dig. EE Swine          | 72.5 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 3.32 |         |
| N-Free Extract (NFE)      | 69.0 |    |      | Linoleic Acid                | 1.63 | 1 -     |
| Coef. Dig. NFE Poultry    | 85.0 |    |      | Linolenic Acid               | 0.13 | 1 -     |
| Digestible NFE Poultry    | 58.7 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 12.7 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 3963 | 6  | 81   | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3159 |         |
| Metabolizable Energy      | 3189 |    |      | Metabolizable Energy         | 3046 |         |
| Std. Metab. Energy        | 3354 |    |      | Net Energy                   | 2414 |         |
| Net Energy                | 2563 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3324 |         |
| Metabolizable Energy      | 3230 |    |      | Metabolizable Energy         | 3201 |         |
| Net Energy                | 2604 |    |      | Net Energy                   | 2527 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 1.72 | 15 | 0.67 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 17.8 | 1 -     |
| Potassium (K)             | 0.34 | 3  | 0.01 | Iron (Fe)                    | 96.8 | 1 -     |
| Sodium (Na)               | 0.01 | 2  | 0.00 | Copper (Cu)                  | 17.6 | 1 -     |
| Chlorine (Cl)             | 0.03 | 2  | 0.00 | Zinc (Zn)                    | 29.0 | 1 -     |
| Sulfur (S)                | 0.14 | 1  | -    | Selenium (Se)                | 0.06 | 1 -     |
| Magnesium (Mg)            | 0.13 | 1  | -    |                              |      |         |
| Total Calcium (Ca)        | 0.04 | 7  | 0.01 |                              |      |         |
| Total Phosphorus (P)      | 0.29 | 7  | 0.11 |                              |      |         |
| Phytate P                 | 0.21 | 76 | -    |                              |      |         |
| Available P (Pav)         | 0.08 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.11 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 38.0 |    |      |                              |      |         |
| Std. Dig. P Swine         | 0.11 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Millet, Grain**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 11.6  | 100   | 10.6             | 91.0  | 10.4             | 89.1  |
| Lysine, %                            | 0.35  | 3.01  | 0.31             | 89.7  | 0.28             | 81.2  |
| Methionine, %                        | 0.27  | 2.32  | 0.25             | 93.2  | 0.24             | 88.9  |
| Met + Cys, %                         | 0.56  | 4.82  | 0.51             | 90.6  | 0.49             | 87.6  |
| Threonine, %                         | 0.50  | 4.30  | 0.43             | 85.8  | 0.41             | 81.1  |
| Tryptophan, %                        | 0.17  | 1.46  | 0.16             | 92.9  | 0.15             | 86.1  |
| Arginine, %                          | 0.54  | 4.65  | 0.52             | 97.0  | 0.50             | 92.2  |
| Gly + Ser, %                         | 1.10  | 9.47  | 0.94             | 85.0  |                  |       |
| Valine, %                            | 0.68  | 5.85  | 0.63             | 92.1  | 0.60             | 87.5  |
| Isoleucine, %                        | 0.56  | 4.82  | 0.52             | 92.5  | 0.49             | 87.6  |
| Leucine, %                           | 1.29  | 11.1  | 1.23             | 95.0  | 1.16             | 90.3  |
| Histidine, %                         | 0.32  | 2.75  | 0.31             | 95.7  | 0.30             | 93.9  |
| Phenylalanine, %                     | 0.62  | 5.34  | 0.59             | 94.7  | 0.55             | 89.5  |
| Phe + Tyr, %                         | 0.99  | 8.52  | 0.93             | 94.3  | 0.84             | 84.6  |
| Alanine, %                           | 1.13  | 9.73  | 1.04             | 91.9  | 1.03             | 91.0  |
| Cysteine, %                          | 0.29  | 2.50  | 0.26             | 88.2  | 0.25             | 86.4  |
| Tyrosine, %                          | 0.37  | 3.19  | 0.35             | 93.6  | 0.28             | 76.3  |
| Glycine, %                           | 0.43  | 3.70  | 0.32             | 74.9  | 0.36             | 84.0  |
| Serine, %                            | 0.67  | 5.77  | 0.61             | 91.4  | 0.60             | 90.0  |
| Proline, %                           | 0.97  | 8.35  | 0.74             | 76.0  | 0.92             | 95.0  |
| Glutamine <sup>2</sup> , %           | 1.35  | 11.6  | 1.28             | 94.9  | 1.24             | 92.0  |
| Glutamic Acid <sup>2</sup> , %       | 0.85  | 7.30  | 0.80             | 94.9  | 0.78             | 92.0  |
| Asparagine <sup>2</sup> , %          | 0.41  | 3.52  | 0.37             | 91.1  | 0.35             | 86.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.50  | 4.32  | 0.46             | 91.1  | 0.43             | 86.0  |
| Total Nitrogen (PB/6.25), %          | 1.86  | 16.0  | 1.69             | 91.0  | 1.66             | 89.1  |
| Essential Nitrogen Poultry, %        | 0.94  | 50.4* | 0.86             | 91.8  |                  |       |
| Essential Nitrogen Swine, %          | 0.77  | 41.2* |                  |       | 0.68             | 88.3  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 15           | 20     | 20       |           |           |
| Practical Maximum                                           | 40           | 45     | 45       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 20           | 30     | 40       | 40        | 30        |
| Practical Maximum                                           | 40           | 50     | 60       | 60        | 50        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Oats, Grain**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 89.0 | 40 | 0.49 | Organic Matter (OM)          | 86.4 |         |
| Crude Protein (CP)        | 12.6 | 40 | 2.47 | Coef. Dig. OM Swine          | 63.5 |         |
| Starch                    | 45.9 | 5  | 9.88 | Digestible OM Swine          | 54.9 |         |
| Crude Fiber (CF)          | 3.73 | 31 | 2.94 | Undig. OM Pigs               | 31.5 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 4.55 | 40 0.84 |
| NDF                       | 28.7 | 14 | 3.23 | Coef. Dig. EE Poultry        | 72.0 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 3.28 |         |
| ADF                       | 11.1 | 3  | 7.07 | Coef. Dig. EE Swine          | 80.0 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 3.64 |         |
| N-Free Extract (NFE)      | 65.5 |    |      | Linoleic Acid                | 1.61 | 1 -     |
| Coef. Dig. NFE Poultry    | 81.0 |    |      | Linolenic Acid               | 0.06 | 1 -     |
| Digestible NFE Poultry    | 53.1 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 16.2 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 4117 | 31 | 71   | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2645 |         |
| Metabolizable Energy      | 2976 |    |      | Metabolizable Energy         | 2546 |         |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 1967 |         |
| Net Energy                | 2391 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2933 |         |
| Metabolizable Energy      | 3030 |    |      | Metabolizable Energy         | 2784 |         |
| Net Energy                | 2445 |    |      | Net Energy                   | 2141 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 2.54 | 32 | 0.40 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -    | - -     |
| Potassium (K)             | 0.44 | 2  | 0.03 | Iron (Fe)                    | -    | - -     |
| Sodium (Na)               | 0.01 | 2  | 0.00 | Copper (Cu)                  | -    | - -     |
| Chlorine (Cl)             | 0.10 | 1  | -    | Zinc (Zn)                    | -    | - -     |
| Sulfur (S)                | 0.18 | 1  | -    | Selenium (Se)                | -    | - -     |
| Magnesium (Mg)            | 0.15 | 3  | 0.08 |                              |      |         |
| Total Calcium (Ca)        | 0.07 | 18 | 0.02 |                              |      |         |
| Total Phosphorus (P)      | 0.38 | 10 | 0.13 |                              |      |         |
| Phytate P                 | 0.16 | 1  | -    |                              |      |         |
| Available P (Pav)         | 0.22 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | -    |    |      |                              |      |         |
| Std. Dig. P Poultry       | -    |    |      |                              |      |         |
| Coef. Dig. P Swine        | -    |    |      |                              |      |         |
| Std. Dig. P Swine         | -    |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Oats, Grain**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 12.6  | 100   | 11.1             | 87.9  | 10.1             | 79.7  |
| Lysine, %                            | 0.52  | 4.11  | 0.45             | 86.5  | 0.39             | 75.0  |
| Methionine, %                        | 0.21  | 1.66  | 0.19             | 90.5  | 0.19             | 90.5  |
| Met + Cys, %                         | 0.59  | 4.67  | 0.51             | 86.4  | 0.47             | 79.7  |
| Threonine, %                         | 0.43  | 3.40  | 0.36             | 83.7  | 0.32             | 74.4  |
| Tryptophan, %                        | 0.16  | 1.27  | 0.12             | 75.0  | 0.13             | 81.3  |
| Arginine, %                          | 0.86  | 6.80  | 0.80             | 93.0  | 0.76             | 88.4  |
| Gly + Ser, %                         | 1.24  | 9.81  | 1.01             | 81.5  |                  |       |
| Valine, %                            | 0.66  | 5.22  | 0.57             | 86.4  | 0.53             | 80.3  |
| Isoleucine, %                        | 0.48  | 3.80  | 0.42             | 87.5  | 0.39             | 81.3  |
| Leucine, %                           | 0.93  | 7.36  | 0.82             | 88.2  | 0.76             | 81.7  |
| Histidine, %                         | 0.28  | 2.22  | 0.25             | 89.3  | 0.23             | 82.1  |
| Phenylalanine, %                     | 0.65  | 5.14  | 0.59             | 90.8  | 0.55             | 84.6  |
| Phe + Tyr, %                         | 0.88  | 6.96  | 0.78             | 88.7  | 0.73             | 83.0  |
| Alanine, %                           | 0.60  | 4.75  | 0.50             | 83.3  | 0.41             | 68.3  |
| Cysteine, %                          | 0.38  | 3.01  | 0.32             | 84.2  | 0.28             | 73.7  |
| Tyrosine, %                          | 0.23  | 1.82  | 0.19             | 82.6  | 0.18             | 78.3  |
| Glycine, %                           | 0.63  | 4.98  | 0.51             | 81.0  | 0.43             | 68.3  |
| Serine, %                            | 0.61  | 4.83  | 0.50             | 82.0  | 0.46             | 75.4  |
| Proline, %                           | 0.72  | 5.70  | 0.65             | 90.3  | 0.53             | 73.6  |
| Glutamine <sup>2</sup> , %           | 1.43  | 11.3  | 1.33             | 92.9  | 1.24             | 86.4  |
| Glutamic Acid <sup>2</sup> , %       | 0.90  | 7.11  | 0.84             | 93.5  | 0.77             | 86.0  |
| Asparagine <sup>2</sup> , %          | 0.48  | 3.83  | 0.42             | 86.0  | 0.37             | 76.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.60  | 4.71  | 0.51             | 86.2  | 0.45             | 75.9  |
| Total Nitrogen (PB/6.25), %          | 2.02  | 16.0  | 1.78             | 87.9  | 1.61             | 79.7  |
| Essential Nitrogen Poultry, %        | 1.03  | 50.8* | 0.89             | 86.9  |                  |       |
| Essential Nitrogen Swine, %          | 0.83  | 41.0* |                  |       | 0.68             | 82.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 5                   | 7      | 7           |             |           |
| Practical Maximum                                           | 8                   | 10     | 10          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 5                   | 8      | 10          | 10          | 5         |
| Practical Maximum                                           | 8                   | 12     | 15          | 20          | 10        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Ouricuri (*Syagrus coronata*), Meal**

| Main Components (%)       |      |   |    |                              |       |   |    |
|---------------------------|------|---|----|------------------------------|-------|---|----|
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Dry Matter                | 90.0 | 1 | -  | Organic Matter (OM)          | 83.7  |   |    |
| Crude Protein (CP)        | 23.0 | 1 | -  | Coef. Dig. OM Swine          | -     |   |    |
| Starch                    | -    | - | -  | Digestible OM Swine          | -     |   |    |
| Crude Fiber (CF)          | 17.6 | 1 | -  | Undig. OM Pigs               | -     |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 0.82  | 1 | -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -     |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -     |   |    |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -     |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -     |   |    |
| N-Free Extract (NFE)      | 42.3 |   |    | Linoleic Acid                | -     | - | -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -     | - | -  |
| Digestible NFE Poultry    | -    |   |    |                              |       |   |    |
| Undig. NFE + CF Poultry   | -    |   |    |                              |       |   |    |
|                           |      |   |    |                              |       |   |    |
| Energy (kcal/kg)          |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Gross Energy              | -    | - | -  | <b>Swine</b>                 |       |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 1982  |   |    |
| Metabolizable Energy      | 1431 |   |    | Metabolizable Energy         | 1766  |   |    |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | -     |   |    |
| Net Energy                | -    |   |    | <b>Sows</b>                  |       |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -     |   |    |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -     |   |    |
| Net Energy                | -    |   |    | Net Energy                   | -     |   |    |
|                           |      |   |    |                              |       |   |    |
| Minerals                  |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Ash, %                    | 6.32 | 1 | -  | <b>Trace Minerals, mg/kg</b> |       |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 39.30 | 1 | -  |
| Potassium (K)             | 0.62 | 1 | -  | Iron (Fe)                    | 310.0 | 1 | -  |
| Sodium (Na)               | 0.03 | 1 | -  | Copper (Cu)                  | 15.60 | 1 | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | 68.70 | 1 | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -     | - | -  |
| Magnesium (Mg)            | 0.25 | 1 | -  |                              |       |   |    |
| Total Calcium (Ca)        | 0.10 | 1 | -  |                              |       |   |    |
| Total Phosphorus (P)      | 0.70 | 1 | -  |                              |       |   |    |
| Phytate P                 | 0.47 | 1 | -  |                              |       |   |    |
| Available P (Pav)         | 0.23 |   |    |                              |       |   |    |
| Coef. Dig. P Poultry      | 30.0 |   |    |                              |       |   |    |
| Std. Dig. P Poultry       | 0.21 |   |    |                              |       |   |    |
| Coef. Dig. P Swine        | 34.7 |   |    |                              |       |   |    |
| Std. Dig. P Swine         | 0.24 |   |    |                              |       |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Ouricuri (*Syagrus coronata*), Meal**

| Amino Acid Content and Digestibility |       |      |                  |       |                  |       |
|--------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                      | Total | % CP | Poultry          |       | Swine            |       |
|                                      |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 23.0  | 100  | -                | -     | -                | -     |
| Lysine, %                            | 0.70  | 3.04 | -                | -     | -                | -     |
| Methionine, %                        | 0.36  | 1.57 | -                | -     | -                | -     |
| Met + Cys, %                         | 0.68  | 2.96 | -                | -     | -                | -     |
| Threonine, %                         | 0.59  | 2.57 | -                | -     | -                | -     |
| Tryptophan, %                        | 0.21  | 0.91 | -                | -     | -                | -     |
| Arginine, %                          | 2.71  | 11.8 | -                | -     | -                | -     |
| Gly + Ser, %                         | 1.68  | 7.30 | -                | -     | -                | -     |
| Valine, %                            | 1.06  | 4.61 | -                | -     | -                | -     |
| Isoleucine, %                        | 0.76  | 3.30 | -                | -     | -                | -     |
| Leucine, %                           | 1.30  | 5.65 | -                | -     | -                | -     |
| Histidine, %                         | 0.38  | 1.65 | -                | -     | -                | -     |
| Phenylalanine, %                     | 0.92  | 4.00 | -                | -     | -                | -     |
| Phe + Tyr, %                         | 1.39  | 6.04 | -                | -     | -                | -     |
| Alanine, %                           | -     | -    | -                | -     | -                | -     |
| Cysteine, %                          | 0.32  | 1.39 | -                | -     | -                | -     |
| Tyrosine, %                          | 0.47  | 2.04 | -                | -     | -                | -     |
| Glycine, %                           | -     | -    | -                | -     | -                | -     |
| Serine, %                            | -     | -    | -                | -     | -                | -     |
| Proline, %                           | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %           | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %          | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %          | 3.68  | 16.0 | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %        | -     | -*   | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | -     | -*   | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 2            | 3      | 4        |           |           |
| Practical Maximum                                           | 4            | 6      | 8        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 4      | 5        | 4         | 3         |
| Practical Maximum                                           | 4            | 6      | 8        | 8         | 6         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Pasta/Spaguetti, By-product**

| Main Components (%)       |      |   |      |                              |       |   |      |
|---------------------------|------|---|------|------------------------------|-------|---|------|
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Dry Matter                | 88.6 | 8 | 0.47 | Organic Matter (OM)          | 87.7  |   |      |
| Crude Protein (CP)        | 11.7 | 8 | 0.83 | Coef. Dig. OM Swine          | 95.5  |   |      |
| Starch                    | -    | - | -    | Digestible OM Swine          | 83.7  |   |      |
| Crude Fiber (CF)          | 1.75 | 5 | 0.23 | Undig. OM Pigs               | 4.00  |   |      |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 0.81  | 3 | 0.63 |
| NDF                       | 1.07 | 3 | 0.24 | Coef. Dig. EE Poultry        | 87.0  |   |      |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 0.70  |   |      |
| ADF                       | 0.62 | 3 | 0.04 | Coef. Dig. EE Swine          | -     |   |      |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | -     |   |      |
| N-Free Extract (NFE)      | 73.5 |   |      | Linoleic Acid                | 0.46  | 1 | -    |
| Coef. Dig. NFE Poultry    | 97.5 |   |      | Linolenic Acid               | -     | - | -    |
| Digestible NFE Poultry    | 71.6 |   |      |                              |       |   |      |
| Undig. NFE + CF Poultry   | 3.59 |   |      |                              |       |   |      |
|                           |      |   |      |                              |       |   |      |
| Energy (kcal/kg)          |      |   |      |                              |       |   |      |
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Gross Energy              | 3860 | 3 | 70   | <b>Swine</b>                 |       |   |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3685  |   |      |
| Metabolizable Energy      | 3494 |   |      | Metabolizable Energy         | 3538  |   |      |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 2495  |   |      |
| Net Energy                | 2782 |   |      | <b>Sows</b>                  |       |   |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3725  |   |      |
| Metabolizable Energy      | 3510 |   |      | Metabolizable Energy         | 3568  |   |      |
| Net Energy                | 2798 |   |      | Net Energy                   | 2517  |   |      |
|                           |      |   |      |                              |       |   |      |
| Minerals                  |      |   |      |                              |       |   |      |
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Ash, %                    | 0.85 | 5 | 0.27 | <b>Trace Minerals, mg/kg</b> |       |   |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 9.4   | 1 | -    |
| Potassium (K)             | 0.18 | 1 | -    | Iron (Fe)                    | 195.8 | 1 | -    |
| Sodium (Na)               | 0.01 | 1 | -    | Copper (Cu)                  | 3.4   | 1 | -    |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | 35.6  | 1 | -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -     | - | -    |
| Magnesium (Mg)            | 0.05 | 1 | -    |                              |       |   |      |
| Total Calcium (Ca)        | 0.08 | 3 | 0.00 |                              |       |   |      |
| Total Phosphorus (P)      | 0.18 | 3 | 0.08 |                              |       |   |      |
| Phytate P                 | 0.09 | 1 | -    |                              |       |   |      |
| Available P (Pav)         | 0.09 |   |      |                              |       |   |      |
| Coef. Dig. P Poultry      | 28.0 |   |      |                              |       |   |      |
| Std. Dig. P Poultry       | 0.05 |   |      |                              |       |   |      |
| Coef. Dig. P Swine        | 28.0 |   |      |                              |       |   |      |
| Std. Dig. P Swine         | 0.05 |   |      |                              |       |   |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Pasta/Spaguetti, By-product**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 11.7  | 100   | 10.9             | 93.1  | 10.4             | 88.7  |
| Lysine, %                            | 0.23  | 1.97  | 0.21             | 89.9  | 0.19             | 83.6  |
| Methionine, %                        | 0.18  | 1.54  | 0.17             | 92.8  | 0.17             | 92.7  |
| Met + Cys, %                         | 0.45  | 3.85  | 0.42             | 93.2  | 0.41             | 90.9  |
| Threonine, %                         | 0.32  | 2.74  | 0.25             | 77.7  | 0.27             | 82.9  |
| Tryptophan, %                        | 0.13  | 1.11  | 0.12             | 92.3  | -                | -     |
| Arginine, %                          | 0.45  | 3.85  | 0.42             | 94.3  | 0.42             | 92.6  |
| Gly + Ser, %                         | 0.94  | 8.04  | 0.84             | 89.5  |                  |       |
| Valine, %                            | 0.46  | 3.94  | 0.41             | 89.5  | 0.41             | 88.2  |
| Isoleucine, %                        | 0.39  | 3.34  | 0.36             | 93.5  | 0.35             | 90.3  |
| Leucine, %                           | 0.79  | 6.76  | 0.74             | 93.2  | 0.73             | 92.0  |
| Histidine, %                         | 0.25  | 2.14  | 0.23             | 92.7  | 0.23             | 92.6  |
| Phenylalanine, %                     | 0.54  | 4.62  | 0.52             | 96.0  | 0.49             | 91.3  |
| Phe + Tyr, %                         | 0.84  | 7.19  | 0.80             | 95.4  | -                | -     |
| Alanine, %                           | 0.36  | 3.08  | 0.32             | 89.2  | 0.29             | 81.1  |
| Cysteine, %                          | 0.27  | 2.31  | 0.25             | 93.5  | 0.24             | 89.7  |
| Tyrosine, %                          | 0.30  | 2.57  | 0.28             | 94.4  | -                | -     |
| Glycine, %                           | 0.40  | 3.42  | 0.38             | 94.8  | 0.36             | 89.2  |
| Serine, %                            | 0.54  | 4.62  | 0.46             | 85.5  | 0.49             | 90.8  |
| Proline, %                           | 1.34  | 11.5  | 1.22             | 91.2  | 1.27             | 95.0  |
| Glutamine <sup>2</sup> , %           | 1.55  | 13.2  | 1.51             | 97.7  | 1.50             | 96.7  |
| Glutamic Acid <sup>2</sup> , %       | 2.06  | 17.7  | 2.02             | 97.7  | 1.99             | 96.7  |
| Asparagine <sup>2</sup> , %          | 0.22  | 1.89  | 0.18             | 83.6  | 0.18             | 82.2  |
| Aspartic Acid <sup>2</sup> , %       | 0.25  | 2.13  | 0.21             | 83.6  | 0.20             | 82.2  |
| Total Nitrogen (PB/6.25), %          | 1.87  | 16.0  | 1.74             | 93.1  | 1.66             | 88.7  |
| Essential Nitrogen Poultry, %        | 0.70  | 37.6* | 0.64             | 91.2  |                  |       |
| Essential Nitrogen Swine, %          | 0.56  | 29.7* |                  |       | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 10           | 12     |          | 12        |           |
| Practical                                                   | 15           | 20     |          | 20        |           |
| Maximum                                                     |              |        |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 10           | 15     | 20       | 20        | 20        |
| Practical                                                   | 15           | 25     | 30       | 30        | 30        |
| Maximum                                                     |              |        |          |           |           |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Peanuts, Meal**

| Main Components (%)       |      |   |      |                              |       |        |
|---------------------------|------|---|------|------------------------------|-------|--------|
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Dry Matter                | 89.8 | 8 | 1.39 | Organic Matter (OM)          | 84.0  |        |
| Crude Protein (CP)        | 48.2 | 8 | 4.46 | Coef. Dig. OM Swine          | 80.2  |        |
| Starch                    | 12.3 | 1 | -    | Digestible OM Swine          | 67.4  |        |
| Crude Fiber (CF)          | 6.88 | 5 | 0.87 | Undig. OM Pigs               | 16.6  |        |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 0.91  | 4 0.20 |
| NDF                       | 15.3 | 6 | 0.92 | Coef. Dig. EE Poultry        | 83.0  |        |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 0.76  |        |
| ADF                       | 11.0 | 6 | 1.22 | Coef. Dig. EE Swine          | 55.0  |        |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 0.50  |        |
| N-Free Extract (NFE)      | 28.0 |   |      | Linoleic Acid                | 0.28  | 1 -    |
| Coef. Dig. NFE Poultry    | 31.6 |   |      | Linolenic Acid               | -     | - -    |
| Digestible NFE Poultry    | 8.84 |   |      |                              |       |        |
| Undig. NFE + CF Poultry   | 26.0 |   |      |                              |       |        |
| Energy (kcal/kg)          |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Gross Energy              | 4438 | 6 | 276  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3455  |        |
| Metabolizable Energy      | 2228 |   |      | Metabolizable Energy         | 3155  |        |
| Std. Metab. Energy        | 2394 |   |      | Net Energy                   | 1971  |        |
| Net Energy                | 1718 |   |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3607  |        |
| Metabolizable Energy      | 2306 |   |      | Metabolizable Energy         | 3277  |        |
| Net Energy                | 1796 |   |      | Net Energy                   | 2060  |        |
| Minerals                  |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Ash, %                    | 5.82 | 5 | 0.77 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 37.0  | 1 -    |
| Potassium (K)             | 1.25 | 4 | 0.04 | Iron (Fe)                    | 195.0 | 1 -    |
| Sodium (Na)               | 0.05 | 4 | 0.02 | Copper (Cu)                  | 17.5  | 1 -    |
| Chlorine (Cl)             | 0.05 | 4 | 0.02 | Zinc (Zn)                    | 48.3  | 1 -    |
| Sulfur (S)                | 0.31 | 1 | -    | Selenium (Se)                | 0.25  | 1 -    |
| Magnesium (Mg)            | 0.32 | 2 | 0.01 |                              |       |        |
| Total Calcium (Ca)        | 0.20 | 6 | 0.09 |                              |       |        |
| Total Phosphorus (P)      | 0.63 | 6 | 0.05 |                              |       |        |
| Phytate P                 | 0.42 | 1 | -    |                              |       |        |
| Available P (Pav)         | 0.21 |   |      |                              |       |        |
| Coef. Dig. P Poultry      | -    |   |      |                              |       |        |
| Std. Dig. P Poultry       | -    |   |      |                              |       |        |
| Coef. Dig. P Swine        | -    |   |      |                              |       |        |
| Std. Dig. P Swine         | -    |   |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Peanuts, Meal**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 48.2  | 100.0 | 41.6             | 86.2  | 41.3             | 85.7  |
| Lysine, %                                   | 1.58  | 3.28  | 1.16             | 73.7  | 1.18             | 74.7  |
| Methionine, %                               | 0.52  | 1.08  | 0.43             | 82.0  | 0.42             | 81.2  |
| Met + Cys, %                                | 1.13  | 2.34  | 0.90             | 79.3  | 0.90             | 79.3  |
| Threonine, %                                | 1.27  | 2.63  | 1.00             | 78.7  | 0.99             | 78.1  |
| Tryptophan, %                               | 0.48  | 1.00  | 0.40             | 84.0  | 0.38             | 79.8  |
| Arginine, %                                 | 5.45  | 11.3  | 4.83             | 88.7  | 5.08             | 93.3  |
| Gly + Ser, %                                | 5.01  | 10.4  | 4.10             | 81.9  |                  |       |
| Valine, %                                   | 1.87  | 3.88  | 1.56             | 83.3  | 1.54             | 82.5  |
| Isoleucine, %                               | 1.59  | 3.30  | 1.30             | 81.7  | 1.33             | 83.8  |
| Leucine, %                                  | 2.95  | 6.12  | 2.49             | 84.3  | 2.50             | 84.9  |
| Histidine, %                                | 1.10  | 2.28  | 0.95             | 86.3  | 0.92             | 83.3  |
| Phenylalanine, %                            | 2.30  | 4.77  | 2.02             | 87.7  | 2.06             | 89.6  |
| Phe + Tyr, %                                | 4.01  | 8.32  | 3.57             | 89.1  | 3.63             | 90.6  |
| Alanine, %                                  | 1.89  | 3.92  | 1.68             | 89.0  | 1.59             | 84.0  |
| Cysteine, %                                 | 0.61  | 1.27  | 0.47             | 77.0  | 0.47             | 77.7  |
| Tyrosine, %                                 | 1.71  | 3.55  | 1.56             | 91.0  | 1.57             | 92.0  |
| Glycine, %                                  | 2.78  | 5.77  | 2.14             | 77.0  | 2.11             | 76.0  |
| Serine, %                                   | 2.23  | 4.63  | 1.96             | 88.0  | 1.92             | 86.0  |
| Proline, %                                  | 1.81  | 3.76  | 1.61             | 89.0  | 1.41             | 78.0  |
| Glutamine <sup>2</sup> , %                  | 3.27  | 6.79  | 3.01             | 92.0  | 2.91             | 89.0  |
| Glutamic Acid <sup>2</sup> , %              | 5.14  | 10.7  | 4.73             | 92.0  | 4.57             | 89.0  |
| Asparagine <sup>2</sup> , %                 | 1.98  | 4.12  | 1.69             | 85.0  | 1.73             | 87.0  |
| Aspartic Acid <sup>2</sup> , %              | 2.78  | 5.76  | 2.36             | 85.0  | 2.42             | 87.0  |
| Total Nitrogen (PB/6.25), %                 | 7.71  | 16.0  | 6.65             | 86.2  | 6.61             | 85.7  |
| Essential Nitrogen Poultry, %               | 4.34  | 56.2* | 3.64             | 83.9  |                  |       |
| Essential Nitrogen Swine, %                 | 3.52  | 45.7* |                  |       | 3.03             | 85.9  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 3                   | 5      | 5           |             |           |
| <b>Practical</b>                                                   |                     |        |             |             |           |
| <b>Maximum</b>                                                     | 7                   | 10     | 10          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 4                   | 6      | 6           | 6           | 6         |
| <b>Practical</b>                                                   |                     |        |             |             |           |
| <b>Maximum</b>                                                     | 7                   | 10     | 10          | 10          | 10        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Pork Meat and Bone, Meal**

| Main Components (%)       |      |     |      |                              |       |          |
|---------------------------|------|-----|------|------------------------------|-------|----------|
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Dry Matter                | 96.1 | 444 | 0.84 | Organic Matter (OM)          | 70.5  |          |
| Crude Protein (CP)        | 52.5 | 444 | 1.93 | Coef. Dig. OM Swine          | 72.7  |          |
| Starch                    | -    | -   | -    | Digestible OM Swine          | 51.2  |          |
| Crude Fiber (CF)          | -    | -   | -    | Undig. OM Pigs               | 19.3  |          |
| Coef. Dig. CF Swine       | -    | -   | -    | Ether Extract (EE)           | 14.1  | 440 1.35 |
| NDF                       | -    | -   | -    | Coef. Dig. EE Poultry        | 62.5  |          |
| Coef. Dig. NDF Swine      | -    | -   | -    | Digestible EE Poultry        | 8.22  |          |
| ADF                       | -    | -   | -    | Coef. Dig. EE Swine          | 60.5  |          |
| Coef. Dig. ADF Swine      | -    | -   | -    | Digestible EE Swine          | 8.54  |          |
| N-Free Extract (NFE)      | 3.92 |     |      | Linoleic Acid                | 1.42  | 1 -      |
| Coef. Dig. NFE Poultry    | -    |     |      | Linolenic Acid               | 0.14  | 1 -      |
| Digestible NFE Poultry    | -    |     |      |                              |       |          |
| Undig. NFE + CF Poultry   | -    |     |      |                              |       |          |
| Energy (kcal/kg)          |      |     |      |                              |       |          |
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Gross Energy              | 4127 | 9   | 76   | <b>Swine</b>                 |       |          |
| <b>Poultry</b>            |      |     |      | Digestible Energy            | 2999  |          |
| Metabolizable Energy      | 2784 |     |      | Metabolizable Energy         | 2780  |          |
| Std. Metab. Energy        | -    |     |      | Net Energy                   | 1862  |          |
| Net Energy                | 2231 |     |      | <b>Sows</b>                  |       |          |
| <b>Hens</b>               |      |     |      | Digestible Energy            | 2999  |          |
| Metabolizable Energy      | 2784 |     |      | Metabolizable Energy         | 2780  |          |
| Net Energy                | 2231 |     |      | Net Energy                   | 1862  |          |
| Minerals                  |      |     |      |                              |       |          |
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Ash, %                    | 25.7 | 438 | 2.51 | <b>Trace Minerals, mg/kg</b> |       |          |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)               | 23.9  | 1 -      |
| Potassium (K)             | -    | -   | -    | Iron (Fe)                    | 655.0 | 1 -      |
| Sodium (Na)               | -    | -   | -    | Copper (Cu)                  | 16.7  | 1 -      |
| Chlorine (Cl)             | -    | -   | -    | Zinc (Zn)                    | 115.0 | 1 -      |
| Sulfur (S)                | -    | -   | -    | Selenium (Se)                | -     | - -      |
| Magnesium (Mg)            | 0.15 | 1   | -    |                              |       |          |
| Total Calcium (Ca)        | 7.85 | 437 | 1.12 |                              |       |          |
| Total Phosphorus (P)      | 4.08 | 437 | 0.46 |                              |       |          |
| Phytate P                 | -    | -   | -    |                              |       |          |
| Available P (Pav)         | 3.67 |     |      |                              |       |          |
| Coef. Dig. P Poultry      | 62.0 |     |      |                              |       |          |
| Std. Dig. P Poultry       | 2.53 |     |      |                              |       |          |
| Coef. Dig. P Swine        | 64.0 |     |      |                              |       |          |
| Std. Dig. P Swine         | 2.61 |     |      |                              |       |          |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Pork Meat and Bone, Meal**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 52.5  | 100   | 45.5             | 86.8  | 39.9             | 76.0  |
| Lysine, %                            | 2.65  | 5.05  | 2.31             | 87.4  | 2.01             | 75.9  |
| Methionine, %                        | 0.85  | 1.61  | 0.75             | 88.4  | 0.69             | 82.0  |
| Met + Cys, %                         | 1.29  | 2.46  | 1.10             | 85.9  | 1.03             | 80.4  |
| Threonine, %                         | 1.77  | 3.37  | 1.50             | 85.1  | 1.46             | 82.4  |
| Tryptophan, %                        | 0.33  | 0.63  | 0.28             | 86.0  | 0.26             | 78.0  |
| Arginine, %                          | 3.48  | 6.64  | 3.18             | 91.2  | 2.87             | 82.5  |
| Gly + Ser, %                         | 8.40  | 16.0  | 7.25             | 86.3  |                  |       |
| Valine, %                            | 2.16  | 4.12  | 1.91             | 88.4  | 1.77             | 81.8  |
| Isoleucine, %                        | 1.52  | 2.91  | 1.35             | 88.5  | 1.26             | 82.4  |
| Leucine, %                           | 3.21  | 6.13  | 2.90             | 90.2  | 2.65             | 82.5  |
| Histidine, %                         | 0.99  | 1.88  | 0.87             | 87.6  | 0.52             | 52.2  |
| Phenylalanine, %                     | 1.78  | 3.39  | 1.61             | 90.3  | 1.45             | 81.6  |
| Phe + Tyr, %                         | 2.93  | 5.59  | 2.64             | 90.0  | 2.39             | 81.5  |
| Alanine, %                           | 3.52  | 6.71  | 3.07             | 87.2  | 2.68             | 76.0  |
| Cysteine, %                          | 0.44  | 0.84  | 0.36             | 81.8  | 0.34             | 78.0  |
| Tyrosine, %                          | 1.15  | 2.18  | 1.03             | 89.9  | 0.93             | 81.6  |
| Glycine, %                           | 6.11  | 11.7  | 5.23             | 85.6  | 4.67             | 76.4  |
| Serine, %                            | 2.29  | 4.37  | 2.02             | 88.2  | 1.78             | 77.6  |
| Proline, %                           | 4.02  | 7.66  | 3.33             | 82.9  | 2.66             | 66.1  |
| Glutamine <sup>2</sup> , %           | 2.56  | 4.88  | 2.22             | 86.7  | 1.94             | 75.7  |
| Glutamic Acid <sup>2</sup> , %       | 3.69  | 7.03  | 3.20             | 86.7  | 2.79             | 75.7  |
| Asparagine <sup>2</sup> , %          | 1.64  | 3.13  | 1.33             | 81.1  | 1.07             | 65.2  |
| Aspartic Acid <sup>2</sup> , %       | 2.28  | 4.35  | 1.85             | 81.1  | 1.49             | 65.2  |
| Total Nitrogen (PB/6.25), %          | 8.39  | 16.0  | 7.28             | 86.8  | 6.38             | 76.0  |
| Essential Nitrogen Poultry, %        | 4.59  | 54.7* | 4.04             | 88.1  |                  |       |
| Essential Nitrogen Swine, %          | 3.14  | 37.4* |                  |       | 2.50             | 89.7  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 5                   | 5      | 5           |             |           |
| <b>Practical Maximum</b>                                    | 8                   | 10     | 10          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 4                   | 4      | 4           | 4           | 4         |
| <b>Practical Maximum</b>                                    | 6                   | 7      | 8           | 8           | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry, By-product Meal**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 93.6 | 10 | 1.67 | Organic Matter (OM)          | 77.1  |         |
| Crude Protein (CP)        | 57.4 | 10 | 1.06 | Coef. Dig. OM Swine          | 78.8  |         |
| Starch                    | -    | -  | -    | Digestible OM Swine          | 60.8  |         |
| Crude Fiber (CF)          | -    | -  | -    | Undig. OM Pigs               | 16.4  |         |
| Coef. Dig. CF Swine       | -    | -  | -    | Ether Extract (EE)           | 14.0  | 10 1.63 |
| NDF                       | -    | -  | -    | Coef. Dig. EE Poultry        | 91.0  |         |
| Coef. Dig. NDF Swine      | -    | -  | -    | Digestible EE Poultry        | 12.7  |         |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 89.0  |         |
| Coef. Dig. ADF Swine      | -    | -  | -    | Digestible EE Swine          | 12.4  |         |
| N-Free Extract (NFE)      | 5.72 |    |      | Linoleic Acid                | 2.93  | 1 -     |
| Coef. Dig. NFE Poultry    | -    | -  | -    | Linolenic Acid               | 0.18  | 1 -     |
| Digestible NFE Poultry    | -    | -  | -    |                              |       |         |
| Undig. NFE + CF Poultry   | -    | -  | -    |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 4957 | 3  | 193  | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3905  |         |
| Metabolizable Energy      | 3294 |    |      | Metabolizable Energy         | 3566  |         |
| Std. Metab. Energy        | 3421 |    |      | Net Energy                   | 2402  |         |
| Net Energy                | 2689 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3905  |         |
| Metabolizable Energy      | 3294 |    |      | Metabolizable Energy         | 3566  |         |
| Net Energy                | 2689 |    |      | Net Energy                   | 2402  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 16.5 | 10 | 2.96 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 2.10  | 1 -     |
| Potassium (K)             | 0.50 | 3  | 0.02 | Iron (Fe)                    | 177.0 | 1 -     |
| Sodium (Na)               | 0.36 | 3  | 0.03 | Copper (Cu)                  | 19.3  | 1 -     |
| Chlorine (Cl)             | 0.51 | 1  | -    | Zinc (Zn)                    | 80.4  | 1 -     |
| Sulfur (S)                | 0.55 | 1  | -    | Selenium (Se)                | 0.52  | 1 -     |
| Magnesium (Mg)            | 0.08 | 3  | 0.07 |                              |       |         |
| Total Calcium (Ca)        | 4.01 | 6  | 0.82 |                              |       |         |
| Total Phosphorus (P)      | 2.72 | 6  | 0.74 |                              |       |         |
| Phytate P                 | -    | -  | -    |                              |       |         |
| Available P (Pav)         | 2.72 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 53.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 1.44 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 53.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 1.44 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry, By-product Meal**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 57.4  | 100   | 47.1             | 82.0  | 46.5             | 81.0  |
| Lysine, %                                   | 3.33  | 5.80  | 2.66             | 80.0  | 2.48             | 74.5  |
| Methionine, %                               | 1.10  | 1.92  | 0.92             | 83.9  | 0.87             | 78.7  |
| Met + Cys, %                                | 1.95  | 3.40  | 1.54             | 79.2  | 1.44             | 73.6  |
| Threonine, %                                | 2.36  | 4.11  | 1.85             | 78.4  | 1.82             | 77.3  |
| Tryptophan, %                               | 0.54  | 0.94  | 0.42             | 78.3  | 0.41             | 76.6  |
| Arginine, %                                 | 4.09  | 7.12  | 3.60             | 87.9  | 3.50             | 85.5  |
| Gly + Ser, %                                | 8.41  | 14.6  | 6.23             | 74.1  |                  |       |
| Valine, %                                   | 2.93  | 5.10  | 2.41             | 82.2  | 2.09             | 71.2  |
| Isoleucine, %                               | 2.31  | 4.02  | 1.93             | 83.5  | 1.76             | 76.2  |
| Leucine, %                                  | 4.10  | 7.14  | 3.40             | 82.9  | 3.12             | 76.2  |
| Histidine, %                                | 1.10  | 1.92  | 0.78             | 71.0  | 0.87             | 79.5  |
| Phenylalanine, %                            | 2.39  | 4.16  | 2.03             | 84.9  | 1.85             | 77.2  |
| Phe + Tyr, %                                | 3.99  | 6.95  | 3.38             | 84.8  | 3.06             | 76.6  |
| Alanine, %                                  | 3.74  | 6.51  | 2.78             | 74.4  | 3.03             | 81.0  |
| Cysteine, %                                 | 0.85  | 1.48  | 0.62             | 73.1  | 0.57             | 66.9  |
| Tyrosine, %                                 | 1.60  | 2.79  | 1.36             | 84.7  | 1.21             | 75.8  |
| Glycine, %                                  | 5.46  | 9.51  | 4.02             | 73.7  | 4.31             | 79.0  |
| Serine, %                                   | 2.95  | 5.14  | 2.21             | 74.9  | 2.24             | 76.0  |
| Proline, %                                  | 3.52  | 6.13  | 2.75             | 78.0  | 2.85             | 81.0  |
| Glutamine <sup>2</sup> , %                  | 2.74  | 4.77  | 2.13             | 77.6  | 2.14             | 78.0  |
| Glutamic Acid <sup>2</sup> , %              | 3.77  | 6.56  | 2.92             | 77.6  | 2.94             | 78.0  |
| Asparagine <sup>2</sup> , %                 | 1.74  | 3.04  | 1.16             | 66.7  | 1.10             | 63.0  |
| Aspartic Acid <sup>2</sup> , %              | 2.64  | 4.59  | 1.76             | 66.7  | 1.66             | 63.0  |
| Total Nitrogen (PB/6.25), %                 | 9.19  | 16.0  | 7.54             | 82.0  | 7.44             | 81.0  |
| Essential Nitrogen Poultry, %               | 5.36  | 58.3* | 4.30             | 80.3  |                  |       |
| Essential Nitrogen Swine, %                 | 3.94  | 42.9* |                  |       | 3.05             | 77.4  |

<sup>1</sup>Div = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 3                   | 3      | 3           |             |           |
| <b>Practical Maximum</b>                                           | 7                   | 8      | 8           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 3                   | 4      | 4           | 4           | 4         |
| <b>Practical Maximum</b>                                           | 5                   | 7      | 8           | 8           | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry, By-product High-fat Meal**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 94.6 | 3 | 1.58 | Organic Matter (OM)          | 82.1 |        |
| Crude Protein (CP)        | 55.6 | 3 | 0.33 | Coef. Dig. OM Swine          | 78.9 |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 64.7 |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 17.3 |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 21.0 | 3 2.51 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | 90.2 |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | 18.9 |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 90.0 |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 18.9 |        |
| N-Free Extract (NFE)      | 5.48 |   |      | Linoleic Acid                | 4.26 | 1 -    |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | 0.27 | 1 -    |
| Digestible NFE Poultry    | -    | - | -    |                              |      |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 5343 | 1 | -    | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 4215 |        |
| Metabolizable Energy      | 3682 |   |      | Metabolizable Energy         | 3905 |        |
| Std. Metab. Energy        | 3850 |   |      | Net Energy                   | 2753 |        |
| Net Energy                | 3055 |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 4215 |        |
| Metabolizable Energy      | 3682 |   |      | Metabolizable Energy         | 3905 |        |
| Net Energy                | 3011 |   |      | Net Energy                   | 2753 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 12.6 | 3 | 0.97 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.47 | 2 | 0.09 | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.41 | 2 | 0.15 | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.51 | 1 | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.06 | 1 | -    |                              |      |        |
| Total Calcium (Ca)        | 3.58 | 2 | 0.68 |                              |      |        |
| Total Phosphorus (P)      | 2.19 | 2 | 0.25 |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | 2.19 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | 53.0 |   |      |                              |      |        |
| Std. Dig. P Poultry       | 1.16 |   |      |                              |      |        |
| Coef. Dig. P Swine        | 53.0 |   |      |                              |      |        |
| Std. Dig. P Swine         | 1.16 |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry, By-product High-fat Meal**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 55.6                                 | 100   | 43.7             | 78.5  | 42.8             | 76.8  |
| Lysine, %                      | 3.09                                 | 5.55  | 2.47             | 80.0  | 2.30             | 74.5  |
| Methionine, %                  | 1.06                                 | 1.90  | 0.89             | 83.9  | 0.83             | 78.7  |
| Met + Cys, %                   | 1.84                                 | 3.31  | 1.46             | 79.3  | 1.36             | 73.7  |
| Threonine, %                   | 2.16                                 | 3.88  | 1.69             | 78.4  | 1.67             | 77.3  |
| Tryptophan, %                  | 0.52                                 | 0.93  | 0.41             | 78.3  | 0.40             | 76.6  |
| Arginine, %                    | 3.90                                 | 7.01  | 3.43             | 87.9  | 3.33             | 85.5  |
| Gly + Ser, %                   | 7.75                                 | 13.9  | 5.74             | 74.1  |                  |       |
| Valine, %                      | 2.67                                 | 4.80  | 2.19             | 82.2  | 1.90             | 71.2  |
| Isoleucine, %                  | 2.07                                 | 3.72  | 1.73             | 83.5  | 1.58             | 76.2  |
| Leucine, %                     | 3.89                                 | 6.99  | 3.22             | 82.9  | 2.96             | 76.2  |
| Histidine, %                   | 1.07                                 | 1.92  | 0.76             | 71.0  | 0.85             | 79.5  |
| Phenylalanine, %               | 2.24                                 | 4.03  | 1.90             | 84.9  | 1.73             | 77.2  |
| Phe + Tyr, %                   | 3.71                                 | 6.67  | 3.15             | 84.8  | 2.84             | 76.6  |
| Alanine, %                     | 3.24                                 | 5.82  | 2.41             | 74.4  | 2.62             | 81.0  |
| Cysteine, %                    | 0.78                                 | 1.40  | 0.57             | 73.1  | 0.52             | 66.9  |
| Tyrosine, %                    | 1.47                                 | 2.64  | 1.25             | 84.7  | 1.11             | 75.8  |
| Glycine, %                     | 5.33                                 | 9.58  | 3.93             | 73.7  | 4.21             | 79.0  |
| Serine, %                      | 2.42                                 | 4.35  | 1.81             | 74.9  | 1.84             | 76.0  |
| Proline, %                     | 3.38                                 | 6.07  | 2.64             | 78.0  | 2.74             | 81.0  |
| Glutamine <sup>2</sup> , %     | 2.33                                 | 4.19  | 1.81             | 77.6  | 1.82             | 78.0  |
| Glutamic Acid <sup>2</sup> , % | 3.21                                 | 5.76  | 2.49             | 77.6  | 2.50             | 78.0  |
| Asparagine <sup>2</sup> , %    | 1.41                                 | 2.54  | 0.94             | 66.7  | 0.89             | 63.0  |
| Aspartic Acid <sup>2</sup> , % | 2.14                                 | 3.84  | 1.42             | 66.7  | 1.35             | 63.0  |
| Total Nitrogen (PB/6.25), %    | 8.90                                 | 16.0  | 6.99             | 78.5  | 6.84             | 76.8  |
| Essential Nitrogen Poultry, %  | 5.02                                 | 56.4* | 4.04             | 80.3  |                  |       |
| Essential Nitrogen Swine, %    | 3.71                                 | 41.6* |                  |       | 2.87             | 77.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |          |             |           |
|-------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                             | Starter             | Grower |          |             |           |
|                                                             | 3                   | 3      |          | 3           |           |
| <b>Practical Maximum</b>                                    | 7                   | 8      |          | 8           |           |
|                                                             | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                             | 3                   | 4      | 4        | 4           | 4         |
| <b>Practical Maximum</b>                                    | 5                   | 7      | 8        | 8           | 8         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry, Fat**

| Main Components (%)       |      |    |     |                              |      |      |
|---------------------------|------|----|-----|------------------------------|------|------|
|                           | Mean | n  | SD  |                              | Mean | n SD |
| Dry Matter                | 99.6 | 1  | -   | Organic Matter (OM)          | 99.6 |      |
| Crude Protein (CP)        | -    | -  | -   | Coef. Dig. OM Swine          | 91.3 |      |
| Starch                    | -    | -  | -   | Digestible OM Swine          | 91.0 |      |
| Crude Fiber (CF)          | -    | -  | -   | Undig. OM Pigs               | 8.64 |      |
| Coef. Dig. CF Swine       | -    | -  | -   | Ether Extract (EE)           | 99.6 | 1 -  |
| NDF                       | -    | -  | -   | Coef. Dig. EE Poultry        | 93.9 |      |
| Coef. Dig. NDF Swine      | -    | -  | -   | Digestible EE Poultry        | 93.5 |      |
| ADF                       | -    | -  | -   | Coef. Dig. EE Swine          | 85.5 |      |
| Coef. Dig. ADF Swine      | -    | -  | -   | Digestible EE Swine          | 85.2 |      |
| N-Free Extract (NFE)      | -    | -  | -   | Linoleic Acid                | 20.5 | 1 -  |
| Coef. Dig. NFE Poultry    | -    | -  | -   | Linolenic Acid               | 1.29 | 1 -  |
| Digestible NFE Poultry    | -    | -  | -   |                              |      |      |
| Undig. NFE + CF Poultry   | -    | -  | -   |                              |      |      |
| Energy (kcal/kg)          |      |    |     |                              |      |      |
|                           | Mean | n  | SD  |                              | Mean | n SD |
| Gross Energy              | 9373 | 56 | 114 | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |    |     | Digestible Energy            | 8560 |      |
| Metabolizable Energy      | 8681 |    |     | Metabolizable Energy         | 8228 |      |
| Std. Metab. Energy        | 9159 |    |     | Net Energy                   | 7311 |      |
| Net Energy                | 7812 |    |     | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |    |     | Digestible Energy            | 8560 |      |
| Metabolizable Energy      | 8681 |    |     | Metabolizable Energy         | 8228 |      |
| Net Energy                | 7812 |    |     | Net Energy                   | 7311 |      |
| Minerals                  |      |    |     |                              |      |      |
|                           | Mean | n  | SD  |                              | Mean | n SD |
| Ash, %                    | -    | -  | -   | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |    |     | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | -  | -   | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | -  | -   | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | -  | -   | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | -  | -   | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | -  | -   |                              |      |      |
| Total Calcium (Ca)        | -    | -  | -   |                              |      |      |
| Total Phosphorus (P)      | -    | -  | -   |                              |      |      |
| Phytate P                 | -    | -  | -   |                              |      |      |
| Available P (Pav)         | -    | -  | -   |                              |      |      |
| Coef. Dig. P Poultry      | -    | -  | -   |                              |      |      |
| Std. Dig. P Poultry       | -    | -  | -   |                              |      |      |
| Coef. Dig. P Swine        | -    | -  | -   |                              |      |      |
| Std. Dig. P Swine         | -    | -  | -   |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry, Fat**

| Amino Acid Content and Digestibility |       |      |                  |       |                  |       |
|--------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                      | Total | % CP | Poultry          |       | Swine            |       |
|                                      |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | -     | -    | -                | -     | -                | -     |
| Lysine, %                            | -     | -    | -                | -     | -                | -     |
| Methionine, %                        | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                         | -     | -    | -                | -     | -                | -     |
| Threonine, %                         | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                        | -     | -    | -                | -     | -                | -     |
| Arginine, %                          | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                         | -     | -    | -                | -     | -                | -     |
| Valine, %                            | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                        | -     | -    | -                | -     | -                | -     |
| Leucine, %                           | -     | -    | -                | -     | -                | -     |
| Histidine, %                         | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                     | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                         | -     | -    | -                | -     | -                | -     |
| Alanine, %                           | -     | -    | -                | -     | -                | -     |
| Cysteine, %                          | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                          | -     | -    | -                | -     | -                | -     |
| Glycine, %                           | -     | -    | -                | -     | -                | -     |
| Serine, %                            | -     | -    | -                | -     | -                | -     |
| Proline, %                           | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %           | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %          | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %          | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %        | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 3      |          | 3         |           |
|                                                             | 6            | 7      |          | 7         |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 2      | 2        | 0         | 2         |
|                                                             | 5            | 5      | 5        | 4         | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry Feather and By-product, Meal**

| Main Components (%)       |      |   |      |                              |       |        |
|---------------------------|------|---|------|------------------------------|-------|--------|
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Dry Matter                | 90.8 | 4 | 1.27 | Organic Matter (OM)          | 85.1  |        |
| Crude Protein (CP)        | 66.6 | 4 | 3.32 | Coef. Dig. OM Swine          | 68.4  |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 58.1  |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 26.9  |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 14.3  | 3 0.61 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | 77.5  |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | 11.1  |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 75.0  |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 10.7  |        |
| N-Free Extract (NFE)      | 4.15 |   |      | Linoleic Acid                | 2.00  | 1 -    |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | 0.23  | 1 -    |
| Digestible NFE Poultry    | -    | - | -    |                              |       |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |       |        |
| Energy (kcal/kg)          |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Gross Energy              | 5219 | 3 | 24   | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3568  |        |
| Metabolizable Energy      | 3264 |   |      | Metabolizable Energy         | 3263  |        |
| Std. Metab. Energy        | 3482 |   |      | Net Energy                   | 2123  |        |
| Net Energy                | 2624 |   |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3568  |        |
| Metabolizable Energy      | 3264 |   |      | Metabolizable Energy         | 3263  |        |
| Net Energy                | 2624 |   |      | Net Energy                   | 2123  |        |
| Minerals                  |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Ash, %                    | 5.75 | 4 | 1.17 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 6.80  | 1 -    |
| Potassium (K)             | 0.33 | 1 | -    | Iron (Fe)                    | 221.1 | 1 -    |
| Sodium (Na)               | 0.34 | 1 | -    | Copper (Cu)                  | 9.50  | 1 -    |
| Chlorine (Cl)             | 0.34 | - | -    | Zinc (Zn)                    | 95.2  | 1 -    |
| Sulfur (S)                | 0.52 | 1 | -    | Selenium (Se)                | 0.61  | 1 -    |
| Magnesium (Mg)            | 0.13 | 1 | -    |                              |       |        |
| Total Calcium (Ca)        | 2.47 | 3 | 0.13 |                              |       |        |
| Total Phosphorus (P)      | 1.15 | 3 | 0.38 |                              |       |        |
| Phytate P                 | -    | - | -    |                              |       |        |
| Available P (Pav)         | 1.15 |   |      |                              |       |        |
| Coef. Dig. P Poultry      | 53.0 |   |      |                              |       |        |
| Std. Dig. P Poultry       | 0.61 |   |      |                              |       |        |
| Coef. Dig. P Swine        | 53.0 |   |      |                              |       |        |
| Std. Dig. P Swine         | 0.61 |   |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Poultry Feather and By-product, Meal**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 66.6                                 | 100   | 51.9             | 77.9  | 51.2             | 76.8  |
| Lysine, %                      | 2.84                                 | 4.26  | 2.04             | 71.9  | 2.14             | 75.2  |
| Methionine, %                  | 0.89                                 | 1.34  | 0.72             | 81.2  | 0.69             | 77.2  |
| Met + Cys, %                   | 2.80                                 | 4.20  | 1.98             | 70.8  | 1.95             | 69.8  |
| Threonine, %                   | 2.81                                 | 4.22  | 2.19             | 78.1  | 2.19             | 77.9  |
| Tryptophan, %                  | 0.56                                 | 0.84  | 0.46             | 82.2  | 0.42             | 74.7  |
| Arginine, %                    | 4.47                                 | 6.71  | 3.61             | 80.7  | 3.87             | 86.5  |
| Gly + Ser, %                   | 10.1                                 | 15.2  | 7.74             | 76.5  |                  |       |
| Valine, %                      | 3.86                                 | 5.80  | 3.02             | 78.2  | 2.86             | 74.0  |
| Isoleucine, %                  | 2.82                                 | 4.23  | 2.34             | 82.9  | 2.21             | 78.3  |
| Leucine, %                     | 4.98                                 | 7.48  | 3.83             | 76.9  | 3.85             | 77.4  |
| Histidine, %                   | 1.18                                 | 1.77  | 0.86             | 72.9  | 0.91             | 77.5  |
| Phenylalanine, %               | 2.93                                 | 4.40  | 2.42             | 82.6  | 2.32             | 79.2  |
| Phe + Tyr, %                   | 4.75                                 | 7.13  | 3.88             | 81.7  | 3.69             | 77.6  |
| Alanine, %                     | 3.73                                 | 5.60  | 2.86             | 76.7  | 2.99             | 80.2  |
| Cysteine, %                    | 1.91                                 | 2.87  | 1.26             | 65.9  | 1.26             | 66.1  |
| Tyrosine, %                    | 1.82                                 | 2.73  | 1.46             | 80.3  | 1.36             | 74.9  |
| Glycine, %                     | 5.73                                 | 8.60  | 4.33             | 75.5  | 4.57             | 79.8  |
| Serine, %                      | 4.37                                 | 6.56  | 3.41             | 78.1  | 3.43             | 78.4  |
| Proline, %                     | 5.02                                 | 7.54  | 4.18             | 83.3  | 3.99             | 79.4  |
| Glutamine <sup>2</sup> , %     | 2.82                                 | 4.23  | 2.32             | 82.4  | 2.14             | 76.0  |
| Glutamic Acid <sup>2</sup> , % | 4.28                                 | 6.43  | 3.53             | 82.4  | 3.26             | 76.0  |
| Asparagine <sup>2</sup> , %    | 1.78                                 | 2.68  | 1.22             | 68.7  | 1.12             | 63.0  |
| Aspartic Acid <sup>2</sup> , % | 2.87                                 | 4.31  | 1.97             | 68.7  | 1.81             | 63.0  |
| Total Nitrogen (PB/6.25), %    | 10.7                                 | 16.0  | 8.30             | 77.9  | 8.19             | 76.8  |
| Essential Nitrogen Poultry, %  | 5.99                                 | 56.2* | 4.67             | 78.1  |                  |       |
| Essential Nitrogen Swine, %    | 4.34                                 | 40.7* |                  |       | 3.40             | 78.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 2            | 2      | 2        |           |           |
| Practical Maximum                                           | 4            | 4      | 4        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 1            | 2      | 2        | 2         | 2         |
| Practical Maximum                                           | 2            | 4      | 5        | 5         | 4         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rice, Bran**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 89.4 | 32 | 1.06 | Organic Matter (OM)          | 80.4  |         |
| Proteína Bruta            | 13.1 | 35 | 0.75 | Coef. Dig. OM Swine          | 72.2  |         |
| Starch                    | 23.8 | 7  | 2.56 | Digestible OM Swine          | 56.5  |         |
| Crude Fiber (CF)          | 7.35 | 22 | 1.35 | Undig. OM Pigs               | 23.9  |         |
| Coef. Dig. CF Swine       | 39.7 |    |      | Ether Extract (EE)           | 15.3  | 23 1.36 |
| NDF                       | 22.5 | 8  | 1.75 | Coef. Dig. EE Poultry        | 70.3  |         |
| Coef. Dig. NDF Swine      | 50.7 |    |      | Digestible EE Poultry        | 10.7  |         |
| ADF                       | 12.3 | 6  | 1.15 | Coef. Dig. EE Swine          | 75.0  |         |
| Coef. Dig. ADF Swine      | 52.9 |    |      | Digestible EE Swine          | 11.5  |         |
| N-Free Extract (NFE)      | 44.7 |    |      | Linoleic Acid                | 3.15  | 3 1.35  |
| Coef. Dig. NFE Poultry    | 62.3 |    |      | Linolenic Acid               | 0.08  | 3 0.10  |
| Digestible NFE Poultry    | 27.8 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 24.2 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 4428 | 19 | 189  | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3110  |         |
| Metabolizable Energy      | 2583 |    |      | Metabolizable Energy         | 3027  |         |
| Std. Metab. Energy        | 3152 |    |      | Net Energy                   | 2339  |         |
| Net Energy                | 2148 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3329  |         |
| Energy Met.               | 2658 |    |      | Metabolizable Energy         | 3203  |         |
| Net Energy                | 2223 |    |      | Net Energy                   | 2468  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 9.01 | 21 | 0.85 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 194.5 | 1 -     |
| Potassium (K)             | 1.41 | 5  | 0.09 | Iron (Fe)                    | 98.2  | 11 44.5 |
| Sodium (Na)               | 0.04 | 5  | 0.01 | Copper (Cu)                  | 28.2  | 1 -     |
| Chlorine (Cl)             | 0.07 | 3  | 0.01 | Zinc (Zn)                    | 54.9  | 11 3.59 |
| Sulfur (S)                | 0.18 | 3  | 0.01 | Selenium (Se)                | 0.35  | 1 -     |
| Magnesium (Mg)            | 1.00 | 11 | 0.12 |                              |       |         |
| Total Calcium (Ca)        | 0.07 | 16 | 0.02 |                              |       |         |
| Total Phosphorus (P)      | 2.00 | 18 | 0.21 |                              |       |         |
| Phytate P                 | 1.37 | 2  | 0.10 |                              |       |         |
| Available P (Pav)         | 0.63 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 29.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.58 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 28.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.56 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P).

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rice, Bran**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 13.1  | 100   | 10.1             | 77.1  | 9.40             | 71.7  |
| Lysine, %                                   | 0.63  | 4.81  | 0.49             | 77.0  | 0.47             | 74.8  |
| Methionine, %                               | 0.24  | 1.83  | 0.19             | 78.0  | 0.18             | 73.7  |
| Met + Cys, %                                | 0.47  | 3.58  | 0.33             | 79.9  | 0.34             | 71.4  |
| Threonine, %                                | 0.55  | 4.19  | 0.40             | 72.3  | 0.41             | 74.2  |
| Tryptophan, %                               | 0.15  | 1.14  | 0.11             | 75.4  | 0.11             | 72.0  |
| Arginine, %                                 | 1.05  | 7.97  | 0.91             | 86.7  | 0.90             | 86.2  |
| Gly + Ser, %                                | 1.33  | 10.1  | 1.02             | 76.9  |                  |       |
| Valine, %                                   | 0.76  | 5.80  | 0.59             | 77.1  | 0.55             | 73.0  |
| Isoleucine                                  | 0.46  | 3.47  | 0.35             | 76.0  | 0.33             | 72.0  |
| Leucine, %                                  | 0.92  | 7.02  | 0.70             | 75.6  | 0.66             | 72.0  |
| Histidine, %                                | 0.37  | 2.82  | 0.31             | 83.4  | 0.31             | 83.3  |
| Phenylalanine, %                            | 0.58  | 4.42  | 0.42             | 73.2  | 0.42             | 72.8  |
| Phe + Tyr, %                                | 1.02  | 7.78  | 0.78             | 76.7  | 0.78             | 76.3  |
| Alanine, %                                  | 0.82  | 6.25  | 0.62             | 75.1  | 0.54             | 66.0  |
| Cysteine, %                                 | 0.23  | 1.72  | 0.14             | 62.8  | 0.16             | 70.5  |
| Tyrosine, %                                 | 0.44  | 3.36  | 0.36             | 81.3  | 0.36             | 81.0  |
| Glycine, %                                  | 0.70  | 5.30  | 0.57             | 81.4  | 0.41             | 59.0  |
| Serine, %                                   | 0.63  | 4.81  | 0.46             | 72.5  | 0.43             | 69.0  |
| Proline, %                                  | 0.60  | 4.58  | 0.43             | 71.0  | 0.40             | 67.0  |
| Glutamine <sup>2</sup> , %                  | 1.07  | 8.15  | 0.86             | 80.1  | 0.76             | 71.0  |
| Glutamic Acid <sup>2</sup> , %              | 0.67  | 5.12  | 0.54             | 80.1  | 0.48             | 71.0  |
| Asparagine <sup>2</sup> , %                 | 0.59  | 4.47  | 0.43             | 73.5  | 0.37             | 64.0  |
| Aspartic Acid <sup>2</sup> , %              | 0.72  | 5.49  | 0.53             | 73.5  | 0.46             | 64.0  |
| Total Nitrogen (PB/6.25), %                 | 2.10  | 16.0  | 1.62             | 77.1  | 1.50             | 71.7  |
| Essential Nitrogen Poultry, %               | 1.17  | 55.6* | 0.91             | 77.9  |                  |       |
| Essential Nitrogen Swine, %                 | 0.95  | 45.4* |                  |       | 0.72             | 76.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 6      |          | 6         |           |
|                                                             | 8            | 12     |          | 12        |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 4            | 7      | 10       | 10        | 5         |
|                                                             | 10           | 15     | 20       | 20        | 15        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rice, Broken**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 88.2 | 24 | 1.23 | Organic Matter (OM)          | 87.3 |         |
| Crude Protein (CP)        | 8.00 | 24 | 0.53 | Coef. Dig. OM Swine          | 93.0 |         |
| Starch                    | 74.9 | 5  | 1.29 | Digestible OM Swine          | 81.2 |         |
| Crude Fiber (CF)          | 0.60 | 7  | 0.24 | Undig. OM Pigs               | 6.14 |         |
| Coef. Dig. CF Swine       | -    | -  | -    | Ether Extract (EE)           | 1.48 | 19 0.50 |
| NDF                       | 6.33 | 7  | 2.81 | Coef. Dig. EE Poultry        | 84.0 |         |
| Coef. Dig. NDF Swine      | 14.5 |    |      | Digestible EE Poultry        | 1.24 |         |
| ADF                       | 2.09 | 1  | -    | Coef. Dig. EE Swine          | 86.0 |         |
| Coef. Dig. ADF Swine      | 93.0 |    |      | Digestible EE Swine          | 1.27 |         |
| N-Free Extract (NFE)      | 77.2 |    |      | Linoleic Acid                | 0.37 | 3 0.03  |
| Coef. Dig. NFE Poultry    | 89.0 |    |      | Linolenic Acid               | 0.14 | 3 0.10  |
| Digestible NFE Poultry    | 68.7 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 9.10 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 3842 | 7  | 205  | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3572 |         |
| Metabolizable Energy      | 3219 |    |      | Metabolizable Energy         | 3489 |         |
| Std. Metab. Energy        | 3507 |    |      | Net Energy                   | 2784 |         |
| Net Energy                | 2575 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3597 |         |
| Metabolizable Energy      | 3254 |    |      | Metabolizable Energy         | 3532 |         |
| Net Energy                | 2609 |    |      | Net Energy                   | 2816 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 0.89 | 6  | 0.06 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 16.6 | 1 -     |
| Potassium (K)             | 0.20 | 5  | 0.07 | Iron (Fe)                    | 15.6 | 1 -     |
| Sodium (Na)               | 0.02 | 6  | 0.01 | Copper (Cu)                  | 2.30 | 1 -     |
| Chlorine (Cl)             | 0.05 | 4  | 0.02 | Zinc (Zn)                    | 10.3 | 1 -     |
| Sulfur (S)                | 0.80 | 1  | -    | Selenium (Se)                | 0.31 | 1 -     |
| Magnesium (Mg)            | 0.08 | 1  | -    |                              |      |         |
| Total Calcium (Ca)        | 0.05 | 8  | 0.01 |                              |      |         |
| Total Phosphorus (P)      | 0.18 | 8  | 0.02 |                              |      |         |
| Phytate P                 | 0.13 | 2  | 0.02 |                              |      |         |
| Available P (Pav)         | 0.06 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 36.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.06 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 36.0 |    |      |                              |      |         |
| Std. Dig. P Swine         | 0.06 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rice, Broken**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 8.00  | 100   | 6.20             | 77.5  | 7.07             | 88.4  |
| Lysine, %                            | 0.30  | 3.75  | 0.24             | 80.8  | 0.25             | 84.8  |
| Methionine, %                        | 0.20  | 2.50  | 0.16             | 78.6  | 0.17             | 86.5  |
| Met + Cys, %                         | 0.37  | 4.63  | 0.26             | 69.2  | 0.30             | 80.3  |
| Threonine, %                         | 0.28  | 3.50  | 0.22             | 76.8  | 0.23             | 82.4  |
| Tryptophan, %                        | 0.10  | 1.25  | 0.08             | 80.1  | 0.08             | 82.0  |
| Arginine, %                          | 0.61  | 7.63  | 0.54             | 88.4  | 0.57             | 92.8  |
| Gly + Ser, %                         | 0.78  | 9.76  | 0.55             | 70.7  |                  |       |
| Valine, %                            | 0.48  | 6.00  | 0.37             | 78.0  | 0.41             | 85.5  |
| Isoleucine, %                        | 0.34  | 4.25  | 0.27             | 78.1  | 0.30             | 87.8  |
| Leucine, %                           | 0.68  | 8.51  | 0.55             | 81.3  | 0.61             | 89.3  |
| Histidine, %                         | 0.20  | 2.50  | 0.15             | 74.8  | 0.18             | 88.4  |
| Phenylalanine, %                     | 0.40  | 5.00  | 0.30             | 73.8  | 0.35             | 88.0  |
| Phe + Tyr, %                         | 0.78  | 9.76  | 0.60             | 76.6  | 0.68             | 87.4  |
| Alanine, %                           | 0.46  | 5.75  | 0.33             | 71.2  | 0.40             | 86.3  |
| Cysteine, %                          | 0.17  | 2.13  | 0.10             | 58.2  | 0.12             | 73.0  |
| Tyrosine, %                          | 0.38  | 4.75  | 0.30             | 79.6  | 0.33             | 86.8  |
| Glycine, %                           | 0.37  | 4.63  | 0.26             | 69.2  | 0.35             | 95.4  |
| Serine, %                            | 0.41  | 5.13  | 0.30             | 72.1  | 0.37             | 89.9  |
| Proline, %                           | 0.41  | 5.13  | 0.26             | 63.5  | 0.38             | 91.9  |
| Glutamine <sup>2</sup> , %           | 0.88  | 11.0  | 0.71             | 81.1  | 0.79             | 90.2  |
| Glutamic Acid <sup>2</sup> , %       | 0.55  | 6.90  | 0.45             | 81.1  | 0.50             | 90.2  |
| Asparagine <sup>2</sup> , %          | 0.33  | 4.15  | 0.27             | 81.1  | 0.29             | 87.2  |
| Aspartic Acid <sup>2</sup> , %       | 0.41  | 5.10  | 0.33             | 81.1  | 0.36             | 87.2  |
| Total Nitrogen (PB/6.25), %          | 1.28  | 16.0  | 0.99             | 77.5  | 1.13             | 88.4  |
| Essential Nitrogen Poultry, %        | 0.70  | 54.5* | 0.55             | 78.3  |                  |       |
| Essential Nitrogen Swine, %          | 0.57  | 44.8* |                  |       | 0.50             | 87.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 30           | 30     | 30       |           |           |
| Practical Maximum                                           | 65           | 65     | 65       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 30           | 40     | 40       | 40        | 40        |
| Practical Maximum                                           | 60           | 65     | 70       | 65        | 70        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rice, Defatted Bran**

| Main Components (%)       |      |   |      |                              |       |        |
|---------------------------|------|---|------|------------------------------|-------|--------|
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Dry Matter                | 89.8 | 8 | 1.50 | Organic Matter (OM)          | 79.1  |        |
| Crude Protein (CP)        | 15.9 | 9 | 1.37 | Coef. Dig. OM Swine          | 64.7  |        |
| Starch                    | 26.8 | 6 | 1.67 | Digestible OM Swine          | 51.2  |        |
| Crude Fiber (CF)          | 10.5 | 4 | 0.78 | Undig. OM Pigs               | 27.9  |        |
| Coef. Dig. CF Swine       | 39.7 |   |      | Ether Extract (EE)           | 1.60  | 3 0.09 |
| NDF                       | 24.7 | 6 | 1.15 | Coef. Dig. EE Poultry        | 62.0  |        |
| Coef. Dig. NDF Swine      | 50.7 |   |      | Digestible EE Poultry        | 0.99  |        |
| ADF                       | 14.3 | 4 | 2.12 | Coef. Dig. EE Swine          | 70.0  |        |
| Coef. Dig. ADF Swine      | 52.9 |   |      | Digestible EE Swine          | 1.12  |        |
| N-Free Extract (NFE)      | 51.1 |   |      | Linoleic Acid                | 0.58  | 3 0.16 |
| Coef. Dig. NFE Poultry    | 58.2 |   |      | Linolenic Acid               | 0.03  | 1 -    |
| Digestible NFE Poultry    | 29.7 |   |      |                              |       |        |
| Undig. NFE + CF Poultry   | 31.9 |   |      |                              |       |        |
| Energy (kcal/kg)          |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Gross Energy              | 3833 | 4 | 150  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 2364  |        |
| Metabolizable Energy      | 1843 |   |      | Metabolizable Energy         | 2270  |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 1569  |        |
| Net Energy                | 1463 |   |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 2630  |        |
| Metabolizable Energy      | 1937 |   |      | Metabolizable Energy         | 2481  |        |
| Net Energy                | 1558 |   |      | Net Energy                   | 1723  |        |
| Minerals                  |      |   |      |                              |       |        |
|                           | Mean | n | SD   |                              | Mean  | n SD   |
| Ash, %                    | 10.7 | 6 | 0.69 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 170.3 | 1 -    |
| Potassium (K)             | 1.51 | 4 | 0.27 | Iron (Fe)                    | 170.1 | 1 -    |
| Sodium (Na)               | 0.04 | 4 | 0.02 | Copper (Cu)                  | 14.7  | - -    |
| Chlorine (Cl)             | 0.08 | 3 | 0.02 | Zinc (Zn)                    | 47.7  | 1 -    |
| Sulfur (S)                | 0.18 | 2 | 0.92 | Selenium (Se)                | -     | - -    |
| Magnesium (Mg)            | 0.75 | 1 | -    |                              |       |        |
| Total Calcium (Ca)        | 0.12 | 5 | 0.05 |                              |       |        |
| Total Phosphorus (P)      | 1.82 | 6 | 0.08 |                              |       |        |
| Phytate P                 | 1.50 | 4 | 0.08 |                              |       |        |
| Available P (Pav)         | 0.32 |   |      |                              |       |        |
| Coef. Dig. P Poultry      | 29.0 |   |      |                              |       |        |
| Std. Dig. P Poultry       | 0.53 |   |      |                              |       |        |
| Coef. Dig. P Swine        | 28.0 |   |      |                              |       |        |
| Std. Dig. P Swine         | 0.51 |   |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rice, Defatted Bran**

| Amino Acid Content and Digestibility |       |       |                  |      |                  |      |
|--------------------------------------|-------|-------|------------------|------|------------------|------|
|                                      | Total | % CP  | Poultry          |      | Swine            |      |
|                                      |       |       | SID <sup>1</sup> | Coef | SID <sup>1</sup> | Coef |
| Crude Protein, %                     | 15.9  | 100   | 12.0             | 75.7 | 11.4             | 71.5 |
| Lysine, %                            | 0.71  | 4.47  | 0.54             | 75.6 | 0.52             | 72.9 |
| Methionine, %                        | 0.33  | 2.08  | 0.25             | 75.7 | 0.25             | 74.4 |
| Met + Cys, %                         | 0.66  | 4.15  | 0.46             | 70.3 | 0.47             | 71.2 |
| Threonine, %                         | 0.60  | 3.77  | 0.41             | 69.1 | 0.44             | 74.1 |
| Tryptophan, %                        | 0.20  | 1.26  | 0.15             | 75.4 | 0.14             | 73.7 |
| Arginine, %                          | 1.24  | 7.80  | 1.05             | 84.3 | 1.05             | 84.3 |
| Gly + Ser, %                         | 1.59  | 10.0  | 1.18             | 73.9 |                  |      |
| Valine, %                            | 0.86  | 5.41  | 0.63             | 73.0 | 0.64             | 74.2 |
| Isoleucine, %                        | 0.56  | 3.52  | 0.40             | 71.0 | 0.41             | 73.8 |
| Leucine, %                           | 1.12  | 7.04  | 0.80             | 71.6 | 0.82             | 73.0 |
| Histidine, %                         | 0.42  | 2.64  | 0.35             | 82.7 | 0.33             | 79.3 |
| Phenylalanine, %                     | 0.71  | 4.47  | 0.50             | 71.0 | 0.51             | 72.4 |
| Phe + Tyr, %                         | 1.07  | 6.73  | 0.81             | 75.3 | 0.82             | 77.0 |
| Alanine, %                           | 0.98  | 6.16  | 0.72             | 73.2 | 0.65             | 66.0 |
| Cysteine, %                          | 0.33  | 2.08  | 0.21             | 64.9 | 0.22             | 68.0 |
| Tyrosine, %                          | 0.36  | 2.26  | 0.30             | 83.6 | 0.31             | 86.0 |
| Glycine, %                           | 0.85  | 5.35  | 0.64             | 75.3 | 0.50             | 59.0 |
| Serine, %                            | 0.74  | 4.65  | 0.54             | 72.3 | 0.51             | 69.0 |
| Proline, %                           | 0.72  | 4.53  | 0.48             | 67.3 | 0.48             | 67.0 |
| Glutamine <sup>2</sup> , %           | 1.35  | 8.50  | 1.09             | 80.6 | 0.96             | 71.0 |
| Glutamic Acid <sup>2</sup> , %       | 0.85  | 5.33  | 0.68             | 80.6 | 0.60             | 71.0 |
| Asparagine <sup>2</sup> , %          | 0.63  | 3.98  | 0.50             | 78.6 | 0.40             | 64.0 |
| Aspartic Acid <sup>2</sup> , %       | 0.78  | 4.89  | 0.61             | 78.6 | 0.50             | 64.0 |
| Total Nitrogen (PB/6.25), %          | 2.54  | 16.0  | 1.92             | 75.7 | 1.82             | 71.5 |
| Essential Nitrogen Poultry, %        | 1.38  | 54.1* | 1.03             | 75.0 |                  |      |
| Essential Nitrogen Swine, %          | 1.12  | 44.0* |                  |      | 0.85             | 75.8 |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
| Practical<br>Maximum                                        | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 2                   | 5      | 5           |             |           |
| Practical<br>Maximum                                        |                     |        |             |             |           |
|                                                             | 6                   | 8      | 10          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
| Practical<br>Maximum                                        | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 3                   | 5      | 7           | 10          | 5         |
|                                                             | 8                   | 12     | 20          | 20          | 12        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rye, Grain**

| Main Components (%)       |       |   |      |                              |      |        |
|---------------------------|-------|---|------|------------------------------|------|--------|
|                           | Mean  | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 87.3  | 1 | -    | Organic Matter (OM)          | 85.2 |        |
| Crude Protein (CP)        | 10.3  | 2 | 1.77 | Coef. Dig. OM Swine          | 84.0 |        |
| Starch                    | 59.6  | 2 | 8.20 | Digestible OM Swine          | 71.5 |        |
| Crude Fiber (CF)          | 1.90  | 1 | -    | Undig. OM Pigs               | 13.6 |        |
| Coef. Dig. CF Swine       | -     |   |      | Ether Extract (EE)           | 1.60 | 2 0.57 |
| NDF                       | 14.10 | 1 |      | Coef. Dig. EE Poultry        | 32.0 |        |
| Coef. Dig. NDF Swine      | -     |   |      | Digestible EE Poultry        | 0.51 |        |
| ADF                       | 3.10  | 1 | -    | Coef. Dig. EE Swine          | 37.0 |        |
| Coef. Dig. ADF Swine      | -     |   |      | Digestible EE Swine          | 0.59 |        |
| N-Free Extract (NFE)      | 71.4  |   |      | Linoleic Acid                | 0.48 | 1 -    |
| Coef. Dig. NFE Poultry    | 86.8  |   |      | Linolenic Acid               | 0.06 | 1 -    |
| Digestible NFE Poultry    | 61.9  |   |      |                              |      |        |
| Undig. NFE + CF Poultry   | 11.3  |   |      |                              |      |        |
| Energy (kcal/kg)          |       |   |      |                              |      |        |
|                           | Mean  | N | SD   |                              | Mean | n SD   |
| Gross Energy              | 3749  | 1 | -    | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |       |   |      | Digestible Energy            | 3128 |        |
| Metabolizable Energy      | 2870  |   |      | Metabolizable Energy         | 3057 |        |
| Std. Metab. Energy        | -     |   |      | Net Energy                   | 2385 |        |
| Net Energy                | 2289  |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |       |   |      | Digestible Energy            | 3247 |        |
| Metabolizable Energy      | 2912  |   |      | Metabolizable Energy         | 3158 |        |
| Net Energy                | 2330  |   |      | Net Energy                   | 2459 |        |
| Minerals                  |       |   |      |                              |      |        |
|                           | Mean  | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 2.15  | 2 | 0.50 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |       |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.45  | 1 | -    | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.01  | 1 | -    | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.06  | 1 | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -     | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.11  | 1 | -    |                              |      |        |
| Total Calcium (Ca)        | 0.04  | 1 | -    |                              |      |        |
| Total Phosphorus (P)      | 0.31  | 1 | -    |                              |      |        |
| Phytate P                 | 0.19  | 1 | -    |                              |      |        |
| Available P (Pav)         | 0.12  |   |      |                              |      |        |
| Coef. Dig. P Poultry      | 38.0  |   |      |                              |      |        |
| Std. Dig. P Poultry       | 0.12  |   |      |                              |      |        |
| Coef. Dig. P Swine        | 30.0  |   |      |                              |      |        |
| Std. Dig. P Swine         | 0.09  |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Rye, Grain**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 10.3  | 100   | 6.15             | 60.0  | 7.94             | 77.0  |
| Lysine, %                            | 0.39  | 3.79  | -                | -     | 0.28             | 71.8  |
| Methionine, %                        | 0.17  | 1.65  | -                | -     | 0.14             | 82.4  |
| Met + Cys, %                         | 0.89  | 8.64  | -                | -     | 0.65             | 73.0  |
| Threonine, %                         | 0.35  | 3.40  | -                | -     | 0.25             | 71.4  |
| Tryptophan, %                        | 0.10  | 0.97  | -                | -     | 0.07             | 70.0  |
| Arginine, %                          | 0.51  | 4.95  | -                | -     | 0.41             | 80.4  |
| Gly + Ser, %                         | 0.91  | 8.83  | -                | -     | -                | -     |
| Valine, %                            | 0.49  | 4.76  | -                | -     | 0.37             | 75.5  |
| Isoleucine, %                        | 0.35  | 3.40  | -                | -     | 0.27             | 77.1  |
| Leucine, %                           | 0.63  | 6.12  | -                | -     | 0.50             | 79.4  |
| Histidine, %                         | 0.22  | 2.14  | -                | -     | 0.18             | 81.8  |
| Phenylalanine, %                     | 0.46  | 4.47  | -                | -     | 0.38             | 82.6  |
| Phe + Tyr, %                         | 0.73  | 7.09  | -                | -     | 0.59             | 80.8  |
| Alanine, %                           | 0.44  | 4.27  | -                | -     | 0.30             | 68.2  |
| Cysteine, %                          | 0.72  | 6.99  | -                | -     | 0.51             | 70.8  |
| Tyrosine, %                          | 0.27  | 2.62  | -                | -     | 0.21             | 77.8  |
| Glycine, %                           | 0.45  | 4.37  | -                | -     | 0.33             | 73.3  |
| Serine, %                            | 0.46  | 4.47  | -                | -     | 0.35             | 76.1  |
| Proline, %                           | 0.99  | 9.61  | -                | -     | 0.89             | 89.9  |
| Glutamine <sup>2</sup> , %           | 1.45  | 14.1  | -                | -     | 1.12             | 77.0  |
| Glutamic Acid <sup>2</sup> , %       | 0.91  | 8.83  | -                | -     | 0.70             | 77.0  |
| Asparagine <sup>2</sup> , %          | 0.34  | 3.27  | -                | -     | 0.24             | 71.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.41  | 4.01  | -                | -     | 0.29             | 71.0  |
| Total Nitrogen (PB/6.25), %          | 1.65  | 16.0  | 0.99             | 60.0  | 1.27             | 77.0  |
| Essential Nitrogen Poultry, %        | 0.72  | 43.5* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | 0.57  | 34.7* | -                | -     | 0.44             | 77.7  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 4            | 7      |          | 7         |           |
| Practical                                                   | 8            | 15     |          | 15        |           |
| Maximum                                                     |              |        |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 4            | 8      | 8        | 8         | 8         |
| Practical                                                   | 8            | 15     | 15       | 15        | 15        |
| Maximum                                                     |              |        |          |           |           |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Shrimp, By-product Meal #**

| Main Components (%)       |      |   |    |                              |       |      |
|---------------------------|------|---|----|------------------------------|-------|------|
|                           | Mean | n | SD |                              | Mean  | n SD |
| Dry Matter                | 89.0 | 1 | -  | Organic Matter (OM)          | 47.9  |      |
| Crude Protein (CP)        | 32.6 | 1 | -  | Coef. Dig. OM Swine          | -     |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | -     |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | -     |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 3.90  | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -     |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | -     |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -     |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | -     |      |
| N-Free Extract (NFE)      | 11.4 |   |    | Linoleic Acid                | -     | - -  |
| Coef. Dig. NFE Poultry    | -    | - | -  | Linolenic Acid               | -     | - -  |
| Digestible NFE Poultry    | -    | - | -  |                              |       |      |
| Undig. NFE + CF Poultry   | -    | - | -  |                              |       |      |
| Energy (kcal/kg)          |      |   |    |                              |       |      |
|                           | Mean | n | SD |                              | Mean  | n SD |
| Gross Energy              | 2386 | 1 | -  | <b>Swine</b>                 |       |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | -     |      |
| Metabolizable Energy      | 1163 |   |    | Metabolizable Energy         | -     |      |
| Std. Metab. Energy        | -    | - | -  | Net Energy                   | -     |      |
| Net Energy                | -    | - | -  | <b>Sows</b>                  |       |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -     |      |
| Metabolizable Energy      | -    | - | -  | Metabolizable Energy         | -     |      |
| Net Energy                | -    | - | -  | Net Energy                   | -     |      |
| Minerals                  |      |   |    |                              |       |      |
|                           | Mean | n | SD |                              | Mean  | n SD |
| Ash, %                    | 41.1 | 1 | -  | <b>Trace Minerals, mg/kg</b> |       |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 14.1  | 1 -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | 149.0 | 1 -  |
| Sodium (Na)               | 1.33 | 1 | -  | Copper (Cu)                  | 32.2  | 1 -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | 57.0  | 1 -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -     | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |       |      |
| Total Calcium (Ca)        | 12.2 | 1 | -  |                              |       |      |
| Total Phosphorus (P)      | 2.31 | 1 | -  |                              |       |      |
| Phytate P                 | -    | - | -  |                              |       |      |
| Available P (Pav)         | 2.31 |   |    |                              |       |      |
| Coef. Dig. P Poultry      | -    | - | -  |                              |       |      |
| Std. Dig. P Poultry       | -    | - | -  |                              |       |      |
| Coef. Dig. P Swine        | -    | - | -  |                              |       |      |
| Std. Dig. P Swine         | -    | - | -  |                              |       |      |

Pav = Non Phytate P (Total P – Phytate P). #By-product after processing to remove shrimp fillets from extractive fishing.

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Shrimp, By-product Meal**

| Amino Acid Content and Digestibility |       |      |                  |       |                  |       |
|--------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                      | Total | % CP | Poultry          |       | Swine            |       |
|                                      |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 32.6  | 100  | 22.0             | 67.5  | -                | -     |
| Lysine, %                            | 1.67  | 5.12 | 1.27             | 76.1  | -                | -     |
| Methionine, %                        | 0.54  | 1.66 | 0.29             | 53.7  | -                | -     |
| Met + Cys, %                         | 0.85  | 2.61 | 0.61             | 71.8  | -                | -     |
| Threonine, %                         | 1.08  | 3.31 | 0.53             | 49.1  | -                | -     |
| Tryptophan, %                        | 0.68  | 2.09 | 0.54             | 79.4  | -                | -     |
| Arginine, %                          | 1.43  | 4.39 | 0.98             | 68.5  | -                | -     |
| Gly + Ser, %                         | 2.77  | 8.50 | 0.70             | 25.3  | -                | -     |
| Valine, %                            | 1.51  | 4.63 | 1.03             | 68.2  | -                | -     |
| Isoleucine, %                        | 1.26  | 3.87 | 0.80             | 63.5  | -                | -     |
| Leucine, %                           | 1.93  | 5.92 | 1.35             | 70.0  | -                | -     |
| Histidine, %                         | 0.52  | 1.60 | 0.34             | 65.4  | -                | -     |
| Phenylalanine, %                     | 2.29  | 7.02 | 1.85             | 80.8  | -                | -     |
| Phe + Tyr, %                         | -     | -    | -                | -     | -                | -     |
| Alanine, %                           | 1.58  | -    | -                | -     | -                | -     |
| Cysteine, %                          | 0.31  | -    | -                | -     | -                | -     |
| Tyrosine, %                          | -     | -    | -                | -     | -                | -     |
| Glycine, %                           | 1.70  | -    | -                | -     | -                | -     |
| Serine, %                            | 1.07  | -    | -                | -     | -                | -     |
| Proline, %                           | 1.17  | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %           | 1.45  | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | 2.20  | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %          | 1.07  | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | 1.59  | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %          | 5.22  | 16.0 | 3.52             | 67.5  | -                | -     |
| Essential Nitrogen Poultry, %        | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %          | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
| Practical                                                   | -            | -      |          |           |           |
| Maximum                                                     | -            | -      |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
| Practical                                                   | -            | -      | -        | -         | -         |
| Maximum                                                     | -            | -      | -        | -         | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sorghum, Grain**

| Main Components (%)       |      |     |      |                              |      |         |
|---------------------------|------|-----|------|------------------------------|------|---------|
|                           | Mean | n   | SD   |                              | Mean | n SD    |
| Dry Matter                | 87.5 | 125 | 1.21 | Organic Matter (OM)          | 86.2 |         |
| Crude Protein (CP)        | 8.65 | 324 | 0.99 | Coef. Dig. OM Swine          | 88.7 |         |
| Starch                    | 66.6 | 10  | 4.44 | Digestible OM Swine          | 76.5 |         |
| Crude Fiber (CF)          | 2.58 | 100 | 0.52 | Undig. OM Pigs               | 9.74 |         |
| Coef. Dig. CF Swine       | 75.5 |     |      | Ether Extract (EE)           | 3.13 | 79 0.47 |
| NDF                       | 11.2 | 11  | 1.41 | Coef. Dig. EE Poultry        | 79.0 |         |
| Coef. Dig. NDF Swine      | 73.2 |     |      | Digestible EE Poultry        | 2.47 |         |
| ADF                       | 5.24 | 11  | 0.75 | Coef. Dig. EE Swine          | 77.0 |         |
| Coef. Dig. ADF Swine      | 85.4 |     |      | Digestible EE Swine          | 2.41 |         |
| N-Free Extract (NFE)      | 71.9 |     |      | Linoleic Acid                | 1.05 | 1 -     |
| Coef. Dig. NFE Poultry    | 88.5 |     |      | Linolenic Acid               | 0.08 | 1 -     |
| Digestible NFE Poultry    | 63.6 |     |      |                              |      |         |
| Undig. NFE + CF Poultry   | 10.8 |     |      |                              |      |         |
| Energy (kcal/kg)          |      |     |      |                              |      |         |
|                           | Mean | n   | SD   |                              | Mean | n SD    |
| Gross Energy              | 3988 | 10  | 226  | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |     |      | Digestible Energy            | 3410 |         |
| Metabolizable Energy      | 3204 |     |      | Metabolizable Energy         | 3358 |         |
| Std. Metab. Energy        | 3374 |     |      | Net Energy                   | 2656 |         |
| Net Energy                | 2572 |     |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |     |      | Digestible Energy            | 3512 |         |
| Metabolizable Energy      | 3234 |     |      | Metabolizable Energy         | 3432 |         |
| Net Energy                | 2602 |     |      | Net Energy                   | 2710 |         |
| Minerals                  |      |     |      |                              |      |         |
|                           | Mean | n   | SD   |                              | Mean | n SD    |
| Ash, %                    | 1.30 | 101 | 0.34 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)               | 10.9 | 1 -     |
| Potassium (K)             | 0.36 | 6   | 0.05 | Iron (Fe)                    | 59.7 | 1 -     |
| Sodium (Na)               | 0.02 | 6   | 0.01 | Copper (Cu)                  | 5.60 | 1 -     |
| Chlorine (Cl)             | 0.06 | 3   | 0.02 | Zinc (Zn)                    | 49.8 | 1 -     |
| Sulfur (S)                | -    | -   | -    | Selenium (Se)                | 0.35 | 1 -     |
| Magnesium (Mg)            | 0.14 | 1   | -    |                              |      |         |
| Total Calcium (Ca)        | 0.03 | 11  | 0.01 |                              |      |         |
| Total Phosphorus (P)      | 0.23 | 19  | 0.06 |                              |      |         |
| Phytate P                 | 0.16 | 5   | 0.02 |                              |      |         |
| Available P (Pav)         | 0.07 |     |      |                              |      |         |
| Coef. Dig. P Poultry      | 36.0 |     |      |                              |      |         |
| Std. Dig. P Poultry       | 0.08 |     |      |                              |      |         |
| Coef. Dig. P Swine        | 36.0 |     |      |                              |      |         |
| Std. Dig. P Swine         | 0.08 |     |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sorghum, Grain**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 8.65  | 100   | 7.61             | 91.7  | 7.07             | 87.9  |
| Lysine, %                                   | 0.20  | 2.31  | 0.18             | 90.2  | 0.16             | 81.3  |
| Methionine, %                               | 0.15  | 1.73  | 0.13             | 86.7  | 0.13             | 89.6  |
| Met + Cys, %                                | 0.30  | 3.47  | 0.27             | 90.0  | 0.26             | 88.2  |
| Threonine, %                                | 0.28  | 3.24  | 0.25             | 89.4  | 0.24             | 84.1  |
| Tryptophan, %                               | 0.10  | 1.16  | 0.09             | 87.0  | 0.08             | 79.8  |
| Arginine, %                                 | 0.35  | 4.05  | 0.31             | 89.9  | 0.32             | 90.2  |
| Gly + Ser, %                                | 0.70  | 8.09  | 0.57             | 81.1  |                  |       |
| Valine, %                                   | 0.44  | 5.09  | 0.41             | 93.2  | 0.40             | 90.1  |
| Isoleucine, %                               | 0.35  | 4.05  | 0.33             | 95.0  | 0.31             | 89.4  |
| Leucine, %                                  | 1.17  | 13.5  | 1.12             | 95.3  | 1.04             | 89.1  |
| Histidine, %                                | 0.20  | 2.31  | 0.19             | 93.9  | 0.17             | 84.8  |
| Phenylalanine, %                            | 0.46  | 5.32  | 0.45             | 97.8  | 0.42             | 91.6  |
| Phe + Tyr, %                                | 0.82  | 9.48  | 0.78             | 95.1  | 0.76             | 92.3  |
| Alanine, %                                  | 0.82  | 9.48  | 0.77             | 93.4  | 0.72             | 87.6  |
| Cysteine, %                                 | 0.15  | 1.73  | 0.14             | 93.3  | 0.13             | 86.7  |
| Tyrosine, %                                 | 0.36  | 4.16  | 0.33             | 91.7  | 0.34             | 93.1  |
| Glycine, %                                  | 0.31  | 3.58  | 0.24             | 77.4  | 0.30             | 97.7  |
| Serine, %                                   | 0.39  | 4.51  | 0.33             | 84.1  | 0.36             | 91.5  |
| Proline, %                                  | 0.76  | 8.79  | 0.71             | 93.3  | 0.56             | 74.0  |
| Glutamine <sup>2</sup> , %                  | 0.86  | 9.92  | 0.81             | 94.4  | 0.76             | 88.9  |
| Glutamic Acid <sup>2</sup> , %              | 1.19  | 13.8  | 1.12             | 94.4  | 1.06             | 88.9  |
| Asparagine <sup>2</sup> , %                 | 0.29  | 3.37  | 0.23             | 80.1  | 0.26             | 89.1  |
| Aspartic Acid <sup>2</sup> , %              | 0.34  | 3.91  | 0.27             | 80.1  | 0.30             | 89.1  |
| Total Nitrogen (PB/6.25), %                 | 1.38  | 16.0  | 1.27             | 91.7  | 1.22             | 87.9  |
| Essential Nitrogen Poultry, %               | 0.63  | 45.5* | 0.58             | 91.5  |                  |       |
| Essential Nitrogen Swine, %                 | 0.52  | 37.6* |                  |       | 0.46             | 88.4  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 30                  | 30     | 30          |             |           |
| <b>Practical</b>                                                   | 65                  | 65     | 65          |             |           |
| <b>Maximum</b>                                                     |                     |        |             |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 30                  | 35     | 35          | 35          | 35        |
| <b>Practical</b>                                                   | 60                  | 65     | 70          | 65          | 70        |
| <b>Maximum</b>                                                     |                     |        |             |             |           |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sorghum, Grain High Tannin**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 85.9 | 1 | -  | Organic Matter (OM)          | 84.0 |      |
| Crude Protein (CP)        | 8.97 | 1 | -  | Coef. Dig. OM Swine          | 81.6 |      |
| Starch                    | 56.8 | 1 | -  | Digestible OM Swine          | 68.6 |      |
| Crude Fiber (CF)          | 2.78 | 1 | -  | Undig. OM Pigs               | 15.6 |      |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 2.35 | 1 -  |
| NDF                       | 9.80 | 1 | -  | Coef. Dig. EE Poultry        | 83.0 |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 1.95 |      |
| ADF                       | 4.60 | 1 | -  | Coef. Dig. EE Swine          | 68.0 |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 1.60 |      |
| N-Free Extract (NFE)      | 69.9 |   |    | Linoleic Acid                | 1.13 | 1 -  |
| Coef. Dig. NFE Poultry    | 86.5 |   |    | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | 60.5 |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | 12.2 |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 3860 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3081 |      |
| Metabolizable Energy      | 2956 |   |    | Metabolizable Energy         | 2984 |      |
| Std. Metab. Energy        | 3037 |   |    | Net Energy                   | 2332 |      |
| Net Energy                | 2374 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3179 |      |
| Metabolizable Energy      | 2985 |   |    | Metabolizable Energy         | 3095 |      |
| Net Energy                | 2403 |   |    | Net Energy                   | 2413 |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 1.86 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 10.9 | 1 -  |
| Potassium (K)             | 0.31 | 1 | -  | Iron (Fe)                    | 59.7 | 1 -  |
| Sodium (Na)               | 0.01 | 1 | -  | Copper (Cu)                  | 7.60 | 1 -  |
| Chlorine (Cl)             | 0.01 | 1 | -  | Zinc (Zn)                    | 18.6 | 1 -  |
| Sulfur (S)                | 0.10 | 1 | -  | Selenium (Se)                | 0.25 | 1 -  |
| Magnesium (Mg)            | 0.11 | 1 | -  |                              |      |      |
| Total Calcium (Ca)        | 0.03 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.26 | 1 | -  |                              |      |      |
| Phytate P                 | 0.18 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.08 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | 36.0 |   |    |                              |      |      |
| Std. Dig. P Poultry       | 0.09 |   |    |                              |      |      |
| Coef. Dig. P Swine        | 36.0 |   |    |                              |      |      |
| Std. Dig. P Swine         | 0.09 |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sorghum, Grain High Tannin**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 8.97  | 100   | 6.10             | 68.0  | 6.61             | 73.7  |
| Lysine, %                                   | 0.20  | 2.23  | 0.15             | 72.7  | 0.15             | 72.7  |
| Methionine, %                               | 0.15  | 1.67  | 0.11             | 75.0  | 0.12             | 81.3  |
| Met + Cys, %                                | 0.30  | 3.34  | 0.21             | 69.7  | 0.22             | 72.7  |
| Threonine, %                                | 0.29  | 3.23  | 0.20             | 69.7  | 0.22             | 75.8  |
| Tryptophan, %                               | 0.10  | 1.11  | 0.07             | 66.7  | 0.08             | 77.8  |
| Arginine, %                                 | 0.35  | 3.90  | 0.26             | 73.7  | 0.24             | 68.4  |
| Gly + Ser, %                                | 0.70  | 7.80  | -                | -     | -                | -     |
| Valine, %                                   | 0.44  | 4.91  | 0.32             | 73.6  | 0.35             | 79.2  |
| Isoleucine, %                               | 0.36  | 4.01  | 0.27             | 74.4  | 0.29             | 81.4  |
| Leucine, %                                  | 1.16  | 12.9  | 0.66             | 56.7  | 0.99             | 85.1  |
| Histidine, %                                | 0.20  | 2.23  | 0.12             | 59.1  | 0.16             | 81.8  |
| Phenylalanine, %                            | 0.46  | 5.13  | 0.35             | 77.1  | 0.38             | 83.3  |
| Phe + Tyr, %                                | 0.82  | 9.14  | 0.61             | 75.3  | 0.68             | 83.9  |
| Alanine, %                                  | 0.82  | 9.14  | -                | -     | -                | -     |
| Cysteine, %                                 | 0.15  | 1.67  | 0.10             | 64.4  | 0.10             | 64.1  |
| Tyrosine, %                                 | 0.36  | 4.01  | 0.26             | 72.9  | 0.30             | 84.6  |
| Glycine, %                                  | 0.31  | 3.46  | -                | -     | -                | -     |
| Serine, %                                   | 0.39  | 4.35  | -                | -     | -                | -     |
| Proline, %                                  | 0.76  | 8.47  | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | 0.86  | 9.57  | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | 1.19  | 13.3  | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | 0.29  | 3.25  | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | 0.34  | 3.77  | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | 1.44  | 16.0  | 0.98             | 68.0  | 1.06             | 73.7  |
| Essential Nitrogen Poultry, %               | 0.63  | 43.9* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | 0.52  | 36.3* | -                | -     | 0.42             | 80.3  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 15                  | 20     | 20          |             |           |
| <b>Practical Maximum</b>                                           | 30                  | 30     | 30          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 15                  | 20     | 20          | 20          | 20        |
| <b>Practical Maximum</b>                                           | 30                  | 35     | 35          | 35          | 35        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Acid Oil**

| Main Components (%)       |      |   |      |                              |      |      |
|---------------------------|------|---|------|------------------------------|------|------|
|                           | Mean | n | SD   |                              | Mean | n SD |
| Dry Matter                | 99.2 | 2 | 0.42 | Organic Matter (OM)          | -    |      |
| Crude Protein (CP)        | -    | - | -    | Coef. Dig. OM Swine          | -    |      |
| Starch                    | -    | - | -    | Digestible OM Swine          | -    |      |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | -    |      |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 95.8 | 1 -  |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | 88.0 |      |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | 84.3 |      |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | -    |      |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | -    |      |
| N-Free Extract (NFE)      | -    | - | -    | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    | - | -    |                              |      |      |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |      |      |
| Energy (kcal/kg)          |      |   |      |                              |      |      |
|                           | Mean | n | SD   |                              | Mean | n SD |
| Gross Energy              | 9271 | 2 | 21   | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | -    |      |
| Metabolizable Energy      | 7830 |   |      | Metabolizable Energy         | 7689 |      |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | -    |      |
| Net Energy                | 7047 |   |      | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | -    |      |
| Metabolizable Energy      | 7830 |   |      | Metabolizable Energy         | -    |      |
| Net Energy                | 7047 |   |      | Net Energy                   | -    |      |
| Minerals                  |      |   |      |                              |      |      |
|                           | Mean | n | SD   |                              | Mean | n SD |
| Ash, %                    | -    | - | -    | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | -    | - | -    | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | -    | - | -    | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -    |                              |      |      |
| Total Calcium (Ca)        | -    | - | -    |                              |      |      |
| Total Phosphorus (P)      | -    | - | -    |                              |      |      |
| Phytate P                 | -    | - | -    |                              |      |      |
| Available P (Pav)         | -    | - | -    |                              |      |      |
| Coef. Dig. P Poultry      | -    | - | -    |                              |      |      |
| Std. Dig. P Poultry       | -    | - | -    |                              |      |      |
| Coef. Dig. P Swine        | -    | - | -    |                              |      |      |
| Std. Dig. P Swine         | -    | - | -    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Acid Oil**

|                                | Amino Acid Content and Digestibility |      |                  |       |                  |       |
|--------------------------------|--------------------------------------|------|------------------|-------|------------------|-------|
|                                | Total                                | % CP | Poultry          |       | Swine            |       |
|                                |                                      |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | -                                    | -    | -                | -     | -                | -     |
| Lysine, %                      | -                                    | -    | -                | -     | -                | -     |
| Methionine, %                  | -                                    | -    | -                | -     | -                | -     |
| Met + Cys, %                   | -                                    | -    | -                | -     | -                | -     |
| Threonine, %                   | -                                    | -    | -                | -     | -                | -     |
| Tryptophan, %                  | -                                    | -    | -                | -     | -                | -     |
| Arginine, %                    | -                                    | -    | -                | -     | -                | -     |
| Gly + Ser, %                   | -                                    | -    | -                | -     | -                | -     |
| Valine, %                      | -                                    | -    | -                | -     | -                | -     |
| Isoleucine, %                  | -                                    | -    | -                | -     | -                | -     |
| Leucine, %                     | -                                    | -    | -                | -     | -                | -     |
| Histidine, %                   | -                                    | -    | -                | -     | -                | -     |
| Phenylalanine, %               | -                                    | -    | -                | -     | -                | -     |
| Phe + Tyr, %                   | -                                    | -    | -                | -     | -                | -     |
| Alanine, %                     | -                                    | -    | -                | -     | -                | -     |
| Cysteine, %                    | -                                    | -    | -                | -     | -                | -     |
| Tyrosine, %                    | -                                    | -    | -                | -     | -                | -     |
| Glycine, %                     | -                                    | -    | -                | -     | -                | -     |
| Serine, %                      | -                                    | -    | -                | -     | -                | -     |
| Proline, %                     | -                                    | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | -                                    | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %    | -                                    | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %    | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %  | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | -                                    | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 1            | 2      | 2        |           |           |
| Practical                                                   | 1            | 2      | 2        |           |           |
| Maximum                                                     | 2            | 3      | 3        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 1            | 2      | -        | 2         | 2         |
| Practical                                                   | 1            | 2      | -        | 2         | 2         |
| Maximum                                                     | 2            | 3      | -        | 3         | 3         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Degummed Oil**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 99.7 | 2 | 0.13 | Organic Matter (OM)          | 99.7 |        |
| Crude Protein (CP)        | -    | - | -    | Coef. Dig. OM Swine          | 92.0 |        |
| Starch                    | -    | - | -    | Digestible OM Swine          | 91.8 |        |
| Crude Fiber (CF)          | -    | - | -    | Undig. OM Pigs               | 7.94 |        |
| Coef. Dig. CF Swine       | -    | - | -    | Ether Extract (EE)           | 99.5 | 2 0.14 |
| NDF                       | -    | - | -    | Coef. Dig. EE Poultry        | 95.0 |        |
| Coef. Dig. NDF Swine      | -    | - | -    | Digestible EE Poultry        | 94.5 |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | 88.5 |        |
| Coef. Dig. ADF Swine      | -    | - | -    | Digestible EE Swine          | 88.1 |        |
| N-Free Extract (NFE)      | -    | - | -    | Linoleic Acid                | 52.2 | 2 0.67 |
| Coef. Dig. NFE Poultry    | -    | - | -    | Linolenic Acid               | 6.80 | 2 0.21 |
| Digestible NFE Poultry    | -    | - | -    |                              |      |        |
| Undig. NFE + CF Poultry   | -    | - | -    |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 9344 | 2 | 16   | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 8600 |        |
| Metabolizable Energy      | 8790 |   |      | Metabolizable Energy         | 8300 |        |
| Std. Metab. Energy        | 9200 |   |      | Net Energy                   | 7362 |        |
| Net Energy                | 7912 |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 8600 |        |
| Metabolizable Energy      | 8790 |   |      | Metabolizable Energy         | 8300 |        |
| Net Energy                | 7912 |   |      | Net Energy                   | 7362 |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | -    | - | -    | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | -    | - | -    | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | -    | - | -    | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | -    | - | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | -    | - | -    |                              |      |        |
| Total Calcium (Ca)        | -    | - | -    |                              |      |        |
| Total Phosphorus (P)      | -    | - | -    |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | -    | - | -    |                              |      |        |
| Coef. Dig. P Poultry      | -    | - | -    |                              |      |        |
| Std. Dig. P Poultry       | -    | - | -    |                              |      |        |
| Coef. Dig. P Swine        | -    | - | -    |                              |      |        |
| Std. Dig. P Swine         | -    | - | -    |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Degummed Oil**

|                                | Amino Acid Content and Digestibility |      |                  |       |                  |       |
|--------------------------------|--------------------------------------|------|------------------|-------|------------------|-------|
|                                | Total                                | % CP | Poultry          |       | Swine            |       |
|                                |                                      |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | -                                    | -    | -                | -     | -                | -     |
| Lysine, %                      | -                                    | -    | -                | -     | -                | -     |
| Methionine, %                  | -                                    | -    | -                | -     | -                | -     |
| Met + Cys, %                   | -                                    | -    | -                | -     | -                | -     |
| Threonine, %                   | -                                    | -    | -                | -     | -                | -     |
| Tryptophan, %                  | -                                    | -    | -                | -     | -                | -     |
| Arginine, %                    | -                                    | -    | -                | -     | -                | -     |
| Gly + Ser, %                   | -                                    | -    | -                | -     | -                | -     |
| Valine, %                      | -                                    | -    | -                | -     | -                | -     |
| Isoleucine, %                  | -                                    | -    | -                | -     | -                | -     |
| Leucine, %                     | -                                    | -    | -                | -     | -                | -     |
| Histidine, %                   | -                                    | -    | -                | -     | -                | -     |
| Phenylalanine, %               | -                                    | -    | -                | -     | -                | -     |
| Phe + Tyr, %                   | -                                    | -    | -                | -     | -                | -     |
| Alanine, %                     | -                                    | -    | -                | -     | -                | -     |
| Cysteine, %                    | -                                    | -    | -                | -     | -                | -     |
| Tyrosine, %                    | -                                    | -    | -                | -     | -                | -     |
| Glycine, %                     | -                                    | -    | -                | -     | -                | -     |
| Serine, %                      | -                                    | -    | -                | -     | -                | -     |
| Proline, %                     | -                                    | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | -                                    | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %    | -                                    | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %    | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %  | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | -                                    | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 3      | 3        |           |           |
| Practical Maximum                                           | 6            | 7      | 7        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 2      | 2        | 0         | 2         |
| Practical Maximum                                           | 5            | 5      | 5        | 4         | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Full-fat Extruded**

| Main Components (%)       |      |    |      |                              |       |        |
|---------------------------|------|----|------|------------------------------|-------|--------|
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Dry Matter                | 92.6 | 42 | 1.80 | Organic Matter (OM)          | 87.9  |        |
| Crude Protein (CP)        | 37.3 | 79 | 1.44 | Coef. Dig. OM Swine          | 80.4  |        |
| Starch                    | 6.70 | 1  | -    | Digestible OM Swine          | 70.7  |        |
| Crude Fiber (CF)          | 5.55 | 6  | 1.57 | Undig. OM Pigs               | 17.2  |        |
| Coef. Dig. CF Swine       | 76.6 |    |      | Ether Extract (EE)           | 18.6  | 6 1.43 |
| NDF                       | 14.4 | 3  | 3.01 | Coef. Dig. EE Poultry        | 84.5  |        |
| Coef. Dig. NDF Swine      | 76.7 |    |      | Digestible EE Poultry        | 15.7  |        |
| ADF                       | 10.1 | 3  | 3.21 | Coef. Dig. EE Swine          | 77.0  |        |
| Coef. Dig. ADF Swine      | 85.1 |    |      | Digestible EE Swine          | 14.3  |        |
| N-Free Extract (NFE)      | 26.4 |    |      | Linoleic Acid                | 9.45  | 1 -    |
| Coef. Dig. NFE Poultry    | 44.0 |    |      | Linolenic Acid               | 1.35  | 1 -    |
| Digestible NFE Poultry    | 11.6 |    |      |                              |       |        |
| Undig. NFE + CF Poultry   | 20.4 |    |      |                              |       |        |
| Energy (kcal/kg)          |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Gross Energy              | 5074 | 4  | 262  | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 4071  |        |
| Metabolizable Energy      | 3393 |    |      | Metabolizable Energy         | 3956  |        |
| Std. Metab. Energy        | 3538 |    |      | Net Energy                   | 2853  |        |
| Net Energy                | 2804 |    |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 4351  |        |
| Metabolizable Energy      | 3451 |    |      | Metabolizable Energy         | 4081  |        |
| Net Energy                | 2861 |    |      | Net Energy                   | 2944  |        |
| Minerals                  |      |    |      |                              |       |        |
|                           | Mean | n  | SD   |                              | Mean  | n SD   |
| Ash, %                    | 4.66 | 6  | 0.24 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 24.8  | 1 -    |
| Potassium (K)             | 1.72 | 3  | 0.11 | Iron (Fe)                    | 179.0 | 1 -    |
| Sodium (Na)               | 0.03 | 3  | 0.04 | Copper (Cu)                  | 13.7  | 1 -    |
| Chlorine (Cl)             | 0.03 | 3  | 0.01 | Zinc (Zn)                    | 41.6  | 1 -    |
| Sulfur (S)                | 0.28 | 1  | -    | Selenium (Se)                | 0.21  | 1 -    |
| Magnesium (Mg)            | 0.32 | 1  | -    |                              |       |        |
| Total Calcium (Ca)        | 0.24 | 4  | 0.05 |                              |       |        |
| Total Phosphorus (P)      | 0.53 | 4  | 0.11 |                              |       |        |
| Phytate P                 | 0.36 | 2  | 0.13 |                              |       |        |
| Available P (Pav)         | 0.17 |    |      |                              |       |        |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |       |        |
| Std. Dig. P Poultry       | 0.20 |    |      |                              |       |        |
| Coef. Dig. P Swine        | 38.0 |    |      |                              |       |        |
| Std. Dig. P Swine         | 0.20 |    |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Full-fat Extruded**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 37.3  | 100   | 33.6             | 90.0  | 33.0             | 86.8  |
| Lysine, %                                   | 2.32  | 6.22  | 2.02             | 87.0  | 2.00             | 86.4  |
| Methionine, %                               | 0.50  | 1.34  | 0.46             | 92.8  | 0.46             | 91.1  |
| Met + Cys, %                                | 1.08  | 2.90  | 0.89             | 82.7  | 0.90             | 85.1  |
| Threonine, %                                | 1.44  | 3.86  | 1.27             | 88.0  | 1.24             | 86.2  |
| Tryptophan, %                               | 0.51  | 1.37  | 0.47             | 92.6  | 0.40             | 78.2  |
| Arginine, %                                 | 2.67  | 7.16  | 2.59             | 96.9  | 2.47             | 92.6  |
| Gly + Ser, %                                | 3.50  | 9.38  | 3.11             | 88.9  |                  |       |
| Valine, %                                   | 1.77  | 4.75  | 1.58             | 89.1  | 1.51             | 85.1  |
| Isoleucine, %                               | 1.71  | 4.58  | 1.54             | 90.3  | 1.46             | 85.3  |
| Leucine, %                                  | 2.86  | 7.67  | 2.57             | 89.9  | 2.44             | 85.2  |
| Histidine, %                                | 0.96  | 2.57  | 0.85             | 88.7  | 0.88             | 91.6  |
| Phenylalanine, %                            | 1.89  | 5.07  | 1.69             | 89.6  | 1.64             | 87.0  |
| Phe + Tyr, %                                | 3.15  | 8.45  | 2.84             | 90.2  | 2.75             | 87.4  |
| Alanine, %                                  | 1.60  | 4.29  | 1.40             | 87.7  | 1.33             | 83.0  |
| Cysteine, %                                 | 0.58  | 1.56  | 0.43             | 74.0  | 0.46             | 80.0  |
| Tyrosine, %                                 | 1.26  | 3.38  | 1.15             | 91.0  | 1.11             | 88.0  |
| Glycine, %                                  | 1.60  | 4.29  | 1.45             | 90.4  | 1.31             | 82.0  |
| Serine, %                                   | 1.90  | 5.09  | 1.67             | 87.7  | 1.62             | 85.0  |
| Proline, %                                  | 1.92  | 5.15  | 1.59             | 83.0  | 1.69             | 88.0  |
| Glutamine <sup>2</sup> , %                  | 3.32  | 8.91  | 3.13             | 94.3  | 2.90             | 88.0  |
| Glutamic Acid <sup>2</sup> , %              | 3.71  | 9.94  | 3.50             | 94.3  | 3.28             | 88.0  |
| Asparagine <sup>2</sup> , %                 | 1.73  | 4.63  | 1.51             | 87.5  | 1.50             | 87.0  |
| Aspartic Acid <sup>2</sup> , %              | 2.57  | 6.90  | 2.25             | 87.5  | 2.24             | 87.0  |
| Total Nitrogen (PB/6.25), %                 | 5.97  | 16.0  | 5.37             | 90.0  | 5.18             | 86.8  |
| Essential Nitrogen Poultry, %               | 3.26  | 54.6* | 2.94             | 90.2  |                  |       |
| Essential Nitrogen Swine, %                 | 2.71  | 45.4* |                  |       | 2.36             | 87.2  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 8                   | 10     | 10          |             |           |
| <b>Practical Maximum</b>                                           | 15                  | 20     | 20          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 10                  | 10     | 10          | 5           | 10        |
| <b>Practical Maximum</b>                                           | 25                  | 25     | 25          | 25          | 30        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Full-fat Micronized**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 94.0 | 13 | 1.45 | Organic Matter (OM)          | 89.1 |         |
| Crude Protein (CP)        | 39.4 | 15 | 1.30 | Coef. Dig. OM Swine          | 86.8 |         |
| Starch                    | 6.70 | 1  | -    | Digestible OM Swine          | 77.3 |         |
| Crude Fiber (CF)          | 2.51 | 5  | 1.52 | Undig. OM Pigs               | 11.8 |         |
| Coef. Dig. CF Swine       | 77.7 |    |      | Ether Extract (EE)           | 21.2 | 10 0.90 |
| NDF                       | 10.1 | 2  | 2.26 | Coef. Dig. EE Poultry        | 86.0 |         |
| Coef. Dig. NDF Swine      | 98.3 |    |      | Digestible EE Poultry        | 18.2 |         |
| ADF                       | 5.28 | 2  | 0.25 | Coef. Dig. EE Swine          | 81.0 |         |
| Coef. Dig. ADF Swine      | 82.6 |    |      | Digestible EE Swine          | 17.2 |         |
| N-Free Extract (NFE)      | 26.0 |    |      | Linoleic Acid                | 10.6 | 1 -     |
| Coef. Dig. NFE Poultry    | 42.0 |    |      | Linolenic Acid               | 1.61 | - -     |
| Digestible NFE Poultry    | 10.9 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 17.6 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 5354 | 5  | 72   | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 4607 |         |
| Metabolizable Energy      | 3680 |    |      | Metabolizable Energy         | 4400 |         |
| Std. Metab. Energy        | 4171 |    |      | Net Energy                   | 3226 |         |
| Net Energy                | 3050 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 4770 |         |
| Metabolizable Energy      | 3742 |    |      | Metabolizable Energy         | 4492 |         |
| Net Energy                | 3112 |    |      | Net Energy                   | 3294 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 4.93 | 10 | 0.39 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 19.2 | 1 -     |
| Potassium (K)             | 1.65 | 1  | -    | Iron (Fe)                    | 56.2 | 1 -     |
| Sodium (Na)               | 0.01 | 1  | -    | Copper (Cu)                  | 13.7 | 1 -     |
| Chlorine (Cl)             | 0.03 | 1  | -    | Zinc (Zn)                    | 36.2 | 1 -     |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | 0.20 | 1 -     |
| Magnesium (Mg)            | 0.20 | 1  | -    |                              |      |         |
| Total Calcium (Ca)        | 0.25 | 7  | 0.04 |                              |      |         |
| Total Phosphorus (P)      | 0.57 | 7  | 0.06 |                              |      |         |
| Phytate P                 | 0.37 | 6  | 0.03 |                              |      |         |
| Available P (Pav)         | 0.20 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.22 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 38.0 |    |      |                              |      |         |
| Std. Dig. P Swine         | 0.22 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Full-fat Micronized**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 39.4  | 100   | 35.8             | 91.0  | 35.3             | 89.7  |
| Lysine, %                            | 2.43  | 6.17  | 2.26             | 93.0  | 2.25             | 92.7  |
| Methionine, %                        | 0.54  | 1.37  | 0.50             | 91.8  | 0.50             | 93.0  |
| Met + Cys, %                         | 1.08  | 2.74  | 0.96             | 88.5  | 0.97             | 90.2  |
| Threonine, %                         | 1.57  | 3.99  | 1.33             | 84.6  | 1.32             | 84.1  |
| Tryptophan, %                        | 0.53  | 1.35  | 0.47             | 88.0  | 0.45             | 84.7  |
| Arginine, %                          | 3.02  | 7.67  | 2.79             | 92.4  | 2.85             | 94.4  |
| Gly + Ser, %                         | 3.66  | 9.30  | 3.11             | 85.1  |                  |       |
| Valine, %                            | 1.96  | 4.98  | 1.72             | 87.8  | 1.74             | 88.7  |
| Isoleucine, %                        | 1.87  | 4.75  | 1.71             | 91.5  | 1.68             | 89.8  |
| Leucine, %                           | 3.08  | 7.82  | 2.84             | 92.1  | 2.78             | 90.1  |
| Histidine, %                         | 1.10  | 2.79  | 1.00             | 90.5  | 1.01             | 92.1  |
| Phenylalanine, %                     | 2.08  | 5.28  | 2.00             | 96.2  | 1.91             | 91.6  |
| Phe + Tyr, %                         | 3.48  | 8.84  | 3.33             | 95.7  | 3.14             | 90.1  |
| Alanine, %                           | 1.71  | 4.34  | 1.27             | 74.4  | -                | -     |
| Cysteine, %                          | 0.54  | 1.37  | 0.46             | 85.1  | 0.47             | 87.4  |
| Tyrosine, %                          | 1.40  | 3.56  | 1.33             | 95.0  | 1.23             | 87.9  |
| Glycine, %                           | 1.70  | 4.32  | 1.45             | 85.1  | -                | -     |
| Serine, %                            | 1.96  | 4.98  | 1.67             | 85.1  | -                | -     |
| Proline, %                           | 1.98  | 5.03  | 1.88             | 94.9  | -                | -     |
| Glutamine <sup>2</sup> , %           | 3.47  | 8.81  | 3.31             | 95.4  | -                | -     |
| Glutamic Acid <sup>2</sup> , %       | 3.87  | 9.83  | 3.69             | 95.4  | -                | -     |
| Asparagine <sup>2</sup> , %          | 1.76  | 4.47  | 1.61             | 91.2  | -                | -     |
| Aspartic Acid <sup>2</sup> , %       | 2.62  | 6.66  | 2.39             | 91.2  | -                | -     |
| Total Nitrogen (PB/6.25), %          | 6.30  | 16.0  | 5.73             | 91.0  | 5.65             | 89.7  |
| Essential Nitrogen Poultry, %        | 3.56  | 56.5* | 3.22             | 90.3  |                  |       |
| Essential Nitrogen Swine, %          | 2.98  | 47.3* |                  |       | 2.70             | 90.7  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 8            | 10     | 10       |           |           |
| Practical Maximum                                           | 15           | 20     | 20       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 10           | 10     | 10       | 5         | 10        |
| Practical Maximum                                           | 25           | 25     | 25       | 25        | 30        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Full-fat Roasted**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 92.7 | 59 | 1.90 | Organic Matter (OM)          | 88.0  |         |
| Crude Protein (CP)        | 37.2 | 96 | 1.43 | Coef. Dig. OM Swine          | 72.5  |         |
| Starch                    | 6.70 | 1  | -    | Digestible OM Swine          | 63.8  |         |
| Crude Fiber (CF)          | 4.47 | 11 | 1.82 | Undig. OM Pigs               | 24.2  |         |
| Coef. Dig. CF Swine       | 76.6 |    |      | Ether Extract (EE)           | 19.9  | 14 1.56 |
| NDF                       | 14.4 | 3  | 3.01 | Coef. Dig. EE Poultry        | 83.0  |         |
| Coef. Dig. NDF Swine      | 76.7 |    |      | Digestible EE Poultry        | 16.5  |         |
| ADF                       | 10.1 | 3  | 3.21 | Coef. Dig. EE Swine          | 78.0  |         |
| Coef. Dig. ADF Swine      | 85.1 |    |      | Digestible EE Swine          | 15.5  |         |
| N-Free Extract (NFE)      | 26.4 |    |      | Linoleic Acid                | 9.45  | 1 -     |
| Coef. Dig. NFE Poultry    | 30.0 |    |      | Linolenic Acid               | 1.35  | 1 -     |
| Digestible NFE Poultry    | 7.91 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 22.9 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 5170 | 10 | 91   | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3930  |         |
| Metabolizable Energy      | 3267 |    |      | Metabolizable Energy         | 3706  |         |
| Std. Metab. Energy        | 3454 |    |      | Net Energy                   | 2698  |         |
| Net Energy                | 2709 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 4149  |         |
| Metabolizable Energy      | 3344 |    |      | Metabolizable Energy         | 3885  |         |
| Net Energy                | 2786 |    |      | Net Energy                   | 2829  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 4.75 | 4  | 0.30 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 24.8  | 1 -     |
| Potassium (K)             | 1.72 | 3  | 0.11 | Iron (Fe)                    | 179.1 | 1 -     |
| Sodium (Na)               | 0.03 | 3  | 0.04 | Copper (Cu)                  | 13.7  | 1 -     |
| Chlorine (Cl)             | 0.03 | 3  | 0.01 | Zinc (Zn)                    | 41.6  | 1 -     |
| Sulfur (S)                | 0.28 | 1  | -    | Selenium (Se)                | 0.21  | 1 -     |
| Magnesium (Mg)            | 0.32 | 1  | -    |                              |       |         |
| Total Calcium (Ca)        | 0.24 | 4  | 0.05 |                              |       |         |
| Total Phosphorus (P)      | 0.53 | 4  | 0.11 |                              |       |         |
| Phytate P                 | 0.36 | 2  | 0.13 |                              |       |         |
| Available P (Pav)         | 0.17 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.20 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 38.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.20 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Full-fat Roasted**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 37.2  | 100   | 32.8             | 88.0  | 29.3             | 78.6  |
| Lysine, %                            | 2.32  | 6.23  | 2.09             | 90.2  | 1.89             | 81.5  |
| Methionine, %                        | 0.50  | 1.34  | 0.45             | 89.9  | 0.39             | 77.3  |
| Met + Cys, %                         | 1.08  | 2.90  | 0.90             | 82.9  | 0.82             | 76.2  |
| Threonine, %                         | 1.44  | 3.87  | 1.17             | 81.6  | 1.16             | 80.7  |
| Tryptophan, %                        | 0.51  | 1.37  | 0.42             | 83.2  | 0.41             | 80.6  |
| Arginine, %                          | 2.67  | 7.17  | 2.47             | 92.3  | 2.27             | 85.0  |
| Gly + Ser, %                         | 3.50  | 9.40  | 2.89             | 82.7  |                  |       |
| Valine, %                            | 1.77  | 4.75  | 1.49             | 84.1  | 1.41             | 79.5  |
| Isoleucine, %                        | 1.71  | 4.59  | 1.49             | 87.1  | 1.37             | 80.0  |
| Leucine, %                           | 2.86  | 7.68  | 2.54             | 88.7  | 2.26             | 79.0  |
| Histidine, %                         | 0.96  | 2.58  | 0.88             | 92.0  | 0.77             | 79.7  |
| Phenylalanine, %                     | 1.89  | 5.07  | 1.67             | 88.5  | 1.51             | 80.0  |
| Phe + Tyr, %                         | 3.15  | 8.46  | 2.77             | 88.1  | 2.49             | 79.2  |
| Alanine, %                           | 1.60  | 4.30  | 1.35             | 84.4  | 1.18             | 74.0  |
| Cysteine, %                          | 0.58  | 1.56  | 0.45             | 76.9  | 0.44             | 75.0  |
| Tyrosine, %                          | 1.26  | 3.38  | 1.10             | 87.4  | 0.98             | 78.0  |
| Glycine, %                           | 1.60  | 4.30  | 1.29             | 80.4  | 1.18             | 74.0  |
| Serine, %                            | 1.90  | 5.10  | 1.61             | 84.6  | 1.48             | 78.0  |
| Proline, %                           | 1.92  | 5.16  | 1.64             | 85.6  | 1.40             | 73.0  |
| Glutamine <sup>2</sup> , %           | 3.32  | 8.92  | 3.04             | 91.6  | 2.59             | 78.0  |
| Glutamic Acid <sup>2</sup> , %       | 3.71  | 9.96  | 3.40             | 91.6  | 2.89             | 78.0  |
| Asparagine <sup>2</sup> , %          | 1.73  | 4.64  | 1.55             | 89.6  | 1.35             | 78.0  |
| Aspartic Acid <sup>2</sup> , %       | 2.61  | 7.06  | 2.34             | 89.6  | 2.04             | 78.0  |
| Total Nitrogen (PB/6.25), %          | 5.96  | 16.0  | 5.24             | 88.0  | 4.68             | 78.6  |
| Essential Nitrogen Poultry, %        | 3.26  | 54.7* | 2.85             | 87.3  |                  |       |
| Essential Nitrogen Swine, %          | 2.71  | 45.5* |                  |       | 2.19             | 80.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |          |             |           |
|-------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                             | Starter             | Grower |          |             |           |
|                                                             | 5                   | 8      |          | 10          |           |
| <b>Practical Maximum</b>                                    | 10                  | 20     |          | 20          |           |
|                                                             | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                             | 5                   | 10     | 10       | 5           | 10        |
| <b>Practical Maximum</b>                                    | 20                  | 20     | 20       | 25          | 30        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Hulls**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 89.7 | 45 | 1.59 | Organic Matter (OM)          | 85.5 |         |
| Crude Protein (CP)        | 11.6 | 45 | 2.15 | Coef. Dig. OM Swine          | 53.8 |         |
| Starch                    | 3.65 | 1  | -    | Digestible OM Swine          | 46.0 |         |
| Crude Fiber (CF)          | 36.5 | 42 | 3.23 | Undig. OM Pigs               | 39.5 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 2.53 | 20 0.94 |
| NDF                       | 58.1 | 5  | 0.42 | Coef. Dig. EE Poultry        | 60.0 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 1.52 |         |
| ADF                       | 46.1 | 5  | 1.97 | Coef. Dig. EE Swine          | 65.0 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.64 |         |
| N-Free Extract (NFE)      | 34.8 |    |      | Linoleic Acid                | 1.11 | 2 0.01  |
| Coef. Dig. NFE Poultry    | 30.0 |    |      | Linolenic Acid               | 0.21 | 1 -     |
| Digestible NFE Poultry    | 10.5 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 60.9 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 3959 | 6  | 189  | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2162 |         |
| Metabolizable Energy      | 841  |    |      | Metabolizable Energy         | 2046 |         |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 1109 |         |
| Net Energy                | 672  |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2495 |         |
| Metabolizable Energy      | 1021 |    |      | Metabolizable Energy         | 2346 |         |
| Net Energy                | 857  |    |      | Net Energy                   | 1328 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 4.23 | 18 | 0.26 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 19.0 | 1 -     |
| Potassium (K)             | 1.16 | 1  | -    | Iron (Fe)                    | 534  | 1 -     |
| Sodium (Na)               | 0.01 | 1  | -    | Copper (Cu)                  | 76.2 | 1 -     |
| Chlorine (Cl)             | 0.03 | 1  | -    | Zinc (Zn)                    | 35.7 | 1 -     |
| Sulfur (S)                | 0.11 | 1  | -    | Selenium (Se)                | 0.22 | 1 -     |
| Magnesium (Mg)            | 0.17 | 1  | -    |                              |      |         |
| Total Calcium (Ca)        | 0.49 | 9  | 0.03 |                              |      |         |
| Total Phosphorus (P)      | 0.14 | 9  | 0.03 |                              |      |         |
| Phytate P                 | 0.03 | 1  | -    |                              |      |         |
| Available P (Pav)         | 0.11 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 30.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.04 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 30.0 |    |      |                              |      |         |
| Std. Dig. P Swine         | 0.04 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Hulls**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 11.6  | 100   | 6.08             | 52.3  | 7.21             | 62.1  |
| Lysine, %                                   | 0.83  | 7.15  | 0.51             | 61.0  | 0.52             | 63.0  |
| Methionine, %                               | 0.16  | 1.38  | 0.11             | 66.7  | 0.12             | 75.3  |
| Met + Cys, %                                | 0.37  | 3.19  | 0.16             | 43.8  | 0.25             | 68.3  |
| Threonine, %                                | 0.48  | 4.13  | 0.22             | 45.8  | 0.31             | 64.2  |
| Tryptophan, %                               | 0.14  | 1.21  | 0.08             | 55.2  | 0.09             | 64.5  |
| Arginine, %                                 | 0.80  | 6.89  | 0.64             | 79.5  | 0.70             | 87.6  |
| Gly + Ser, %                                | 1.71  | 14.7  | 0.55             | 31.9  |                  |       |
| Valine, %                                   | 0.63  | 5.42  | 0.34             | 53.3  | 0.40             | 64.1  |
| Isoleucine, %                               | 0.55  | 4.74  | 0.30             | 54.2  | 0.39             | 70.4  |
| Leucine, %                                  | 0.92  | 7.92  | 0.53             | 58.0  | 0.66             | 72.0  |
| Histidine, %                                | 0.36  | 3.10  | 0.18             | 49.1  | 0.22             | 60.4  |
| Phenylalanine, %                            | 0.55  | 4.74  | 0.35             | 63.2  | 0.42             | 75.5  |
| Phe + Tyr, %                                | 1.08  | 9.30  | 0.60             | 55.5  | 0.74             | 68.9  |
| Alanine, %                                  | 0.56  | 4.82  | 0.19             | 34.5  | 0.30             | 54.0  |
| Cysteine, %                                 | 0.21  | 1.81  | 0.06             | 26.4  | 0.13             | 62.9  |
| Tyrosine, %                                 | 0.53  | 4.56  | 0.25             | 47.6  | 0.33             | 62.1  |
| Glycine, %                                  | 0.98  | 8.44  | 0.25             | 26.0  | 0.53             | 54.0  |
| Serine, %                                   | 0.73  | 6.28  | 0.29             | 39.9  | 0.39             | 54.0  |
| Proline, %                                  | 0.55  | 4.74  | 0.37             | 67.0  | 0.30             | 54.0  |
| Glutamine <sup>2</sup> , %                  | 0.78  | 6.75  | 0.48             | 60.9  | 0.42             | 54.0  |
| Glutamic Acid <sup>2</sup> , %              | 0.88  | 7.54  | 0.53             | 60.9  | 0.47             | 54.0  |
| Asparagine <sup>2</sup> , %                 | 0.51  | 4.39  | 0.23             | 44.8  | 0.28             | 54.0  |
| Aspartic Acid <sup>2</sup> , %              | 0.76  | 6.54  | 0.34             | 44.8  | 0.41             | 54.0  |
| Total Nitrogen (PB/6.25), %                 | 1.86  | 16.0  | 0.97             | 52.3  | 1.15             | 62.1  |
| Essential Nitrogen Poultry, %               | 1.16  | 62.6* | 0.62             | 53.1  |                  |       |
| Essential Nitrogen Swine, %                 | 0.88  | 47.5* |                  |       | 0.62             | 60.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
| <b>Practical</b>                                                   | -                   | -      | 0           |             |           |
| <b>Maximum</b>                                                     | -                   | -      | 5           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                                   | 0                   | 0      | 0           | 5           | 0         |
| <b>Maximum</b>                                                     | 0                   | 3      | 5           | 12          | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 44.5% CP**

| Main Components (%)       |      |   |    |                              |       |   |    |
|---------------------------|------|---|----|------------------------------|-------|---|----|
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Dry Matter                | 89.5 | - | -  | Organic Matter (OM)          | 83.6  |   |    |
| Crude Protein (CP)        | 44.5 | - | -  | Coef. Dig. OM Swine          | 79.6  |   |    |
| Starch                    | 4.70 | - | -  | Digestible OM Swine          | 66.6  |   |    |
| Crude Fiber (CF)          | 5.84 | - | -  | Undig. OM Pigs               | 17.1  |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 1.93  | - | -  |
| NDF                       | 13.1 | - | -  | Coef. Dig. EE Poultry        | 50.3  |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 0.97  |   |    |
| ADF                       | 8.30 | - | -  | Coef. Dig. EE Swine          | 60.2  |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 1.16  |   |    |
| N-Free Extract (NFE)      | 31.4 |   |    | Linoleic Acid                | 0.68  | - | -  |
| Coef. Dig. NFE Poultry    | 31.9 |   |    | Linolenic Acid               | 0.09  | - | -  |
| Digestible NFE Poultry    | 10.0 |   |    |                              |       |   |    |
| Undig. NFE + CF Poultry   | 27.2 |   |    |                              |       |   |    |
|                           |      |   |    |                              |       |   |    |
| Energy (kcal/kg)          |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Gross Energy              | 4147 | - | -  | <b>Swine</b>                 |       |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3396  |   |    |
| Metabolizable Energy      | 2212 |   |    | Metabolizable Energy         | 3142  |   |    |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | 1982  |   |    |
| Net Energy                | 1715 |   |    | <b>Sows</b>                  |       |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3587  |   |    |
| Metabolizable Energy      | 2276 |   |    | Metabolizable Energy         | 3269  |   |    |
| Net Energy                | 1778 |   |    | Net Energy                   | 2074  |   |    |
|                           |      |   |    |                              |       |   |    |
| Minerals                  |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Ash, %                    | 5.86 | - | -  | <b>Trace Minerals, mg/kg</b> |       |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 30.1  | - | -  |
| Potassium (K)             | 1.94 | - | -  | Iron (Fe)                    | 159.4 | - | -  |
| Sodium (Na)               | 0.01 | - | -  | Copper (Cu)                  | 18.8  | - | -  |
| Chlorine (Cl)             | 0.05 | - | -  | Zinc (Zn)                    | 47.5  | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | 0.43  | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |       |   |    |
| Total Calcium (Ca)        | 0.31 | - | -  |                              |       |   |    |
| Total Phosphorus (P)      | 0.57 | - | -  |                              |       |   |    |
| Phytate P                 | 0.35 | - | -  |                              |       |   |    |
| Available P (Pav)         | 0.22 |   |    |                              |       |   |    |
| Coef. Dig. P Poultry      | 41.6 |   |    |                              |       |   |    |
| Std. Dig. P Poultry       | 0.24 |   |    |                              |       |   |    |
| Coef. Dig. P Swine        | 45.2 |   |    |                              |       |   |    |
| Std. Dig. P Swine         | 0.26 |   |    |                              |       |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 44.5% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 44.5  | 100   | 39.2             | 88.1  | 39.4             | 88.6  |
| Lysine, %                            | 2.81  | 6.31  | 2.52             | 89.6  | 2.51             | 89.2  |
| Methionine, %                        | 0.60  | 1.35  | 0.55             | 90.9  | 0.55             | 91.3  |
| Met + Cys, %                         | 1.23  | 2.76  | 1.08             | 87.5  | 1.12             | 90.7  |
| Threonine, %                         | 1.80  | 4.04  | 1.52             | 84.7  | 1.54             | 85.7  |
| Tryptophan, %                        | 0.62  | 1.39  | 0.55             | 88.0  | 0.55             | 88.4  |
| Arginine, %                          | 3.25  | 7.30  | 3.00             | 92.4  | 3.05             | 93.8  |
| Gly + Ser, %                         | 4.41  | 9.91  | 3.72             | 84.3  |                  |       |
| Valine, %                            | 2.16  | 4.85  | 1.87             | 86.7  | 1.89             | 87.3  |
| Isoleucine, %                        | 2.04  | 4.58  | 1.79             | 87.7  | 1.81             | 88.8  |
| Leucine, %                           | 3.43  | 7.71  | 3.02             | 88.1  | 3.03             | 88.5  |
| Histidine, %                         | 1.17  | 2.63  | 1.03             | 87.7  | 1.05             | 89.6  |
| Phenylalanine, %                     | 2.28  | 5.12  | 2.02             | 88.7  | 2.04             | 89.5  |
| Phe + Tyr, %                         | 3.95  | 8.88  | 3.47             | 88.0  | 3.53             | 89.3  |
| Alanine, %                           | 2.04  | 4.58  | 1.69             | 83.0  | 1.75             | 85.8  |
| Cysteine, %                          | 0.64  | 1.44  | 0.53             | 82.9  | 0.57             | 88.7  |
| Tyrosine, %                          | 1.67  | 3.75  | 1.45             | 87.0  | 1.48             | 88.9  |
| Glycine, %                           | 2.01  | 4.52  | 1.62             | 80.4  | 1.71             | 84.9  |
| Serine, %                            | 2.40  | 5.39  | 2.10             | 87.6  | 2.10             | 87.7  |
| Proline, %                           | 2.33  | 5.24  | 2.06             | 88.5  | 2.06             | 88.5  |
| Glutamine <sup>2</sup> , %           | 3.93  | 8.83  | 3.58             | 91.2  | 3.50             | 89.1  |
| Glutamic Acid <sup>2</sup> , %       | 4.39  | 9.87  | 4.00             | 91.2  | 3.91             | 89.1  |
| Asparagine <sup>2</sup> , %          | 2.21  | 4.97  | 1.93             | 87.4  | 1.94             | 87.7  |
| Aspartic Acid <sup>2</sup> , %       | 3.30  | 7.42  | 2.88             | 87.4  | 2.89             | 87.7  |
| Total Nitrogen (PB/6.25), %          | 7.12  | 16.0  | 6.27             | 88.1  | 6.31             | 88.6  |
| Essential Nitrogen Poultry, %        | 4.98  | 56.0* | 3.50             | 87.9  |                  |       |
| Essential Nitrogen Swine, %          | 3.29  | 46.2* |                  |       | 2.94             | 89.4  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 35           | 35     | 35       | 30        | 30        |
| Practical Maximum                                           | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 30           | 25     | 20       | 15        | 25        |
|                                                             | 30           | 25     | 20       | 15        | 25        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 45.6% CP (Average)**

| Main Components (%)       |      |     |      |                              |       |          |
|---------------------------|------|-----|------|------------------------------|-------|----------|
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Dry Matter                | 89.5 | 311 | 1.36 | Organic Matter (OM)          | 83.6  |          |
| Crude Protein (CP)        | 45.6 | 284 | 1.02 | Coef. Dig. OM Swine          | 80.5  |          |
| Starch                    | 4.74 | 20  | 1.88 | Digestible OM Swine          | 67.3  |          |
| Crude Fiber (CF)          | 4.82 | 173 | 0.63 | Undig. OM Pigs               | 16.3  |          |
| Coef. Dig. CF Swine       | 68.6 |     |      | Ether Extract (EE)           | 1.91  | 189 0.80 |
| NDF                       | 11.6 | 11  | 1.70 | Coef. Dig. EE Poultry        | 50.0  |          |
| Coef. Dig. NDF Swine      | 82.6 |     |      | Digestible EE Poultry        | 0.95  |          |
| ADF                       | 7.07 | 11  | 1.36 | Coef. Dig. EE Swine          | 60.0  |          |
| Coef. Dig. ADF Swine      | 77.7 |     |      | Digestible EE Swine          | 1.15  |          |
| N-Free Extract (NFE)      | 31.3 |     |      | Linoleic Acid                | 0.67  | 1 -      |
| Coef. Dig. NFE Poultry    | 32.0 |     |      | Linolenic Acid               | 0.09  | 1 -      |
| Digestible NFE Poultry    | 10.0 |     |      |                              |       |          |
| Undig. NFE + CF Poultry   | 26.1 |     |      |                              |       |          |
| Energy (kcal/kg)          |      |     |      |                              |       |          |
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Gross Energy              | 4153 | 27  | 71   | <b>Swine</b>                 |       |          |
| <b>Poultry</b>            |      |     |      | Digestible Energy            | 3437  |          |
| Metabolizable Energy      | 2258 |     |      | Metabolizable Energy         | 3179  |          |
| Std. Metab. Energy        | 2538 |     |      | Net Energy                   | 2011  |          |
| Net Energy                | 1746 |     |      | <b>Sows</b>                  |       |          |
| <b>Hens</b>               |      |     |      | Digestible Energy            | 3626  |          |
| Metabolizable Energy      | 2332 |     |      | Metabolizable Energy         | 3301  |          |
| Net Energy                | 1820 |     |      | Net Energy                   | 2100  |          |
| Minerals                  |      |     |      |                              |       |          |
|                           | Mean | n   | SD   |                              | Mean  | n SD     |
| Ash, %                    | 5.91 | 66  | 0.41 | <b>Trace Minerals, mg/kg</b> |       |          |
| <b>Macro Minerals (%)</b> |      |     |      | Manganese (Mn)               | 30.4  | 4 4.63   |
| Potassium (K)             | 1.97 | 9   | 0.23 | Iron (Fe)                    | 146.9 | 4 28.1   |
| Sodium (Na)               | 0.01 | 15  | 0.01 | Copper (Cu)                  | 16.9  | 4 3.10   |
| Chlorine (Cl)             | 0.05 | 1   | -    | Zinc (Zn)                    | 47.9  | 4 5.64   |
| Sulfur (S)                | 0.31 | 1   | -    | Selenium (Se)                | 0.44  | 1 -      |
| Magnesium (Mg)            | 0.33 | 9   | 0.02 |                              |       |          |
| Total Calcium (Ca)        | 0.30 | 34  | 0.05 |                              |       |          |
| Total Phosphorus (P)      | 0.58 | 97  | 0.06 |                              |       |          |
| Phytate P                 | 0.36 | 65  | 0.04 |                              |       |          |
| Available P (Pav)         | 0.22 |     |      |                              |       |          |
| Coef. Dig. P Poultry      | 42.0 |     |      |                              |       |          |
| Std. Dig. P Poultry       | 0.24 |     |      |                              |       |          |
| Coef. Dig. P Swine        | 45.7 |     |      |                              |       |          |
| Std. Dig. P Swine         | 0.26 |     |      |                              |       |          |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 45.6% CP (Average)**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 45.6  | 100   | 40.7             | 89.3  | 40.8             | 89.5  |
| Lysine, %                            | 2.88  | 6.31  | 2.60             | 90.6  | 2.59             | 90.1  |
| Methionine, %                        | 0.61  | 1.34  | 0.56             | 91.7  | 0.56             | 91.8  |
| Met + Cys, %                         | 1.26  | 2.77  | 1.11             | 88.1  | 1.15             | 90.7  |
| Threonine, %                         | 1.84  | 4.04  | 1.58             | 86.0  | 1.59             | 86.4  |
| Tryptophan, %                        | 0.64  | 1.40  | 0.57             | 89.1  | 0.57             | 89.2  |
| Arginine, %                          | 3.33  | 7.31  | 3.09             | 92.8  | 3.13             | 94.0  |
| Gly + Ser, %                         | 4.50  | 9.86  | 3.87             | 86.0  |                  |       |
| Valine, %                            | 2.21  | 4.85  | 1.94             | 87.8  | 1.95             | 88.1  |
| Isoleucine, %                        | 2.09  | 4.59  | 1.86             | 88.8  | 1.87             | 89.4  |
| Leucine, %                           | 3.51  | 7.69  | 3.12             | 89.1  | 3.12             | 89.0  |
| Histidine, %                         | 1.20  | 2.63  | 1.07             | 89.0  | 1.09             | 90.6  |
| Phenylalanine, %                     | 2.34  | 5.13  | 2.10             | 89.6  | 2.11             | 90.0  |
| Phe + Tyr, %                         | 4.05  | 8.88  | 3.60             | 89.1  | 3.64             | 89.9  |
| Alanine, %                           | 2.09  | 4.58  | 1.77             | 84.6  | 1.81             | 86.9  |
| Cysteine, %                          | 0.65  | 1.43  | 0.55             | 84.8  | 0.58             | 89.6  |
| Tyrosine, %                          | 1.71  | 3.75  | 1.51             | 88.3  | 1.53             | 89.8  |
| Glycine, %                           | 2.04  | 4.47  | 1.67             | 82.2  | 1.75             | 85.9  |
| Serine, %                            | 2.46  | 5.40  | 2.19             | 89.2  | 2.18             | 88.8  |
| Proline, %                           | 2.39  | 5.24  | 2.13             | 89.2  | 2.14             | 89.7  |
| Glutamine <sup>2</sup> , %           | 4.04  | 8.87  | 3.73             | 92.2  | 3.65             | 90.3  |
| Glutamic Acid <sup>2</sup> , %       | 4.51  | 9.90  | 4.16             | 92.2  | 4.07             | 90.3  |
| Asparagine <sup>2</sup> , %          | 2.27  | 4.98  | 2.02             | 88.8  | 2.02             | 88.8  |
| Aspartic Acid <sup>2</sup> , %       | 3.38  | 7.41  | 3.00             | 88.8  | 3.00             | 88.8  |
| Total Nitrogen (PB/6.25), %          | 7.29  | 16.0  | 6.51             | 89.3  | 6.52             | 89.5  |
| Essential Nitrogen Poultry, %        | 4.08  | 55.9* | 3.63             | 89.0  |                  |       |
| Essential Nitrogen Swine, %          | 3.37  | 46.2* |                  |       | 3.03             | 90.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 35           | 35     | 35       | 30        | 30        |
| Practical Maximum                                           | 35           | 35     | 35       | 30        | 30        |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 30           | 25     | 20       | 15        | 25        |
| Practical Maximum                                           | 30           | 25     | 20       | 15        | 25        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 46.5% CP**

| Main Components (%)       |       |   |    |                              |       |   |    |
|---------------------------|-------|---|----|------------------------------|-------|---|----|
|                           | Mean  | n | SD |                              | Mean  | n | SD |
| Dry Matter                | 89.5  | - | -  | Organic Matter (OM)          | 83.5  |   |    |
| Crude Protein (CP)        | 46.5  | - | -  | Coef. Dig. OM Swine          | 81.2  |   |    |
| Starch                    | 4.77  | - | -  | Digestible OM Swine          | 67.8  |   |    |
| Crude Fiber (CF)          | 3.98  | - | -  | Undig. OM Pigs               | 15.7  |   |    |
| Coef. Dig. CF Swine       | -     |   |    | Ether Extract (EE)           | 1.89  | - | -  |
| NDF                       | 10.41 | - | -  | Coef. Dig. EE Poultry        | 49.7  |   |    |
| Coef. Dig. NDF Swine      | -     |   |    | Digestible EE Poultry        | 0.94  |   |    |
| ADF                       | 6.04  | - | -  | Coef. Dig. EE Swine          | 59.9  |   |    |
| Coef. Dig. ADF Swine      | -     |   |    | Digestible EE Swine          | 1.13  |   |    |
| N-Free Extract (NFE)      | 31.2  |   |    | Linoleic Acid                | 0.66  | - | -  |
| Coef. Dig. NFE Poultry    | 32.1  |   |    | Linolenic Acid               | 0.09  | - | -  |
| Digestible NFE Poultry    | 10.0  |   |    |                              |       |   |    |
| Undig. NFE + CF Poultry   | 25.2  |   |    |                              |       |   |    |
| Energy (kcal/kg)          |       |   |    |                              |       |   |    |
|                           | Mean  | n | SD |                              | Mean  | n | SD |
| Gross Energy              | 4158  | - | -  | <b>Swine</b>                 |       |   |    |
| <b>Poultry</b>            |       |   |    | Digestible Energy            | 3471  |   |    |
| Metabolizable Energy      | 2296  |   |    | Metabolizable Energy         | 3209  |   |    |
| Std. Metab. Energy        | -     |   |    | Net Energy                   | 2035  |   |    |
| Net Energy                | 1771  |   |    | <b>Sows</b>                  |       |   |    |
| <b>Hens</b>               |       |   |    | Digestible Energy            | 3657  |   |    |
| Metabolizable Energy      | 2385  |   |    | Metabolizable Energy         | 3325  |   |    |
| Net Energy                | 1859  |   |    | Net Energy                   | 2120  |   |    |
| Minerals                  |       |   |    |                              |       |   |    |
|                           | Mean  | n | SD |                              | Mean  | n | SD |
| Ash, %                    | 5.95  | - | -  | <b>Trace Minerals, mg/kg</b> |       |   |    |
| <b>Macro Minerals (%)</b> |       |   |    | Manganese (Mn)               | 30.7  | - | -  |
| Potassium (K)             | 1.99  | - | -  | Iron (Fe)                    | 136.7 | - | -  |
| Sodium (Na)               | 0.01  | - | -  | Copper (Cu)                  | 15.3  | - | -  |
| Chlorine (Cl)             | 0.05  | - | -  | Zinc (Zn)                    | 48.2  | - | -  |
| Sulfur (S)                | -     | - | -  | Selenium (Se)                | 0.45  | - | -  |
| Magnesium (Mg)            | -     | - | -  |                              |       |   |    |
| Total Calcium (Ca)        | 0.29  | - | -  |                              |       |   |    |
| Total Phosphorus (P)      | 0.59  | - | -  |                              |       |   |    |
| Phytate P                 | 0.37  | - | -  |                              |       |   |    |
| Available P (Pav)         | 0.22  |   |    |                              |       |   |    |
| Coef. Dig. P Poultry      | 42.3  |   |    |                              |       |   |    |
| Std. Dig. P Poultry       | 0.25  |   |    |                              |       |   |    |
| Coef. Dig. P Swine        | 46.1  |   |    |                              |       |   |    |
| Std. Dig. P Swine         | 0.27  |   |    |                              |       |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 46.5% CP**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 46.5  | 100   | 41.9             | 90.2  | 41.9             | 90.2  |
| Lysine, %                            | 2.93  | 6.31  | 2.68             | 91.4  | 2.66             | 90.8  |
| Methionine, %                        | 0.62  | 1.34  | 0.57             | 92.4  | 0.57             | 92.2  |
| Met + Cys, %                         | 1.28  | 2.76  | 1.15             | 89.3  | 1.17             | 91.2  |
| Threonine, %                         | 1.88  | 4.03  | 1.63             | 87.1  | 1.63             | 87.0  |
| Tryptophan, %                        | 0.65  | 1.40  | 0.59             | 90.0  | 0.59             | 89.9  |
| Arginine, %                          | 3.40  | 7.31  | 3.16             | 93.2  | 3.20             | 94.2  |
| Gly + Ser, %                         | 4.57  | 9.84  | 4.00             | 87.4  |                  |       |
| Valine, %                            | 2.25  | 4.84  | 2.00             | 88.7  | 2.00             | 88.7  |
| Isoleucine, %                        | 2.13  | 4.58  | 1.91             | 89.7  | 1.92             | 89.9  |
| Leucine, %                           | 3.58  | 7.70  | 3.22             | 89.9  | 3.20             | 89.5  |
| Histidine, %                         | 1.22  | 2.63  | 1.10             | 90.1  | 1.12             | 91.4  |
| Phenylalanine, %                     | 2.39  | 5.13  | 2.16             | 90.3  | 2.16             | 90.4  |
| Phe + Tyr, %                         | 4.13  | 8.88  | 3.71             | 89.9  | 3.73             | 90.4  |
| Alanine, %                           | 2.13  | 4.58  | 1.83             | 85.9  | 1.87             | 87.8  |
| Cysteine, %                          | 0.66  | 1.42  | 0.57             | 86.3  | 0.60             | 90.3  |
| Tyrosine, %                          | 1.74  | 3.74  | 1.56             | 89.4  | 1.58             | 90.5  |
| Glycine, %                           | 2.07  | 4.45  | 1.73             | 83.7  | 1.79             | 86.7  |
| Serine, %                            | 2.51  | 5.39  | 2.27             | 90.5  | 2.25             | 89.7  |
| Proline, %                           | 2.44  | 5.24  | 2.19             | 89.8  | 2.21             | 90.6  |
| Glutamine <sup>2</sup> , %           | 4.13  | 8.87  | 3.84             | 93.0  | 3.77             | 91.3  |
| Glutamic Acid <sup>2</sup> , %       | 4.61  | 9.91  | 4.28             | 93.0  | 4.20             | 91.3  |
| Asparagine <sup>2</sup> , %          | 2.32  | 4.98  | 2.08             | 90.0  | 2.08             | 89.7  |
| Aspartic Acid <sup>2</sup> , %       | 3.45  | 7.42  | 3.10             | 90.0  | 3.09             | 89.7  |
| Total Nitrogen (PB/6.25), %          | 7.44  | 16.0  | 6.71             | 90.2  | 6.71             | 90.2  |
| Essential Nitrogen Poultry, %        | 4.16  | 55.9* | 3.73             | 89.8  |                  |       |
| Essential Nitrogen Swine, %          | 3.44  | 46.2* |                  |       | 3.11             | 90.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 35           | 35     | 35       | 30        | 30        |
| Practical Maximum                                           | 35           | 35     | 35       | 30        | 30        |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 30           | 25     | 20       | 15        | 25        |
| Practical Maximum                                           | 30           | 25     | 20       | 15        | 25        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 48% CP**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 88.9 | 74 | 1.01 | Organic Matter (OM)          | 82.8  |         |
| Crude Protein (CP)        | 48.2 | 54 | 0.72 | Coef. Dig. OM Swine          | 84.5  |         |
| Starch                    | 3.00 | 1  | -    | Digestible OM Swine          | 69.9  |         |
| Crude Fiber (CF)          | 4.55 | 41 | 0.54 | Undig. OM Pigs               | 12.8  |         |
| Coef. Dig. CF Swine       | 68.6 |    |      | Ether Extract (EE)           | 1.72  | 60 0.53 |
| NDF                       | 11.5 | 3  | 2.98 | Coef. Dig. EE Poultry        | 50.0  |         |
| Coef. Dig. NDF Swine      | 82.6 |    |      | Digestible EE Poultry        | 0.86  |         |
| ADF                       | 8.60 | 3  | 3.47 | Coef. Dig. EE Swine          | 60.0  |         |
| Coef. Dig. ADF Swine      | 77.7 |    |      | Digestible EE Swine          | 1.03  |         |
| N-Free Extract (NFE)      | 28.3 |    |      | Linoleic Acid                | 0.77  | 1 -     |
| Coef. Dig. NFE Poultry    | 30.0 |    |      | Linolenic Acid               | 0.10  | 1 -     |
| Digestible NFE Poultry    | 8.50 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 24.4 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 4187 | 4  | 28   | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3548  |         |
| Metabolizable Energy      | 2295 |    |      | Metabolizable Energy         | 3306  |         |
| Std. Metab. Energy        | 2373 |    |      | Net Energy                   | 2080  |         |
| Net Energy                | 1769 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3801  |         |
| Metabolizable Energy      | 2371 |    |      | Metabolizable Energy         | 3447  |         |
| Net Energy                | 1845 |    |      | Net Energy                   | 2183  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 6.10 | 81 | 0.36 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 30.7  | 2 1.41  |
| Potassium (K)             | 2.13 | 2  | 0.03 | Iron (Fe)                    | 159.5 | 2 12.1  |
| Sodium (Na)               | 0.02 | 2  | 0.00 | Copper (Cu)                  | 9.0   | 1 -     |
| Chlorine (Cl)             | 0.05 | 1  | -    | Zinc (Zn)                    | 47.7  | 2 4.03  |
| Sulfur (S)                | 0.42 | 1  | -    | Selenium (Se)                | 0.34  | 1 -     |
| Magnesium (Mg)            | 0.27 | 2  | 0.06 |                              |       |         |
| Total Calcium (Ca)        | 0.34 | 10 | 0.03 |                              |       |         |
| Total Phosphorus (P)      | 0.59 | 27 | 0.03 |                              |       |         |
| Phytate P                 | 0.36 | 25 | 0.03 |                              |       |         |
| Available P (Pav)         | 0.23 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 45.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.27 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 45.7 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.27 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Meal 48% CP**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 48.2  | 100   | 43.3             | 89.9  | 44.0             | 91.3  |
| Lysine, %                                   | 2.97  | 6.17  | 2.74             | 92.4  | 2.71             | 91.2  |
| Methionine, %                               | 0.63  | 1.31  | 0.59             | 93.6  | 0.58             | 92.5  |
| Met + Cys, %                                | 1.35  | 2.80  | 1.21             | 89.6  | 1.22             | 90.3  |
| Threonine, %                                | 1.87  | 3.88  | 1.64             | 87.6  | 1.64             | 87.5  |
| Tryptophan, %                               | 0.67  | 1.39  | 0.61             | 90.9  | 0.61             | 90.3  |
| Arginine, %                                 | 3.49  | 7.25  | 3.23             | 92.5  | 3.31             | 94.7  |
| Gly + Ser, %                                | 4.65  | 9.65  | 4.01             | 86.2  |                  |       |
| Valine, %                                   | 2.29  | 4.75  | 2.00             | 87.4  | 2.05             | 89.5  |
| Isoleucine, %                               | 2.23  | 4.63  | 1.99             | 89.1  | 2.01             | 90.2  |
| Leucine, %                                  | 3.65  | 7.58  | 3.35             | 91.8  | 3.30             | 90.5  |
| Histidine, %                                | 1.25  | 2.59  | 1.14             | 91.0  | 1.14             | 91.2  |
| Phenylalanine, %                            | 2.48  | 5.15  | 2.34             | 94.2  | 2.24             | 90.5  |
| Phe + Tyr, %                                | 4.18  | 8.68  | 3.83             | 91.6  | 3.81             | 91.1  |
| Alanine, %                                  | 2.00  | 4.15  | 1.74             | 86.9  | 1.78             | 89.2  |
| Cysteine, %                                 | 0.72  | 1.49  | 0.62             | 86.1  | 0.64             | 88.4  |
| Tyrosine, %                                 | 1.70  | 3.53  | 1.49             | 87.8  | 1.56             | 91.9  |
| Glycine, %                                  | 2.10  | 4.36  | 1.73             | 82.4  | 1.89             | 90.0  |
| Serine, %                                   | 2.55  | 5.29  | 2.28             | 89.4  | 2.32             | 91.0  |
| Proline, %                                  | 2.36  | 4.90  | 2.12             | 90.0  | 2.17             | 92.0  |
| Glutamine <sup>2</sup> , %                  | 4.88  | 10.1  | 4.41             | 90.5  | 4.54             | 93.0  |
| Glutamic Acid <sup>2</sup> , %              | 5.44  | 11.3  | 4.93             | 90.5  | 5.06             | 93.0  |
| Asparagine <sup>2</sup> , %                 | 2.21  | 4.59  | 1.97             | 89.2  | 2.01             | 91.0  |
| Aspartic Acid <sup>2</sup> , %              | 3.29  | 6.83  | 2.93             | 89.2  | 2.99             | 91.0  |
| Total Nitrogen (PB/6.25), %                 | 7.71  | 16.0  | 6.93             | 89.9  | 7.04             | 91.3  |
| Essential Nitrogen Poultry, %               | 4.24  | 55.1* | 3.83             | 90.3  |                  |       |
| Essential Nitrogen Swine, %                 | 3.51  | 45.6* |                  |       | 3.20             | 91.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
| <b>Practical</b>                                                   | 35                  | 35     |             | 30          |           |
| <b>Maximum</b>                                                     | 35                  | 35     |             | 30          |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                                   | 30                  | 25     | 20          | 15          | 25        |
| <b>Maximum</b>                                                     | 30                  | 25     | 20          | 15          | 25        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Protein Concentrate**

| Main Components (%)       |      |    |      |                              |      |        |
|---------------------------|------|----|------|------------------------------|------|--------|
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Dry Matter                | 91.1 | 21 | 2.20 | Organic Matter (OM)          | 85.2 |        |
| Crude Protein (CP)        | 62.4 | 33 | 2.42 | Coef. Dig. OM Swine          | 89.4 |        |
| Starch                    | 7.50 | 1  | -    | Digestible OM Swine          | 76.1 |        |
| Crude Fiber (CF)          | 3.36 | 9  | 0.92 | Undig. OM Pigs               | 9.03 |        |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 0.58 | 8 0.12 |
| NDF                       | 11.8 | 6  | 2.64 | Coef. Dig. EE Poultry        | 50.0 |        |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 0.29 |        |
| ADF                       | 6.36 | 3  | 0.28 | Coef. Dig. EE Swine          | 57.5 |        |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 0.33 |        |
| N-Free Extract (NFE)      | 18.8 |    |      | Linoleic Acid                | 0.27 | 1 -    |
| Coef. Dig. NFE Poultry    | 17.0 |    |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | 3.19 |    |      |                              |      |        |
| Undig. NFE + CF Poultry   | 19.0 |    |      |                              |      |        |
| Energy (kcal/kg)          |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Gross Energy              | 4471 | 5  | 99   | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 4071 |        |
| Metabolizable Energy      | 2635 |    |      | Metabolizable Energy         | 3638 |        |
| Std. Metab. Energy        | 2870 |    |      | Net Energy                   | 2240 |        |
| Net Energy                | 2010 |    |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 4131 |        |
| Metabolizable Energy      | 2699 |    |      | Metabolizable Energy         | 3705 |        |
| Net Energy                | 2074 |    |      | Net Energy                   | 2289 |        |
| Minerals                  |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Ash, %                    | 5.90 | 15 | 0.49 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 38.3 | 1 -    |
| Potassium (K)             | 2.18 | 1  | -    | Iron (Fe)                    | 92.3 | 1 -    |
| Sodium (Na)               | 0.05 | 1  | -    | Copper (Cu)                  | 32.6 | 1 -    |
| Chlorine (Cl)             | -    | -  | -    | Zinc (Zn)                    | 24.0 | 1 -    |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | 0.29 | 1  | -    |                              |      |        |
| Total Calcium (Ca)        | 0.29 | 6  | 0.04 |                              |      |        |
| Total Phosphorus (P)      | 0.73 | 13 | 0.14 |                              |      |        |
| Phytate P                 | 0.45 | 6  | 0.10 |                              |      |        |
| Available P (Pav)         | 0.28 |    |      |                              |      |        |
| Coef. Dig. P Poultry      | 40.0 |    |      |                              |      |        |
| Std. Dig. P Poultry       | 0.29 |    |      |                              |      |        |
| Coef. Dig. P Swine        | 40.0 |    |      |                              |      |        |
| Std. Dig. P Swine         | 0.29 |    |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Protein Concentrate**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 62.4                                 | 100   | 57.6             | 92.3  | 57.8             | 92.6  |
| Lysine, %                      | 3.84                                 | 6.15  | 3.61             | 93.9  | 3.56             | 92.6  |
| Methionine, %                  | 0.82                                 | 1.31  | 0.78             | 96.2  | 0.77             | 94.1  |
| Met + Cys, %                   | 1.60                                 | 2.56  | 1.43             | 89.5  | 1.47             | 92.1  |
| Threonine, %                   | 2.57                                 | 4.12  | 2.29             | 89.1  | 2.30             | 89.5  |
| Tryptophan, %                  | 0.72                                 | 1.16  | 0.69             | 95.9  | 0.66             | 90.7  |
| Arginine, %                    | 4.44                                 | 7.11  | 4.22             | 95.0  | 4.35             | 97.9  |
| Gly + Ser, %                   | 5.92                                 | 9.48  | 4.52             | 76.3  |                  |       |
| Valine, %                      | 3.18                                 | 5.09  | 2.89             | 90.9  | 2.90             | 91.1  |
| Isoleucine, %                  | 2.80                                 | 4.48  | 2.66             | 95.2  | 2.62             | 93.7  |
| Leucine, %                     | 4.77                                 | 7.64  | 4.45             | 93.2  | 4.50             | 94.2  |
| Histidine, %                   | 2.11                                 | 3.37  | 1.93             | 91.9  | 1.96             | 93.1  |
| Phenylalanine, %               | 3.12                                 | 5.00  | 2.94             | 94.2  | 2.93             | 93.9  |
| Phe + Tyr, %                   | 5.26                                 | 8.43  | 4.82             | 91.7  | 4.87             | 92.6  |
| Alanine, %                     | 2.67                                 | 4.27  | 2.46             | 92.3  | 2.42             | 90.7  |
| Cysteine, %                    | 0.78                                 | 1.25  | 0.65             | 82.9  | 0.71             | 90.4  |
| Tyrosine, %                    | 2.14                                 | 3.43  | 1.88             | 87.8  | 1.94             | 90.5  |
| Glycine, %                     | 2.60                                 | 4.17  | 1.78             | 68.3  | 2.38             | 91.4  |
| Serine, %                      | 3.32                                 | 5.31  | 2.74             | 82.7  | 2.93             | 88.5  |
| Proline, %                     | 3.11                                 | 4.98  | 2.85             | 91.8  | 2.92             | 94.1  |
| Glutamine <sup>2</sup> , %     | 5.10                                 | 8.16  | 5.01             | 98.4  | 4.76             | 93.5  |
| Glutamic Acid <sup>2</sup> , % | 6.15                                 | 9.86  | 6.06             | 98.4  | 5.75             | 93.5  |
| Asparagine <sup>2</sup> , %    | 2.88                                 | 4.62  | 2.71             | 94.1  | 2.62             | 90.8  |
| Aspartic Acid <sup>2</sup> , % | 4.47                                 | 7.16  | 4.21             | 94.1  | 4.06             | 90.8  |
| Total Nitrogen (PB/6.25), %    | 9.99                                 | 16.0  | 9.22             | 92.3  | 9.25             | 92.6  |
| Essential Nitrogen Poultry, %  | 5.59                                 | 56.0* | 5.05             | 90.4  |                  |       |
| Essential Nitrogen Swine, %    | 4.66                                 | 46.7* |                  |       | 4.36             | 93.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
| <b>Practical</b>                                            | -                   | -      |             |             |           |
| <b>Maximum</b>                                              | -                   | -      |             |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                            | -                   | -      | -           | -           | -         |
| <b>Maximum</b>                                              | -                   | -      | -           | -           | -         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Protein Isolate**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 94.6 | 7 | 4.22 | Organic Matter (OM)          | 90.5 |        |
| Crude Protein (CP)        | 81.0 | 6 | 4.35 | Coef. Dig. OM Swine          | 82.0 |        |
| Starch                    | 1.89 | 1 | -    | Digestible OM Swine          | 74.2 |        |
| Crude Fiber (CF)          | 0.23 | 2 | 0.08 | Undig. OM Pigs               | 16.3 |        |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 1.11 | 3 0.36 |
| NDF                       | 0.19 | 1 | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | -    |        |
| ADF                       | -    | - | -    | Coef. Dig. EE Swine          | -    |        |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | -    |        |
| N-Free Extract (NFE)      | 8.11 |   |      | Linoleic Acid                | 1.18 | 1 -    |
| Coef. Dig. NFE Poultry    | -    |   |      | Linolenic Acid               | 0.15 | 1 -    |
| Digestible NFE Poultry    | -    |   |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |   |      |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 5062 | 2 | 458  | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 4150 |        |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | 3573 |        |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | -    |        |
| Net Energy                | -    |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | -    |        |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | -    |        |
| Net Energy                | -    |   |      | Net Energy                   | -    |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 4.08 | 2 | 0.13 | <b>Trace Minerals, mg/kg</b> | -    | - -    |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.16 | 1 | -    | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 1.14 | 1 | -    | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.02 | 1 | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | -    | - | -    |                              |      |        |
| Total Calcium (Ca)        | 0.17 | 2 | 0.00 |                              |      |        |
| Total Phosphorus (P)      | 0.74 | 2 | 0.02 |                              |      |        |
| Phytate P                 | -    | - | -    |                              |      |        |
| Available P (Pav)         | -    |   |      |                              |      |        |
| Coef. Dig. P Poultry      | -    |   |      |                              |      |        |
| Std. Dig. P Poultry       | -    |   |      |                              |      |        |
| Coef. Dig. P Swine        | -    |   |      |                              |      |        |
| Std. Dig. P Swine         | -    |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Protein Isolate**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 81.0  | 100   | 76.2             | 94.0  | 73.6             | 90.9  |
| Lysine, %                            | 4.79  | 5.91  | 4.50             | 93.9  | 4.36             | 91.0  |
| Methionine, %                        | 1.05  | 1.30  | 0.99             | 94.4  | 0.91             | 86.0  |
| Met + Cys, %                         | 2.01  | 2.48  | 1.89             | 94.0  | 1.66             | 82.6  |
| Threonine, %                         | 2.80  | 3.46  | 2.67             | 95.4  | 2.32             | 83.0  |
| Tryptophan, %                        | 1.08  | 1.33  | -                | -     | 0.94             | 87.0  |
| Arginine, %                          | 5.76  | 7.11  | 5.61             | 97.4  | 5.41             | 94.0  |
| Gly + Ser, %                         | 7.43  | 9.17  | 6.94             | 93.4  |                  |       |
| Valine, %                            | 3.78  | 4.66  | 3.51             | 92.9  | 3.25             | 86.0  |
| Isoleucine, %                        | 3.62  | 4.47  | 3.36             | 92.7  | 3.19             | 88.0  |
| Leucine, %                           | 6.09  | 7.51  | 5.63             | 92.5  | 5.42             | 89.0  |
| Histidine, %                         | 1.99  | 2.46  | 1.85             | 93.2  | 1.75             | 88.0  |
| Phenylalanine, %                     | 4.15  | 5.12  | 3.90             | 94.1  | 3.65             | 88.0  |
| Phe + Tyr, %                         | 7.03  | 8.67  | 6.62             | 94.1  | 6.19             | 88.0  |
| Alanine, %                           | 3.15  | 3.88  | -                | -     | 2.83             | 90.0  |
| Cysteine, %                          | 0.96  | 1.18  | 0.90             | 93.8  | 0.75             | 79.0  |
| Tyrosine, %                          | 2.88  | 3.56  | 2.71             | 94.0  | 2.54             | 88.0  |
| Glycine, %                           | 3.16  | 3.90  | -                | -     | 2.81             | 89.0  |
| Serine, %                            | 3.70  | 4.57  | -                | -     | 3.44             | 93.0  |
| Proline, %                           | 3.93  | 4.85  | -                | -     | 3.89             | 99.0  |
| Glutamine <sup>2</sup> , %           | 6.51  | 8.03  | -                | -     | 6.12             | 94.0  |
| Glutamic Acid <sup>2</sup> , %       | 7.58  | 9.35  | -                | -     | 7.12             | 94.0  |
| Asparagine <sup>2</sup> , %          | 3.43  | 4.24  | -                | -     | 3.16             | 92.0  |
| Aspartic Acid <sup>2</sup> , %       | 5.32  | 6.57  | -                | -     | 4.90             | 92.0  |
| Total Nitrogen (PB/6.25), %          | 13.0  | 16.0  | 12.2             | 94.0  | 11.8             | 90.9  |
| Essential Nitrogen Poultry, %        | 6.81  | 52.5* | -                | -     |                  |       |
| Essential Nitrogen Swine, %          | 5.73  | 44.2* |                  |       | 5.09             | 88.9  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
| <b>Practical</b>                                            | -                   | -      | -           | -           | -         |
| <b>Maximum</b>                                              | -                   | -      | -           | -           | -         |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                            | -                   | -      | -           | -           | -         |
| <b>Maximum</b>                                              | -                   | -      | -           | -           | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Semi-defatted Extruded**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 91.4 | 6  | 0.89 | Organic Matter (OM)          | 86.0  |         |
| Crude Protein (CP)        | 40.2 | 16 | 1.56 | Coef. Dig. OM Swine          | 78.5  |         |
| Starch                    | 7.37 | 1  | -    | Digestible OM Swine          | 67.5  |         |
| Crude Fiber (CF)          | 6.63 | 1  | -    | Undig. OM Pigs               | 18.5  |         |
| Coef. Dig. CF Swine       | 76.6 |    |      | Ether Extract (EE)           | 10.5  | 13 1.47 |
| NDF                       | 18.3 | 1  | -    | Coef. Dig. EE Poultry        | 79.0  |         |
| Coef. Dig. NDF Swine      | 76.7 |    |      | Digestible EE Poultry        | 8.30  |         |
| ADF                       | 13.6 | 1  | -    | Coef. Dig. EE Swine          | 80.0  |         |
| Coef. Dig. ADF Swine      | 85.1 |    |      | Digestible EE Swine          | 8.40  |         |
| N-Free Extract (NFE)      | 28.6 |    |      | Linoleic Acid                | 4.27  | 1 -     |
| Coef. Dig. NFE Poultry    | 41.4 |    |      | Linolenic Acid               | 0.60  | 1 -     |
| Digestible NFE Poultry    | 11.9 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 23.4 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 4456 | 1  | -    | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3760  |         |
| Metabolizable Energy      | 2811 |    |      | Metabolizable Energy         | 3530  |         |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 2408  |         |
| Net Energy                | 2263 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3957  |         |
| Metabolizable Energy      | 2886 |    |      | Metabolizable Energy         | 3665  |         |
| Net Energy                | 2338 |    |      | Net Energy                   | 2507  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 5.45 | 16 | 0.41 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 24.8  | 1 -     |
| Potassium (K)             | 1.80 | 1  | -    | Iron (Fe)                    | 179.1 | 1 -     |
| Sodium (Na)               | 0.01 | 1  | -    | Copper (Cu)                  | 13.7  | 1 -     |
| Chlorine (Cl)             | 0.02 | 1  | -    | Zinc (Zn)                    | 41.6  | 1 -     |
| Sulfur (S)                | 0.31 | 1  | -    | Selenium (Se)                | 0.21  | 1 -     |
| Magnesium (Mg)            | 0.32 | 1  | -    |                              |       |         |
| Total Calcium (Ca)        | 0.25 | 1  | -    |                              |       |         |
| Total Phosphorus (P)      | 0.55 | 14 | 0.02 |                              |       |         |
| Phytate P                 | 0.36 | 13 | 0.02 |                              |       |         |
| Available P (Pav)         | 0.19 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.21 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 38.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.21 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Semi-defatted Extruded**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 40.2                                 | 100   | 36.1             | 89.7  | 35.2             | 87.6  |
| Lysine, %                      | 2.48                                 | 6.17  | 2.22             | 89.5  | 2.16             | 87.1  |
| Methionine, %                  | 0.55                                 | 1.37  | 0.50             | 90.1  | 0.48             | 86.9  |
| Met + Cys, %                   | 1.14                                 | 2.84  | 1.01             | 88.2  | 0.98             | 85.9  |
| Threonine, %                   | 1.61                                 | 4.00  | 1.40             | 87.0  | 1.39             | 86.4  |
| Tryptophan, %                  | 0.56                                 | 1.39  | 0.50             | 89.9  | 0.51             | 91.2  |
| Arginine, %                    | 2.93                                 | 7.29  | 2.73             | 93.2  | 2.69             | 91.9  |
| Gly + Ser, %                   | 3.45                                 | 8.58  | 3.16             | 91.6  |                  |       |
| Valine, %                      | 1.94                                 | 4.83  | 1.65             | 84.8  | 1.67             | 85.9  |
| Isoleucine, %                  | 1.84                                 | 4.58  | 1.60             | 87.1  | 1.62             | 88.1  |
| Leucine, %                     | 3.09                                 | 7.69  | 2.70             | 87.4  | 2.73             | 88.2  |
| Histidine, %                   | 1.07                                 | 2.66  | 0.95             | 89.6  | 0.96             | 90.1  |
| Phenylalanine, %               | 2.04                                 | 5.07  | 1.80             | 88.4  | 1.83             | 89.7  |
| Phe + Tyr, %                   | 3.48                                 | 8.66  | 3.09             | 88.8  | 3.11             | 89.5  |
| Alanine, %                     | 1.60                                 | 3.98  | 1.41             | 88.1  | 1.33             | 83.0  |
| Cysteine, %                    | 0.59                                 | 1.47  | 0.51             | 86.5  | 0.50             | 84.7  |
| Tyrosine, %                    | 1.44                                 | 3.58  | 1.29             | 89.3  | 1.29             | 89.3  |
| Glycine, %                     | 1.60                                 | 3.98  | 1.49             | 93.1  | 1.31             | 82.0  |
| Serine, %                      | 1.85                                 | 4.60  | 1.67             | 90.3  | 1.57             | 85.0  |
| Proline, %                     | 1.84                                 | 4.58  | 1.66             | 90.2  | 1.62             | 88.0  |
| Glutamine <sup>2</sup> , %     | 3.62                                 | 9.02  | 3.27             | 90.3  | 3.19             | 88.0  |
| Glutamic Acid <sup>2</sup> , % | 4.05                                 | 10.1  | 3.65             | 90.3  | 3.56             | 88.0  |
| Asparagine <sup>2</sup> , %    | 1.67                                 | 4.15  | 1.55             | 92.8  | 1.45             | 87.0  |
| Aspartic Acid <sup>2</sup> , % | 2.48                                 | 6.17  | 2.30             | 92.8  | 2.16             | 87.0  |
| Total Nitrogen (PB/6.25), %    | 6.43                                 | 16.0  | 5.77             | 89.7  | 5.63             | 87.6  |
| Essential Nitrogen Poultry, %  | 3.50                                 | 54.4* | 3.12             | 89.1  |                  |       |
| Essential Nitrogen Swine, %    | 2.96                                 | 46.0* |                  |       | 2.62             | 88.6  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 10           | 12     | 10       |           |           |
| Practical Maximum                                           | 20           | 22     | 20       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 10           | 10     | 10       | 5         | 10        |
| Practical Maximum                                           | 25           | 25     | 25       | 25        | 30        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Semi-defatted Roasted**

| Main Components (%)       |      |    |      |                              |       |    |      |
|---------------------------|------|----|------|------------------------------|-------|----|------|
|                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Dry Matter                | 91.4 | 6  | 0.89 | Organic Matter (OM)          | 86.0  |    |      |
| Crude Protein (CP)        | 40.2 | 16 | 1.56 | Coef. Dig. OM Swine          | 73.8  |    |      |
| Starch                    | 7.37 | 1  | -    | Digestible OM Swine          | 63.4  |    |      |
| Crude Fiber (CF)          | 6.63 | 1  | -    | Undig. OM Pigs               | 22.5  |    |      |
| Coef. Dig. CF Swine       | 76.6 |    |      | Ether Extract (EE)           | 10.5  | 13 | 1.48 |
| NDF                       | 18.3 | 1  | -    | Coef. Dig. EE Poultry        | 74.0  |    |      |
| Coef. Dig. NDF Swine      | 76.7 |    |      | Digestible EE Poultry        | 7.77  |    |      |
| ADF                       | 13.6 | 1  | -    | Coef. Dig. EE Swine          | 78.0  |    |      |
| Coef. Dig. ADF Swine      | 85.1 |    |      | Digestible EE Swine          | 8.19  |    |      |
| N-Free Extract (NFE)      | 28.6 |    |      | Linoleic Acid                | 4.27  | 1  | -    |
| Coef. Dig. NFE Poultry    | 40.0 |    |      | Linolenic Acid               | 0.60  | 1  | -    |
| Digestible NFE Poultry    | 11.5 |    |      |                              |       |    |      |
| Undig. NFE + CF Poultry   | 23.8 |    |      |                              |       |    |      |
| Energy (kcal/kg)          |      |    |      |                              |       |    |      |
|                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Gross Energy              | 4456 | 1  | -    | <b>Swine</b>                 |       |    |      |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3525  |    |      |
| Metabolizable Energy      | 2726 |    |      | Metabolizable Energy         | 3315  |    |      |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 2251  |    |      |
| Net Energy                | 2193 |    |      | <b>Sows</b>                  |       |    |      |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3760  |    |      |
| Metabolizable Energy      | 2793 |    |      | Metabolizable Energy         | 3484  |    |      |
| Net Energy                | 2260 |    |      | Net Energy                   | 2374  |    |      |
| Minerals                  |      |    |      |                              |       |    |      |
|                           | Mean | n  | SD   |                              | Mean  | n  | SD   |
| Ash, %                    | 5.45 | 16 | 0.41 | <b>Trace Minerals, mg/kg</b> |       |    |      |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 24.8  | 1  | -    |
| Potassium (K)             | 1.80 | 1  | -    | Iron (Fe)                    | 179.0 | 1  | -    |
| Sodium (Na)               | 0.01 | 1  | -    | Copper (Cu)                  | 13.7  | 1  | -    |
| Chlorine (Cl)             | 0.02 | 1  | -    | Zinc (Zn)                    | 41.6  | 1  | -    |
| Sulfur (S)                | 0.31 | 1  | -    | Selenium (Se)                | 0.21  | 1  | -    |
| Magnesium (Mg)            | 0.32 | 1  | -    |                              |       |    |      |
| Total Calcium (Ca)        | 0.25 | 1  | -    |                              |       |    |      |
| Total Phosphorus (P)      | 0.55 | 14 | 0.02 |                              |       |    |      |
| Phytate P                 | 0.36 | 13 | 0.02 |                              |       |    |      |
| Available P (Pav)         | 0.19 |    |      |                              |       |    |      |
| Coef. Dig. P Poultry      | 38.0 |    |      |                              |       |    |      |
| Std. Dig. P Poultry       | 0.21 |    |      |                              |       |    |      |
| Coef. Dig. P Swine        | 38.0 |    |      |                              |       |    |      |
| Std. Dig. P Swine         | 0.21 |    |      |                              |       |    |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Soybean, Semi-defatted Roasted**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 40.2                                 | 100   | 35.4             | 88.1  | 31.5             | 78.3  |
| Lysine, %                      | 2.48                                 | 6.17  | 2.15             | 86.8  | 2.02             | 81.3  |
| Methionine, %                  | 0.55                                 | 1.37  | 0.48             | 86.8  | 0.44             | 79.8  |
| Met + Cys, %                   | 1.14                                 | 2.84  | 0.95             | 83.5  | 0.89             | 78.2  |
| Threonine, %                   | 1.61                                 | 4.00  | 1.35             | 83.6  | 1.26             | 78.2  |
| Tryptophan, %                  | 0.56                                 | 1.39  | 0.48             | 84.9  | 0.46             | 82.1  |
| Arginine, %                    | 2.93                                 | 7.29  | 2.68             | 91.4  | 2.49             | 85.1  |
| Gly + Ser, %                   | 3.45                                 | 8.58  | 3.04             | 88.2  |                  |       |
| Valine, %                      | 1.94                                 | 4.83  | 1.63             | 84.2  | 1.48             | 76.3  |
| Isoleucine, %                  | 1.84                                 | 4.58  | 1.60             | 86.8  | 1.42             | 77.0  |
| Leucine, %                     | 3.09                                 | 7.69  | 2.69             | 86.9  | 2.39             | 77.4  |
| Histidine, %                   | 1.07                                 | 2.66  | 0.96             | 89.7  | 0.88             | 82.6  |
| Phenylalanine, %               | 2.04                                 | 5.07  | 1.79             | 87.7  | 1.61             | 78.9  |
| Phe + Tyr, %                   | 3.48                                 | 8.66  | 3.06             | 87.9  | 2.75             | 79.0  |
| Alanine, %                     | 1.60                                 | 3.98  | 1.32             | 82.8  | 1.18             | 74.0  |
| Cysteine, %                    | 0.59                                 | 1.47  | 0.47             | 80.4  | 0.45             | 76.8  |
| Tyrosine, %                    | 1.44                                 | 3.58  | 1.27             | 88.3  | 1.14             | 79.1  |
| Glycine, %                     | 1.60                                 | 3.98  | 1.52             | 95.0  | 1.18             | 74.0  |
| Serine, %                      | 1.85                                 | 4.60  | 1.52             | 82.3  | 1.44             | 78.0  |
| Proline, %                     | 1.84                                 | 4.58  | 1.56             | 85.0  | 1.34             | 73.0  |
| Glutamine <sup>2</sup> , %     | 3.62                                 | 9.02  | 3.32             | 91.6  | 2.83             | 78.0  |
| Glutamic Acid <sup>2</sup> , % | 4.05                                 | 10.1  | 3.71             | 91.6  | 3.16             | 78.0  |
| Asparagine <sup>2</sup> , %    | 1.67                                 | 4.15  | 1.49             | 89.6  | 1.30             | 78.0  |
| Aspartic Acid <sup>2</sup> , % | 2.48                                 | 6.17  | 2.22             | 89.6  | 1.94             | 78.0  |
| Total Nitrogen (PB/6.25), %    | 6.43                                 | 16.0  | 5.66             | 88.1  | 5.04             | 78.3  |
| Essential Nitrogen Poultry, %  | 3.50                                 | 54.4* | 3.06             | 87.4  |                  |       |
| Essential Nitrogen Swine, %    | 2.96                                 | 46.0* |                  |       | 2.36             | 79.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        |          | Hens      |           |
|                                                             | Starter      |        | Grower   |           |           |
|                                                             | 7            |        | 10       | 10        |           |
| Practical                                                   | 12           |        | 20       | 20        |           |
| Maximum                                                     |              |        |          |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 7            | 10     | 10       | 5         | 10        |
| Practical                                                   | 20           | 20     | 20       | 25        | 30        |
| Maximum                                                     |              |        |          |           |           |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Starch**

| Main Components (%)                       |      |   |      |                              |      |   |    |
|-------------------------------------------|------|---|------|------------------------------|------|---|----|
|                                           | Mean | n | SD   |                              | Mean | n | SD |
| Dry Matter                                | 88.6 | 9 | 2.21 | Organic Matter (OM)          | 87.8 |   |    |
| Crude Protein (CP)                        | 0.40 | 5 | 0.17 | Coef. Dig. OM Swine          | 96.4 |   |    |
| Starch                                    | 87.7 | 4 | 0.11 | Digestible OM Swine          | 84.8 |   |    |
| Crude Fiber (CF)                          | 0.20 | 1 | -    | Undig. OM Pigs               | 2.98 |   |    |
| Coef. Dig. CF Swine                       | -    |   |      | Ether Extract (EE)           | 0.50 | 1 | -  |
| NDF                                       | -    | - | -    | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine                      | -    |   |      | Digestible EE Poultry        | -    |   |    |
| ADF                                       | -    | - | -    | Coef. Dig. EE Swine          | -    |   |    |
| Coef. Dig. ADF Swine                      | -    |   |      | Digestible EE Swine          | -    |   |    |
| N-Free Extract (NFE)                      | 86.6 |   |      | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry                    | 97.1 |   |      | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry                    | 84.1 |   |      |                              |      |   |    |
| Undig. NFE + CF Poultry                   | 2.71 |   |      |                              |      |   |    |
|                                           |      |   |      |                              |      |   |    |
| Energy (kcal/kg)                          |      |   |      |                              |      |   |    |
|                                           | Mean | n | SD   |                              | Mean | n | SD |
| Gross Energy                              | 3736 | 4 | 86   | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>                            |      |   |      | Digestible Energy            | 3594 |   |    |
| Metabolizable Energy                      | 3528 |   |      | Metabolizable Energy         | 3533 |   |    |
| Std. Metab. Energy                        | -    |   |      | Net Energy                   | -    |   |    |
| Net Energy                                | 2823 |   |      | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>                               |      |   |      | Digestible Energy            | -    |   |    |
| Metabolizable Energy                      | 3528 |   |      | Metabolizable Energy         | -    |   |    |
| Net Energy                                | 2823 |   |      | Net Energy                   | -    |   |    |
|                                           |      |   |      |                              |      |   |    |
| Minerals                                  |      |   |      |                              |      |   |    |
|                                           | Mean | n | SD   |                              | Mean | n | SD |
| Ash, %                                    | 0.80 | - | -    | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b>                 |      |   |      | Manganese (Mn)               | 1.0  | 1 | -  |
| Potassium (K)                             | -    | - | -    | Iron (Fe)                    | 12.0 | 1 | -  |
| Sodium (Na)                               | -    | - | -    | Copper (Cu)                  | 1.0  | 1 | -  |
| Chlorine (Cl)                             | -    | - | -    | Zinc (Zn)                    | 1.0  | 1 | -  |
| Sulfur (S)                                | -    | - | -    | Selenium (Se)                | 1.04 | 1 | -  |
| Magnesium (Mg)                            | -    | - | -    |                              |      |   |    |
| Total Calcium (Ca)                        | -    | - | -    |                              |      |   |    |
| Total Phosphorus (P)                      | -    | - | -    |                              |      |   |    |
| Phytate P                                 | -    | - | -    |                              |      |   |    |
| Available P (Pav)                         | -    |   |      |                              |      |   |    |
| Coef. Dig. P Poultry                      | -    |   |      |                              |      |   |    |
| Std. Dig. P Poultry                       | -    |   |      |                              |      |   |    |
| Coef. Dig. P Swine                        | -    |   |      |                              |      |   |    |
| Std. Dig. P Swine                         | -    |   |      |                              |      |   |    |
| Pav = Non Phytate P (Total P – Phytate P) |      |   |      |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Starch**

| Amino Acid Content and Digestibility |       |      |                  |      |                  |      |
|--------------------------------------|-------|------|------------------|------|------------------|------|
|                                      | Total | % CP | Poultry          |      | Swine            |      |
|                                      |       |      | SID <sup>1</sup> | Coef | SID <sup>1</sup> | Coef |
| Crude Protein, %                     | -     | -    | -                | -    | -                | -    |
| Lysine, %                            | -     | -    | -                | -    | -                | -    |
| Methionine, %                        | -     | -    | -                | -    | -                | -    |
| Met + Cys, %                         | -     | -    | -                | -    | -                | -    |
| Threonine, %                         | -     | -    | -                | -    | -                | -    |
| Tryptophan, %                        | -     | -    | -                | -    | -                | -    |
| Arginine, %                          | -     | -    | -                | -    | -                | -    |
| Gly + Ser, %                         | -     | -    | -                | -    | -                | -    |
| Valine, %                            | -     | -    | -                | -    | -                | -    |
| Isoleucine, %                        | -     | -    | -                | -    | -                | -    |
| Leucine, %                           | -     | -    | -                | -    | -                | -    |
| Histidine, %                         | -     | -    | -                | -    | -                | -    |
| Phenylalanine, %                     | -     | -    | -                | -    | -                | -    |
| Phe + Tyr, %                         | -     | -    | -                | -    | -                | -    |
| Alanine, %                           | -     | -    | -                | -    | -                | -    |
| Cysteine, %                          | -     | -    | -                | -    | -                | -    |
| Tyrosine, %                          | -     | -    | -                | -    | -                | -    |
| Glycine, %                           | -     | -    | -                | -    | -                | -    |
| Serine, %                            | -     | -    | -                | -    | -                | -    |
| Proline, %                           | -     | -    | -                | -    | -                | -    |
| Glutamine <sup>2</sup> , %           | -     | -    | -                | -    | -                | -    |
| Glutamic Acid <sup>2</sup> , %       | -     | -    | -                | -    | -                | -    |
| Asparagine <sup>2</sup> , %          | -     | -    | -                | -    | -                | -    |
| Aspartic Acid <sup>2</sup> , %       | -     | -    | -                | -    | -                | -    |
| Total Nitrogen (PB/6.25), %          | -     | -    | -                | -    | -                | -    |
| Essential Nitrogen Poultry, %        | -     | -    | -                | -    | -                | -    |
| Essential Nitrogen Swine, %          | -     | -    | -                | -    | -                | -    |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |           |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-----------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |           |           |
|                                                             | Starter             | Grower |             |           |           |
|                                                             | -                   | -      |             |           |           |
| Practical Maximum                                           | -                   | -      |             |           |           |
|                                                             | <b>Growing Pigs</b> |        | <b>Sows</b> |           |           |
|                                                             | Starter             | Grower | Finisher    | Gestation | Lactation |
|                                                             | -                   | -      | -           | -         | -         |
| Practical Maximum                                           | -                   | -      | -           | -         | -         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugar**

| Main Components (%)       |      |   |    |                              |      |   |    |
|---------------------------|------|---|----|------------------------------|------|---|----|
|                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                | 99.0 | 1 | -  | Organic Matter (OM)          | 98.9 |   |    |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 91.2 |   |    |
| Starch                    | -    | - | -  | Digestible OM Swine          | 90.2 |   |    |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 8.70 |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | -    | - | -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -    |   |    |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -    |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -    |   |    |
| N-Free Extract (NFE)      | 98.9 |   |    | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry    | 93.6 |   |    | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry    | 92.5 |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry   | 6.33 |   |    |                              |      |   |    |
| Energy (kcal/kg)          |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy              | 4008 | 1 | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3873 |   |    |
| Metabolizable Energy      | 3831 |   |    | Metabolizable Energy         | 3737 |   |    |
| Std. Metab. Energy        | 3887 |   |    | Net Energy                   | 2728 |   |    |
| Net Energy                | 3065 |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3873 |   |    |
| Metabolizable Energy      | 3831 |   |    | Metabolizable Energy         | 3737 |   |    |
| Net Energy                | 3065 |   |    | Net Energy                   | 2728 |   |    |
| Minerals                  |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Ash, %                    | 0.14 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - | -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |   |    |
| Total Calcium (Ca)        | -    | - | -  |                              |      |   |    |
| Total Phosphorus (P)      | -    | - | -  |                              |      |   |    |
| Phytate P                 | -    | - | -  |                              |      |   |    |
| Available P (Pav)         | -    |   |    |                              |      |   |    |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |   |    |
| Std. Dig. P Poultry       | -    |   |    |                              |      |   |    |
| Coef. Dig. P Swine        | -    |   |    |                              |      |   |    |
| Std. Dig. P Swine         | -    |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugar**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | -     | -    | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
| <b>Practical</b>                                                   | -                   | -      | -           |             |           |
| <b>Maximum</b>                                                     | 5                   | 10     | 15          |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                                   | 3                   | -      | -           | -           | 3         |
| <b>Maximum</b>                                                     | 10                  | 10     | 10          | 10          | 10        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugarcane, Juice**

| Principais Componentes (%) |      |   |      |                              |      |   |    |
|----------------------------|------|---|------|------------------------------|------|---|----|
|                            | Mean | n | SD   |                              | Mean | n | SD |
| Dry Matter                 | 19.7 | 2 | 1.53 | Organic Matter (OM)          | 19.4 |   |    |
| Crude Protein (CP)         | 0.32 | 2 | 0.03 | Coef. Dig. OM Swine          | 93.4 |   |    |
| Starch                     | -    | - | -    | Digestible OM Swine          | 18.1 |   |    |
| Crude Fiber (CF)           | 0.05 | - | -    | Undig. OM Pigs               | 1.28 |   |    |
| Coef. Dig. CF Swine        | -    | - | -    | Ether Extract (EE)           | 0.15 | 1 | -  |
| NDF                        | -    | - | -    | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine       | -    | - | -    | Digestible EE Poultry        | -    |   |    |
| ADF                        | -    | - | -    | Coef. Dig. EE Swine          | -    |   |    |
| Coef. Dig. ADF Swine       | -    | - | -    | Digestible EE Swine          | -    |   |    |
| N-Free Extract (NFE)       | 18.9 |   |      | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry     | -    |   |      | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry     | -    |   |      |                              |      |   |    |
| Undig. NFE + CF Poultry    | -    |   |      |                              |      |   |    |
| Energy (kcal/kg)           |      |   |      |                              |      |   |    |
|                            | Mean | n | SD   |                              | Mean | n | SD |
| Gross Energy               | 757  | 1 | -    | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>             |      |   |      | Digestible Energy            | 707  |   |    |
| Metabolizable Energy       | -    |   |      | Metabolizable Energy         | 675  |   |    |
| Std. Metab. Energy         | -    |   |      | Net Energy                   | -    |   |    |
| Net Energy                 | -    |   |      | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>                |      |   |      | Digestible Energy            | -    |   |    |
| Metabolizable Energy       | -    |   |      | Metabolizable Energy         | -    |   |    |
| Net Energy                 | -    |   |      | Net Energy                   | -    |   |    |
| Minerals                   |      |   |      |                              |      |   |    |
|                            | Mean | n | SD   |                              | Mean | n | SD |
| Ash, %                     | 0.27 | 2 | 0.05 | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b>  |      |   |      | Manganese (Mn)               | -    | - | -  |
| Potassium (K)              | -    | - | -    | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)                | -    | - | -    | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)              | -    | - | -    | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                 | -    | - | -    | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)             | -    | - | -    |                              |      |   |    |
| Total Calcium (Ca)         | 0.01 | 1 | -    |                              |      |   |    |
| Total Phosphorus (P)       | 0.02 | 1 | -    |                              |      |   |    |
| Phytate P                  | 0.01 | 1 | -    |                              |      |   |    |
| Available P (Pav)          | 0.01 |   |      |                              |      |   |    |
| Coef. Dig. P Poultry       | -    |   |      |                              |      |   |    |
| Std. Dig. P Poultry        | -    |   |      |                              |      |   |    |
| Coef. Dig. P Swine         | 32.0 |   |      |                              |      |   |    |
| Std. Dig. P Swine          | 0.01 |   |      |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugarcane, Juice**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 0.32  | 100.0 | -                | -     | -                | -     |
| Lysine, %                                   | -     | -     | -                | -     | -                | -     |
| Methionine, %                               | -     | -     | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -     | -                | -     | -                | -     |
| Threonine, %                                | -     | -     | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -     | -                | -     | -                | -     |
| Arginine, %                                 | -     | -     | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -     | -                | -     | -                | -     |
| Valine, %                                   | -     | -     | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -     | -                | -     | -                | -     |
| Leucine, %                                  | -     | -     | -                | -     | -                | -     |
| Histidine, %                                | -     | -     | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -     | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -     | -                | -     | -                | -     |
| Alanine, %                                  | -     | -     | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -     | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -     | -                | -     | -                | -     |
| Glycine, %                                  | -     | -     | -                | -     | -                | -     |
| Serine, %                                   | -     | -     | -                | -     | -                | -     |
| Proline, %                                  | -     | -     | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -     | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -     | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -     | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -     | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -     | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -     | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -     | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
| <b>Practical</b>                                                   | -                   | -      | -           | -           | -         |
| <b>Maximum</b>                                                     | -                   | -      | -           | -           | -         |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
| <b>Practical</b>                                                   | -                   | -      | -           | -           | -         |
| <b>Maximum</b>                                                     | -                   | -      | -           | -           | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugarcane, Molasses**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 73.9 | 1 | -  | Organic Matter (OM)          | 65.2 |      |
| Crude Protein (CP)        | 3.66 | 1 | -  | Coef. Dig. OM Swine          | 84.3 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 54.9 |      |
| Crude Fiber (CF)          | 2.46 | 1 | -  | Undig. OM Pigs               | 10.2 |      |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 0.10 | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -    |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -    |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -    |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -    |      |
| N-Free Extract (NFE)      | 58.9 |   |    | Linoleic Acid                | -    | - -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | -    |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | -    |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 2850 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 2403 |      |
| Metabolizable Energy      | 1880 |   |    | Metabolizable Energy         | 2345 |      |
| Std. Metab. Energy        | 2230 |   |    | Net Energy                   | 1665 |      |
| Net Energy                | -    |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -    |      |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -    |      |
| Net Energy                | -    |   |    | Net Energy                   | -    |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 8.75 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - -  |
| Potassium (K)             | 3.25 | 1 | -  | Iron (Fe)                    | -    | - -  |
| Sodium (Na)               | 0.58 | 1 | -  | Copper (Cu)                  | -    | - -  |
| Chlorine (Cl)             | 1.38 | 1 | -  | Zinc (Zn)                    | -    | - -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |      |
| Total Calcium (Ca)        | 0.76 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.06 | 1 | -  |                              |      |      |
| Phytate P                 | 0.04 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.02 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |      |
| Std. Dig. P Poultry       | -    |   |    |                              |      |      |
| Coef. Dig. P Swine        | 32.0 |   |    |                              |      |      |
| Std. Dig. P Swine         | 0.02 |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugarcane, Molasses**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 3.66  | 100  | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |             |             |           |
|--------------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                                    | Starter             | Grower |             |             |           |
|                                                                    | 1                   | 1      | 1           |             |           |
| <b>Practical Maximum</b>                                           | 1                   | 3      | 3           |             |           |
|                                                                    | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                                    | 2                   | 2      | 2           | 2           | 2         |
| <b>Practical Maximum</b>                                           | 3                   | 5      | 5           | 5           | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugarcane, Molasses Dried**

| Main Components (%)       |      |   |    |                              |      |   |    |
|---------------------------|------|---|----|------------------------------|------|---|----|
|                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                | 93.3 | 1 | -  | Organic Matter (OM)          | 77.0 |   |    |
| Crude Protein (CP)        | 2.44 | 1 | -  | Coef. Dig. OM Swine          | 82.5 |   |    |
| Starch                    | -    | - | -  | Digestible OM Swine          | 63.5 |   |    |
| Crude Fiber (CF)          | 6.20 | 1 | -  | Undig. OM Pigs               | 13.5 |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | -    | - | -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | -    |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | -    |   |    |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | -    |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | -    |   |    |
| N-Free Extract (NFE)      | 68.4 |   |    | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry    | -    |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry   | -    |   |    |                              |      |   |    |
|                           |      |   |    |                              |      |   |    |
| Energy (kcal/kg)          |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy              | 3170 | 1 | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 2616 |   |    |
| Metabolizable Energy      | 2153 |   |    | Metabolizable Energy         | 2495 |   |    |
| Std. Metab. Energy        | 2480 |   |    | Net Energy                   | 1745 |   |    |
| Net Energy                | -    |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | -    |   |    |
| Metabolizable Energy      | -    |   |    | Metabolizable Energy         | -    |   |    |
| Net Energy                | -    |   |    | Net Energy                   | -    |   |    |
|                           |      |   |    |                              |      |   |    |
| Minerals                  |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Ash, %                    | 16.3 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - | -  |
| Potassium (K)             | 2.19 | 1 | -  | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)               | 0.15 | 1 | -  | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |   |    |
| Total Calcium (Ca)        | 6.21 | 1 | -  |                              |      |   |    |
| Total Phosphorus (P)      | 0.21 | 1 | -  |                              |      |   |    |
| Phytate P                 | 0.14 | 1 | -  |                              |      |   |    |
| Available P (Pav)         | 0.07 |   |    |                              |      |   |    |
| Coef. Dig. P Poultry      | -    |   |    |                              |      |   |    |
| Std. Dig. P Poultry       | -    |   |    |                              |      |   |    |
| Coef. Dig. P Swine        | 32.0 |   |    |                              |      |   |    |
| Std. Dig. P Swine         | 0.07 |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sugarcane, Molasses Dried**

|                                | Amino Acid Content and Digestibility |      |                  |       |                  |       |
|--------------------------------|--------------------------------------|------|------------------|-------|------------------|-------|
|                                | Total                                | % CP | Poultry          |       | Swine            |       |
|                                |                                      |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 2.44                                 | 100  | -                | -     | -                | -     |
| Lysine, %                      | -                                    | -    | -                | -     | -                | -     |
| Methionine, %                  | -                                    | -    | -                | -     | -                | -     |
| Met + Cys, %                   | -                                    | -    | -                | -     | -                | -     |
| Threonine, %                   | -                                    | -    | -                | -     | -                | -     |
| Tryptophan, %                  | -                                    | -    | -                | -     | -                | -     |
| Arginine, %                    | -                                    | -    | -                | -     | -                | -     |
| Gly + Ser, %                   | -                                    | -    | -                | -     | -                | -     |
| Valine, %                      | -                                    | -    | -                | -     | -                | -     |
| Isoleucine, %                  | -                                    | -    | -                | -     | -                | -     |
| Leucine, %                     | -                                    | -    | -                | -     | -                | -     |
| Histidine, %                   | -                                    | -    | -                | -     | -                | -     |
| Phenylalanine, %               | -                                    | -    | -                | -     | -                | -     |
| Phe + Tyr, %                   | -                                    | -    | -                | -     | -                | -     |
| Alanine, %                     | -                                    | -    | -                | -     | -                | -     |
| Cysteine, %                    | -                                    | -    | -                | -     | -                | -     |
| Tyrosine, %                    | -                                    | -    | -                | -     | -                | -     |
| Glycine, %                     | -                                    | -    | -                | -     | -                | -     |
| Serine, %                      | -                                    | -    | -                | -     | -                | -     |
| Proline, %                     | -                                    | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | -                                    | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %    | -                                    | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , % | -                                    | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %    | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %  | -                                    | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %    | -                                    | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 1                   | 1      | 1           |             |           |
| <b>Practical Maximum</b>                                    | 2                   | 3      | 3           |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 1                   | 2      | 2           | 2           | 2         |
| <b>Practical Maximum</b>                                    | 2                   | 3      | 3           | 3           | 3         |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sunflower Meal**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 89.8 | 24 | 0.89 | Organic Matter (OM)          | 83.7  |         |
| Crude Protein (CP)        | 33.0 | 25 | 5.02 | Coef. Dig. OM Swine          | 48.0  |         |
| Starch                    | 4.38 | 2  | 0.88 | Digestible OM Swine          | 40.2  |         |
| Crude Fiber (CF)          | 25.8 | 7  | 2.23 | Undig. OM Pigs               | 43.5  |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 1.98  | 13 0.53 |
| NDF                       | 40.7 | 7  | 3.56 | Coef. Dig. EE Poultry        | 60.0  |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 1.19  |         |
| ADF                       | 26.3 | 7  | 4.37 | Coef. Dig. EE Swine          | 65.0  |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.29  |         |
| N-Free Extract (NFE)      | 23.0 |    |      | Linoleic Acid                | 1.03  | 1 -     |
| Coef. Dig. NFE Poultry    | 45.0 |    |      | Linolenic Acid               | -     | - -     |
| Digestible NFE Poultry    | 10.4 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 38.4 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | N  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 4216 | 9  | 109  | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2159  |         |
| Metabolizable Energy      | 1795 |    |      | Metabolizable Energy         | 1951  |         |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | 995   |         |
| Net Energy                | 1396 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2588  |         |
| Metabolizable Energy      | 1913 |    |      | Metabolizable Energy         | 2285  |         |
| Net Energy                | 1514 |    |      | Net Energy                   | 1239  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 6.11 | 17 | 0.86 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 0.34  | 1 -     |
| Potassium (K)             | 1.42 | 6  | 0.25 | Iron (Fe)                    | 248.0 | 1 -     |
| Sodium (Na)               | 0.02 | 6  | 0.01 | Copper (Cu)                  | 26.0  | 1 -     |
| Chlorine (Cl)             | 0.15 | 3  | 0.05 | Zinc (Zn)                    | 79.0  | 1 -     |
| Sulfur (S)                | 0.32 | 2  | 0.02 | Selenium (Se)                | 0.50  | 1 -     |
| Magnesium (Mg)            | 0.65 | 3  | 0.09 |                              |       |         |
| Total Calcium (Ca)        | 0.35 | 7  | 0.05 |                              |       |         |
| Total Phosphorus (P)      | 0.98 | 6  | 0.10 |                              |       |         |
| Phytate P                 | 0.66 | 1  | -    |                              |       |         |
| Available P (Pav)         | 0.32 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 39.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.38 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 25.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.25 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sunflower, Meal**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 33.0  | 100   | 29.2             | 88.6  | 27.9             | 84.5  |
| Lysine, %                                   | 1.14  | 3.46  | 0.94             | 82.8  | 0.90             | 79.2  |
| Methionine, %                               | 0.70  | 2.12  | 0.64             | 91.2  | 0.63             | 90.4  |
| Met + Cys, %                                | 1.26  | 3.82  | 1.08             | 86.0  | 1.08             | 85.4  |
| Threonine, %                                | 1.16  | 3.52  | 0.96             | 82.6  | 0.92             | 79.7  |
| Tryptophan, %                               | 0.43  | 1.30  | 0.37             | 86.0  | 0.36             | 83.5  |
| Arginine, %                                 | 2.67  | 8.10  | 2.45             | 91.8  | 2.48             | 92.9  |
| Gly + Ser, %                                | 3.15  | 9.55  | 2.60             | 82.6  |                  |       |
| Valine, %                                   | 1.53  | 4.64  | 1.35             | 88.3  | 1.24             | 81.1  |
| Isoleucine, %                               | 1.25  | 3.79  | 1.12             | 89.5  | 1.04             | 83.3  |
| Leucine, %                                  | 1.98  | 6.00  | 1.76             | 89.0  | 1.66             | 83.6  |
| Histidine, %                                | 0.79  | 2.40  | 0.69             | 86.8  | 0.65             | 82.8  |
| Phenylalanine, %                            | 1.45  | 4.40  | 1.31             | 90.0  | 1.25             | 86.2  |
| Phe + Tyr, %                                | 2.25  | 6.82  | 2.00             | 89.0  | 1.95             | 86.8  |
| Alanine, %                                  | 1.40  | 4.25  | 1.20             | 85.6  | 1.12             | 80.1  |
| Cysteine, %                                 | 0.56  | 1.70  | 0.45             | 79.5  | 0.44             | 79.1  |
| Tyrosine, %                                 | 0.80  | 2.43  | 0.70             | 87.2  | 0.70             | 87.8  |
| Glycine, %                                  | 1.75  | 5.31  | 1.44             | 82.0  | 1.26             | 72.1  |
| Serine, %                                   | 1.40  | 4.25  | 1.17             | 83.3  | 1.13             | 80.5  |
| Proline, %                                  | 1.66  | 5.03  | 1.56             | 94.0  | 1.38             | 83.4  |
| Glutamine <sup>2</sup> , %                  | 3.00  | 9.09  | 2.79             | 93.0  | 2.67             | 89.0  |
| Glutamic Acid <sup>2</sup> , %              | 2.34  | 10.1  | 3.11             | 93.0  | 2.98             | 89.0  |
| Asparagine <sup>2</sup> , %                 | 1.16  | 3.52  | 1.01             | 86.7  | 0.98             | 84.0  |
| Aspartic Acid <sup>2</sup> , %              | 1.73  | 5.24  | 1.50             | 86.7  | 1.45             | 84.0  |
| Total Nitrogen (PB/6.25), %                 | 5.28  | 16.0  | 4.67             | 88.6  | 4.46             | 84.5  |
| Essential Nitrogen Poultry, %               | 2.72  | 51.5* | 2.37             | 87.3  |                  |       |
| Essential Nitrogen Swine, %                 | 2.20  | 41.8* |                  |       | 1.87             | 85.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |          |             |           |
|--------------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                                    | Starter             | Grower |          |             |           |
|                                                                    | 5                   | 8      |          | 8           |           |
| <b>Practical Maximum</b>                                           | 10                  | 15     |          | 15          |           |
|                                                                    | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                                    | 5                   | 8      | 10       | 13          | 10        |
| <b>Practical Maximum</b>                                           | 10                  | 15     | 18       | 20          | 20        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sweet Potato, Flour**

| Main Components (%)       |      |   |      |                              |      |        |
|---------------------------|------|---|------|------------------------------|------|--------|
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Dry Matter                | 89.2 | 2 | 0.68 | Organic Matter (OM)          | 86.5 |        |
| Crude Protein (CP)        | 4.00 | 2 | 0.18 | Coef. Dig. OM Swine          | 85.3 |        |
| Starch                    | 62.9 | 1 | -    | Digestible OM Swine          | 73.8 |        |
| Crude Fiber (CF)          | 2.69 | 1 | -    | Undig. OM Pigs               | 12.7 |        |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 1.03 | 2 0.17 |
| NDF                       | 8.80 | 1 | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | -    |        |
| ADF                       | 3.60 | 1 | -    | Coef. Dig. EE Swine          | 70.0 |        |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 0.72 |        |
| N-Free Extract (NFE)      | 78.8 |   |      | Linoleic Acid                | -    | - -    |
| Coef. Dig. NFE Poultry    | -    |   |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    |   |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |   |      |                              |      |        |
| Energy (kcal/kg)          |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Gross Energy              | 3875 | 1 | -    | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 3305 |        |
| Metabolizable Energy      | 2706 |   |      | Metabolizable Energy         | 3284 |        |
| Std. Metab. Energy        | 2519 |   |      | Net Energy                   | -    |        |
| Net Energy                | -    |   |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |   |      | Digestible Energy            | -    |        |
| Metabolizable Energy      | -    |   |      | Metabolizable Energy         | -    |        |
| Net Energy                | -    |   |      | Net Energy                   | -    |        |
| Minerals                  |      |   |      |                              |      |        |
|                           | Mean | n | SD   |                              | Mean | n SD   |
| Ash, %                    | 2.72 | 2 | 0.39 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | 0.65 | 1 | -    | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | 0.15 | 1 | -    | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | 0.09 | 1 | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | -    | - | -    |                              |      |        |
| Total Calcium (Ca)        | 0.10 | 1 | -    |                              |      |        |
| Total Phosphorus (P)      | 0.16 | 1 | -    |                              |      |        |
| Phytate P                 | 0.11 | 1 | -    |                              |      |        |
| Available P (Pav)         | 0.05 |   |      |                              |      |        |
| Coef. Dig. P Poultry      | -    |   |      |                              |      |        |
| Std. Dig. P Poultry       | -    |   |      |                              |      |        |
| Coef. Dig. P Swine        | -    |   |      |                              |      |        |
| Std. Dig. P Swine         | -    |   |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Sweet Potato, Flour**

| <b>Amino Acid Content and Digestibility</b> |       |       |                  |       |                  |       |
|---------------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                             | Total | % CP  | Poultry          |       | Swine            |       |
|                                             |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | 4.00  | 100   | -                | -     | 2.14             | 53.6  |
| Lysine, %                                   | 0.13  | 3.25  | -                | -     | 0.08             | 58.3  |
| Methionine, %                               | 0.05  | 1.25  | -                | -     | 0.03             | 60.0  |
| Met + Cys, %                                | 0.06  | 1.50  | -                | -     | -                | -     |
| Threonine, %                                | 0.16  | 4.00  | -                | -     | 0.07             | 45.5  |
| Tryptophan, %                               | 0.05  | 1.25  | -                | -     | 0.03             | 50.0  |
| Arginine, %                                 | 0.13  | 3.25  | -                | -     | -                | -     |
| Gly + Ser, %                                | 0.36  | 9.00  | -                | -     | -                | -     |
| Valine, %                                   | 0.19  | 4.75  | -                | -     | 0.10             | 53.8  |
| Isoleucine, %                               | 0.15  | 3.75  | -                | -     | 0.08             | 53.8  |
| Leucine, %                                  | 0.18  | 4.50  | -                | -     | -                | -     |
| Histidine, %                                | 0.11  | 2.75  | -                | -     | -                | -     |
| Phenylalanine, %                            | 0.18  | 4.50  | -                | -     | -                | -     |
| Phe + Tyr, %                                | 0.27  | 6.75  | -                | -     | -                | -     |
| Alanine, %                                  | 0.21  | 5.25  | -                | -     | -                | -     |
| Cysteine, %                                 | 0.01  | 0.25  | -                | -     | -                | -     |
| Tyrosine, %                                 | 0.09  | 2.25  | -                | -     | -                | -     |
| Glycine, %                                  | 0.17  | 4.25  | -                | -     | -                | -     |
| Serine, %                                   | 0.19  | 4.75  | -                | -     | -                | -     |
| Proline, %                                  | -     | -     | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -     | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -     | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -     | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -     | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | 0.64  | 16.00 | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | 0.26  | 40.2* | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | 0.20  | 31.3* | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| <b>Recommended Inclusion Levels in Poultry and Swine Feeds (%)</b> |                     |        |          |             |           |
|--------------------------------------------------------------------|---------------------|--------|----------|-------------|-----------|
|                                                                    | <b>Broilers</b>     |        |          | <b>Hens</b> |           |
|                                                                    | Starter             | Grower |          |             |           |
|                                                                    |                     |        |          |             |           |
| <b>Practical</b>                                                   | -                   | -      | -        | -           | -         |
| <b>Maximum</b>                                                     | -                   | -      | -        | -           | -         |
|                                                                    | <b>Growing Pigs</b> |        |          | <b>Sows</b> |           |
|                                                                    | Starter             | Grower | Finisher | Gestation   | Lactation |
|                                                                    |                     |        |          |             |           |
| <b>Practical</b>                                                   | 2                   | 5      | 6        | 6           | 5         |
| <b>Maximum</b>                                                     | 5                   | 10     | 12       | 12          | 8         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Tallow**

| Main Components (%)       |      |   |    |                              |       |   |    |
|---------------------------|------|---|----|------------------------------|-------|---|----|
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Dry Matter                | 99.4 | 1 | -  | Organic Matter (OM)          | 99.4  |   |    |
| Crude Protein (CP)        | -    | - | -  | Coef. Dig. OM Swine          | 87.1  |   |    |
| Starch                    | -    | - | -  | Digestible OM Swine          | 86.6  |   |    |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 12.8  |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 99.4  | 1 | -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 80.2  |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 79.7  |   |    |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 86.2  |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 85.7  |   |    |
| N-Free Extract (NFE)      | -    |   |    | Linoleic Acid                | 3.10  | 1 | -  |
| Coef. Dig. NFE Poultry    | -    |   |    | Linolenic Acid               | 0.60  | 1 | -  |
| Digestible NFE Poultry    | -    |   |    |                              |       |   |    |
| Undig. NFE + CF Poultry   | -    |   |    |                              |       |   |    |
| Energy (kcal/kg)          |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Mean  | n | SD |
| Gross Energy              | 9408 | 1 | -  | <b>Swine</b>                 |       |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 8193  |   |    |
| Metabolizable Energy      | 7401 |   |    | Metabolizable Energy         | 7886  |   |    |
| Std. Metab. Energy        | 8116 |   |    | Net Energy                   | 7059  |   |    |
| Net Energy                | 6660 |   |    | <b>Sows</b>                  |       |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 8193  |   |    |
| Metabolizable Energy      | 7401 |   |    | Metabolizable Energy         | 7886  |   |    |
| Net Energy                | 6660 |   |    | Net Energy                   | 7059  |   |    |
| Minerals                  |      |   |    |                              |       |   |    |
|                           | Mean | n | SD |                              | Means | n | SD |
| Ash, %                    | -    | - | -  | <b>Trace Minerals, mg/kg</b> |       |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -     | - | -  |
| Potassium (K)             | -    | - | -  | Iron (Fe)                    | -     | - | -  |
| Sodium (Na)               | -    | - | -  | Copper (Cu)                  | -     | - | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -     | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -     | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |       |   |    |
| Total Calcium (Ca)        | -    | - | -  |                              |       |   |    |
| Total Phosphorus (P)      | -    | - | -  |                              |       |   |    |
| Phytate P                 | -    | - | -  |                              |       |   |    |
| Available P (Pav)         | -    |   |    |                              |       |   |    |
| Coef. Dig. P Poultry      | -    |   |    |                              |       |   |    |
| Std. Dig. P Poultry       | -    |   |    |                              |       |   |    |
| Coef. Dig. P Swine        | -    |   |    |                              |       |   |    |
| Std. Dig. P Swine         | -    |   |    |                              |       |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Tallow**

| <b>Amino Acid Content and Digestibility</b> |       |      |                  |       |                  |       |
|---------------------------------------------|-------|------|------------------|-------|------------------|-------|
|                                             | Total | % CP | Poultry          |       | Swine            |       |
|                                             |       |      | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                            | -     | -    | -                | -     | -                | -     |
| Lysine, %                                   | -     | -    | -                | -     | -                | -     |
| Methionine, %                               | -     | -    | -                | -     | -                | -     |
| Met + Cys, %                                | -     | -    | -                | -     | -                | -     |
| Threonine, %                                | -     | -    | -                | -     | -                | -     |
| Tryptophan, %                               | -     | -    | -                | -     | -                | -     |
| Arginine, %                                 | -     | -    | -                | -     | -                | -     |
| Gly + Ser, %                                | -     | -    | -                | -     | -                | -     |
| Valine, %                                   | -     | -    | -                | -     | -                | -     |
| Isoleucine, %                               | -     | -    | -                | -     | -                | -     |
| Leucine, %                                  | -     | -    | -                | -     | -                | -     |
| Histidine, %                                | -     | -    | -                | -     | -                | -     |
| Phenylalanine, %                            | -     | -    | -                | -     | -                | -     |
| Phe + Tyr, %                                | -     | -    | -                | -     | -                | -     |
| Alanine, %                                  | -     | -    | -                | -     | -                | -     |
| Cysteine, %                                 | -     | -    | -                | -     | -                | -     |
| Tyrosine, %                                 | -     | -    | -                | -     | -                | -     |
| Glycine, %                                  | -     | -    | -                | -     | -                | -     |
| Serine, %                                   | -     | -    | -                | -     | -                | -     |
| Proline, %                                  | -     | -    | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %                  | -     | -    | -                | -     | -                | -     |
| Glutamic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Asparagine <sup>2</sup> , %                 | -     | -    | -                | -     | -                | -     |
| Aspartic Acid <sup>2</sup> , %              | -     | -    | -                | -     | -                | -     |
| Total Nitrogen (PB/6.25), %                 | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Poultry, %               | -     | -    | -                | -     | -                | -     |
| Essential Nitrogen Swine, %                 | -     | -    | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 2            | 3      |          |           | 3         |
|                                                             | 4            | 6      |          |           | 6         |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 2      | 2        | 0         | 2         |
|                                                             | 4            | 5      | 5        | 4         | 5         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Triticale, Grain**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 88.0 | 61 | 0.79 | Organic Matter (OM)          | 86.3  |         |
| Crude Protein (CP)        | 13.6 | 62 | 1.30 | Coef. Dig. OM Swine          | 85.0  |         |
| Starch                    | 60.3 | 6  | 4.68 | Digestible OM Swine          | 73.3  |         |
| Crude Fiber (CF)          | 2.13 | 58 | 0.26 | Undig. OM Pigs               | 12.9  |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 1.56  | 60 0.37 |
| NDF                       | 12.6 | 4  | 0.12 | Coef. Dig. EE Poultry        | 67.0  |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 1.05  |         |
| ADF                       | 3.87 | 4  | 0.29 | Coef. Dig. EE Swine          | 70.0  |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.10  |         |
| N-Free Extract (NFE)      | 69.0 |    |      | Linoleic Acid                | 0.50  | 3 0.07  |
| Coef. Dig. NFE Poultry    | 83.0 |    |      | Linolenic Acid               | 0.04  | 1 -     |
| Digestible NFE Poultry    | 57.3 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 13.9 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 3880 | 35 | 60   | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3268  |         |
| Metabolizable Energy      | 2968 |    |      | Metabolizable Energy         | 3185  |         |
| Std. Metab. Energy        | 3165 |    |      | Net Energy                   | 2457  |         |
| Net Energy                | 2363 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3388  |         |
| Metabolizable Energy      | 3016 |    |      | Metabolizable Energy         | 3279  |         |
| Net Energy                | 2411 |    |      | Net Energy                   | 2526  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 1.70 | 58 | 0.19 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 44.6  | 1 -     |
| Potassium (K)             | 0.46 | 4  | 0.02 | Iron (Fe)                    | 156.0 | 1 -     |
| Sodium (Na)               | 0.02 | 4  | 0.01 | Copper (Cu)                  | 21.8  | 1 -     |
| Chlorine (Cl)             | 0.05 | 4  | 0.03 | Zinc (Zn)                    | 64.1  | 1 -     |
| Sulfur (S)                | 0.14 | 2  | 0.01 | Selenium (Se)                | -     | - -     |
| Magnesium (Mg)            | 0.10 | 1  | -    |                              |       |         |
| Total Calcium (Ca)        | 0.05 | 8  | 0.01 |                              |       |         |
| Total Phosphorus (P)      | 0.31 | 9  | 0.05 |                              |       |         |
| Phytate P                 | 0.18 | 4  | 0.03 |                              |       |         |
| Available P (Pav)         | 0.13 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 50.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.15 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 50.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.15 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P);

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Triticale, Grain**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 13.6  | 100   | 11.7             | 86.3  | 11.0             | 81.0  |
| Lysine, %                            | 0.41  | 3.02  | 0.34             | 82.7  | 0.34             | 82.1  |
| Methionine, %                        | 0.20  | 1.47  | 0.17             | 85.2  | 0.18             | 90.6  |
| Met + Cys, %                         | 0.48  | 3.54  | 0.39             | 81.1  | 0.41             | 86.2  |
| Threonine, %                         | 0.37  | 2.72  | 0.30             | 81.8  | 0.29             | 77.3  |
| Tryptophan, %                        | 0.14  | 1.03  | 0.12             | 88.1  | 0.12             | 83.8  |
| Arginine, %                          | 0.62  | 4.57  | 0.53             | 84.7  | 0.54             | 87.7  |
| Gly + Ser, %                         | 1.13  | 8.32  | 0.94             | 83.2  |                  |       |
| Valine, %                            | 0.52  | 3.83  | 0.42             | 80.7  | 0.41             | 79.8  |
| Isoleucine, %                        | 0.42  | 3.09  | 0.36             | 86.1  | 0.36             | 86.3  |
| Leucine, %                           | 0.79  | 5.82  | 0.67             | 84.2  | 0.67             | 85.1  |
| Histidine, %                         | 0.30  | 2.21  | 0.25             | 83.8  | 0.24             | 81.4  |
| Phenylalanine, %                     | 0.56  | 4.12  | 0.46             | 83.0  | 0.45             | 81.2  |
| Phe + Tyr, %                         | 0.88  | 6.48  | 0.73             | 83.2  | 0.71             | 81.2  |
| Alanine, %                           | 0.51  | 3.76  | 0.41             | 80.0  | 0.41             | 80.0  |
| Cysteine, %                          | 0.28  | 2.06  | 0.22             | 78.1  | 0.23             | 83.1  |
| Tyrosine, %                          | 0.32  | 2.36  | 0.27             | 83.5  | 0.26             | 81.3  |
| Glycine, %                           | 0.56  | 4.12  | 0.50             | 89.1  | 0.41             | 73.2  |
| Serine, %                            | 0.57  | 4.20  | 0.44             | 77.4  | 0.45             | 78.9  |
| Proline, %                           | 1.18  | 8.69  | 1.05             | 89.0  | 1.11             | 94.0  |
| Glutamine <sup>2</sup> , %           | 2.25  | 16.6  | 2.09             | 93.0  | 1.70             | 75.7  |
| Glutamic Acid <sup>2</sup> , %       | 1.41  | 10.4  | 1.31             | 93.0  | 1.07             | 75.7  |
| Asparagine <sup>2</sup> , %          | 0.33  | 2.45  | 0.26             | 77.0  | 0.27             | 80.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.41  | 3.00  | 0.31             | 77.0  | 0.33             | 80.0  |
| Total Nitrogen (PB/6.25), %          | 2.17  | 16.0  | 1.87             | 86.3  | 1.76             | 81.0  |
| Essential Nitrogen Poultry, %        | 0.86  | 39.6* | 0.72             | 83.6  |                  |       |
| Essential Nitrogen Swine, %          | 0.68  | 31.3* |                  |       | 0.57             | 83.5  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 10                  | 15     | 15          |             |           |
| Practical Maximum                                           | 20                  | 25     | 30          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 10                  | 20     | 20          | 20          | 20        |
| Practical Maximum                                           | 25                  | 35     | 35          | 35          | 35        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Bran**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 88.5 | 29 | 1.30 | Organic Matter (OM)          | 84.1  |         |
| Crude Protein (CP)        | 15.2 | 29 | 1.18 | Coef. Dig. OM Swine          | 62.0  |         |
| Starch                    | 29.6 | 4  | 4.26 | Digestible OM Swine          | 52.1  |         |
| Crude Fiber (CF)          | 9.07 | 6  | 0.59 | Undig. OM Pigs               | 31.9  |         |
| Coef. Dig. CF Swine       | 36.1 |    |      | Ether Extract (EE)           | 3.40  | 10 0.69 |
| NDF                       | 39.8 | 6  | 2.13 | Coef. Dig. EE Poultry        | 56.0  |         |
| Coef. Dig. NDF Swine      | 50.4 |    |      | Digestible EE Poultry        | 1.90  |         |
| ADF                       | 13.1 | 5  | 0.77 | Coef. Dig. EE Swine          | 63.0  |         |
| Coef. Dig. ADF Swine      | 52.4 |    |      | Digestible EE Swine          | 2.14  |         |
| N-Free Extract (NFE)      | 56.5 |    |      | Linoleic Acid                | 1.54  | 1 -     |
| Coef. Dig. NFE Poultry    | 47.3 |    |      | Linolenic Acid               | 0.12  | 1 -     |
| Digestible NFE Poultry    | 23.7 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 38.8 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 3922 | 6  | 45   | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 2481  |         |
| Metabolizable Energy      | 1810 |    |      | Metabolizable Energy         | 2370  |         |
| Std. Metab. Energy        | 2119 |    |      | Net Energy                   | 1694  |         |
| Net Energy                | 1444 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 2767  |         |
| Metabolizable Energy      | 1927 |    |      | Metabolizable Energy         | 2605  |         |
| Net Energy                | 1561 |    |      | Net Energy                   | 1866  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 4.43 | 9  | 0.97 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 102.7 | 1 -     |
| Potassium (K)             | 1.10 | 6  | 0.11 | Iron (Fe)                    | 205.3 | 1 -     |
| Sodium (Na)               | 0.02 | 5  | 0.01 | Copper (Cu)                  | 15.0  | 1 -     |
| Chlorine (Cl)             | 0.07 | 4  | 0.01 | Zinc (Zn)                    | 134.5 | 1 -     |
| Sulfur (S)                | 0.20 | 2  | 0.03 | Selenium (Se)                | 0.31  | 1 -     |
| Magnesium (Mg)            | 0.43 | 4  | 0.07 |                              |       |         |
| Total Calcium (Ca)        | 0.14 | 12 | 0.03 |                              |       |         |
| Total Phosphorus (P)      | 0.94 | 8  | 0.07 |                              |       |         |
| Phytate P                 | 0.45 | 9  | 0.22 |                              |       |         |
| Available P (Pav)         | 0.49 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 50.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.47 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 52.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.49 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Bran**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 15.2  | 100   | 12.3             | 80.9  | 11.7             | 77.3  |
| Lysine, %                            | 0.60  | 3.96  | 0.44             | 74.1  | 0.43             | 72.0  |
| Methionine, %                        | 0.24  | 1.58  | 0.18             | 76.1  | 0.19             | 77.1  |
| Met + Cys, %                         | 0.55  | 3.63  | 0.42             | 75.6  | 0.41             | 74.9  |
| Threonine, %                         | 0.51  | 3.36  | 0.37             | 72.6  | 0.33             | 65.4  |
| Tryptophan, %                        | 0.22  | 1.45  | 0.17             | 75.0  | 0.16             | 70.9  |
| Arginine, %                          | 1.02  | 6.73  | 0.93             | 91.0  | 0.88             | 86.4  |
| Gly + Ser, %                         | 1.47  | 9.69  | 1.05             | 71.1  |                  |       |
| Valine, %                            | 0.70  | 4.62  | 0.50             | 71.4  | 0.53             | 75.4  |
| Isoleucine, %                        | 0.48  | 3.16  | 0.39             | 80.3  | 0.37             | 77.5  |
| Leucine, %                           | 0.92  | 6.07  | 0.74             | 80.6  | 0.72             | 78.6  |
| Histidine, %                         | 0.40  | 2.64  | 0.29             | 73.5  | 0.34             | 85.3  |
| Phenylalanine, %                     | 0.60  | 3.96  | 0.50             | 83.8  | 0.49             | 81.3  |
| Phe + Tyr, %                         | 1.04  | 6.86  | 0.86             | 82.9  | 0.83             | 80.2  |
| Alanine, %                           | 0.72  | 4.75  | 0.54             | 75.0  | 0.48             | 66.0  |
| Cysteine, %                          | 0.31  | 2.04  | 0.23             | 75.2  | 0.23             | 73.2  |
| Tyrosine, %                          | 0.44  | 2.90  | 0.36             | 81.7  | 0.35             | 78.7  |
| Glycine, %                           | 0.81  | 5.34  | 0.50             | 61.5  | 0.53             | 65.0  |
| Serine, %                            | 0.66  | 4.35  | 0.53             | 80.7  | 0.47             | 71.6  |
| Proline, %                           | 1.00  | 6.59  | 0.88             | 87.6  | 0.79             | 79.1  |
| Glutamine <sup>2</sup> , %           | 1.85  | 12.2  | 1.65             | 89.1  | 1.57             | 85.0  |
| Glutamic Acid <sup>2</sup> , %       | 1.16  | 7.65  | 1.03             | 89.1  | 0.99             | 85.0  |
| Asparagine <sup>2</sup> , %          | 0.48  | 3.17  | 0.38             | 79.9  | 0.34             | 71.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.59  | 3.89  | 0.47             | 79.9  | 0.42             | 71.0  |
| Total Nitrogen (PB/6.25), %          | 2.43  | 16.0  | 1.96             | 80.9  | 1.88             | 77.3  |
| Essential Nitrogen Poultry, %        | 1.19  | 48.9* | 0.92             | 77.4  |                  |       |
| Essential Nitrogen Swine, %          | 0.95  | 39.1* |                  |       | 0.74             | 78.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 3            | 5      | 6        |           |           |
| Practical Maximum                                           | 10           | 15     | 15       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 5      | 8        | 15        | 5         |
| Practical Maximum                                           | 5            | 12     | 15       | 35        | 15        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Dark Flour**

| Main Components (%)       |      |   |      |                              |       |   |      |
|---------------------------|------|---|------|------------------------------|-------|---|------|
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Dry Matter                | 88.2 | 2 | 0.00 | Organic Matter (OM)          | 84.2  |   |      |
| Crude Protein (CP)        | 17.9 | 2 | 0.91 | Coef. Dig. OM Swine          | 72.8  |   |      |
| Starch                    | 27.7 | 1 | -    | Digestible OM Swine          | 61.3  |   |      |
| Crude Fiber (CF)          | 7.75 | 2 | 0.22 | Undig. OM Pigs               | 22.9  |   |      |
| Coef. Dig. CF Swine       | -    |   |      | Ether Extract (EE)           | 2.07  | 2 | 0.79 |
| NDF                       | 31.7 | 2 | 0.29 | Coef. Dig. EE Poultry        | 87.0  |   |      |
| Coef. Dig. NDF Swine      | -    |   |      | Digestible EE Poultry        | 1.80  |   |      |
| ADF                       | 10.1 | 2 | 0.75 | Coef. Dig. EE Swine          | 80.0  |   |      |
| Coef. Dig. ADF Swine      | -    |   |      | Digestible EE Swine          | 1.66  |   |      |
| N-Free Extract (NFE)      | 56.5 |   |      | Linoleic Acid                | 1.46  | 1 | -    |
| Coef. Dig. NFE Poultry    | 64.0 |   |      | Linolenic Acid               | -     | - | -    |
| Digestible NFE Poultry    | 36.2 |   |      |                              |       |   |      |
| Undig. NFE + CF Poultry   | 28.1 |   |      |                              |       |   |      |
| Energy (kcal/kg)          |      |   |      |                              |       |   |      |
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Gross Energy              | 3773 | 2 | 35   | <b>Swine</b>                 |       |   |      |
| <b>Poultry</b>            |      |   |      | Digestible Energy            | 2848  |   |      |
| Metabolizable Energy      | 2321 |   |      | Metabolizable Energy         | 2740  |   |      |
| Std. Metab. Energy        | -    |   |      | Net Energy                   | 1935  |   |      |
| Net Energy                | 1846 |   |      | <b>Sows</b>                  |       |   |      |
| <b>Hens</b>               |      |   |      | Digestible Energy            | 3067  |   |      |
| Metabolizable Energy      | 2411 |   |      | Metabolizable Energy         | 2910  |   |      |
| Net Energy                | 1936 |   |      | Net Energy                   | 2059  |   |      |
| Minerals                  |      |   |      |                              |       |   |      |
|                           | Mean | n | SD   |                              | Mean  | n | SD   |
| Ash, %                    | 4.01 | 2 | 0.14 | <b>Trace Minerals, mg/kg</b> |       |   |      |
| <b>Macro Minerals (%)</b> |      |   |      | Manganese (Mn)               | 103.5 | 2 | 0.01 |
| Potassium (K)             | 1.00 | 2 | 0.01 | Iron (Fe)                    | 177.9 | 2 | 21.0 |
| Sodium (Na)               | 0.03 | 2 | 0.01 | Copper (Cu)                  | 14.94 | 2 | 1.18 |
| Chlorine (Cl)             | 0.04 | - | -    | Zinc (Zn)                    | 153.4 | 2 | 17.5 |
| Sulfur (S)                | -    | - | -    | Selenium (Se)                | -     | - | -    |
| Magnesium (Mg)            | 0.34 | 2 | 0.04 |                              |       |   |      |
| Total Calcium (Ca)        | 0.15 | 1 | 0.01 |                              |       |   |      |
| Total Phosphorus (P)      | 0.90 | 1 | -    |                              |       |   |      |
| Phytate P                 | 0.60 | 1 | -    |                              |       |   |      |
| Available P (Pav)         | 0.30 |   |      |                              |       |   |      |
| Coef. Dig. P Poultry      | 28.0 |   |      |                              |       |   |      |
| Std. Dig. P Poultry       | 0.25 |   |      |                              |       |   |      |
| Coef. Dig. P Swine        | 28.0 |   |      |                              |       |   |      |
| Std. Dig. P Swine         | 0.25 |   |      |                              |       |   |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Dark Flour**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 17.9                                 | 100   | 15.4             | 85.9  | 13.9             | 77.5  |
| Lysine, %                      | 0.74                                 | 4.13  | 0.61             | 81.8  | 0.54             | 73.6  |
| Methionine, %                  | 0.29                                 | 1.62  | 0.24             | 81.6  | 0.23             | 80.0  |
| Met + Cys, %                   | 0.64                                 | 3.58  | 0.53             | 82.3  | 0.47             | 73.5  |
| Threonine, %                   | 0.58                                 | 3.24  | 0.46             | 79.3  | 0.42             | 71.7  |
| Tryptophan, %                  | 0.20                                 | 1.12  | 0.17             | 85.0  | 0.15             | 75.0  |
| Arginine, %                    | 1.24                                 | 6.93  | 1.14             | 92.3  | 1.06             | 85.7  |
| Gly + Ser, %                   | 0.94                                 | 5.25  | 0.79             | 84.5  | -                | -     |
| Valine, %                      | 0.82                                 | 4.58  | 0.67             | 82.0  | 0.63             | 77.2  |
| Isoleucine, %                  | 0.57                                 | 3.18  | 0.48             | 83.5  | 0.44             | 77.8  |
| Leucine, %                     | 1.10                                 | 6.15  | 0.94             | 85.2  | 0.88             | 80.0  |
| Histidine, %                   | 0.49                                 | 2.74  | 0.43             | 86.8  | 0.40             | 81.4  |
| Phenylalanine, %               | 0.68                                 | 3.80  | 0.60             | 87.8  | 0.55             | 81.4  |
| Phe + Tyr, %                   | 1.09                                 | 6.09  | 0.96             | 87.7  | 0.87             | 80.0  |
| Alanine, %                     | 0.83                                 | 4.64  | 0.59             | 71.5  | -                | -     |
| Cysteine, %                    | 0.35                                 | 1.96  | 0.29             | 82.8  | 0.24             | 68.2  |
| Tyrosine, %                    | 0.41                                 | 2.29  | 0.36             | 87.6  | 0.32             | 77.8  |
| Glycine, %                     | 0.19                                 | 1.06  | 0.16             | 84.5  | -                | -     |
| Serine, %                      | 0.75                                 | 4.19  | 0.63             | 84.5  | -                | -     |
| Proline, %                     | 1.35                                 | 7.54  | 1.22             | 90.5  | -                | -     |
| Glutamine <sup>2</sup> , %     | 2.00                                 | 11.2  | 1.84             | 91.9  | -                | -     |
| Glutamic Acid <sup>2</sup> , % | 1.26                                 | 7.02  | 1.16             | 91.9  | -                | -     |
| Asparagine <sup>2</sup> , %    | 0.57                                 | 3.18  | 0.46             | 80.1  | -                | -     |
| Aspartic Acid <sup>2</sup> , % | 0.70                                 | 3.91  | 0.56             | 80.1  | -                | -     |
| Total Nitrogen (PB/6.25), %    | 2.86                                 | 16.0  | 2.46             | 85.9  | 2.22             | 77.5  |
| Essential Nitrogen Poultry, %  | 1.27                                 | 44.2* | 1.08             | 85.2  | -                | -     |
| Essential Nitrogen Swine, %    | 1.13                                 | 39.5* | -                | -     | 0.90             | 79.2  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 6            | 8      | 8        |           |           |
| Practical Maximum                                           | 15           | 15     | 20       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 8            | 15     | 15       | 20        | 15        |
| Practical Maximum                                           | 15           | 30     | 30       | 40        | 35        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Flour**

| Main Components (%)       |      |    |      |                              |      |         |
|---------------------------|------|----|------|------------------------------|------|---------|
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Dry Matter                | 87.1 | 17 | 0.56 | Organic Matter (OM)          | 86.4 |         |
| Crude Protein (CP)        | 11.7 | 18 | 0.93 | Coef. Dig. OM Swine          | 90.8 |         |
| Starch                    | 76.5 | 1  | -    | Digestible OM Swine          | 78.5 |         |
| Crude Fiber (CF)          | 0.11 | 4  | 0.13 | Undig. OM Pigs               | 7.95 |         |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 1.19 | 10 0.30 |
| NDF                       | 2.65 | 1  | -    | Coef. Dig. EE Poultry        | 87.0 |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | 1.04 |         |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | 80.0 |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 0.95 |         |
| N-Free Extract (NFE)      | 73.4 |    |      | Linoleic Acid                | 0.54 | 1 -     |
| Coef. Dig. NFE Poultry    | 96.0 |    |      | Linolenic Acid               | -    | - -     |
| Digestible NFE Poultry    | 70.5 |    |      |                              |      |         |
| Undig. NFE + CF Poultry   | 3.05 |    |      |                              |      |         |
| Energy (kcal/kg)          |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Gross Energy              | 3775 | 1  | -    | <b>Swine</b>                 |      |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3588 |         |
| Metabolizable Energy      | 3503 |    |      | Metabolizable Energy         | 3388 |         |
| Std. Metab. Energy        | 3551 |    |      | Net Energy                   | 2692 |         |
| Net Energy                | 2794 |    |      | <b>Sows</b>                  |      |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3549 |         |
| Metabolizable Energy      | 3504 |    |      | Metabolizable Energy         | 3451 |         |
| Net Energy                | 2796 |    |      | Net Energy                   | 2738 |         |
| Minerals                  |      |    |      |                              |      |         |
|                           | Mean | n  | SD   |                              | Mean | n SD    |
| Ash, %                    | 0.71 | 10 | 0.23 | <b>Trace Minerals, mg/kg</b> |      |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 6.80 | 1 -     |
| Potassium (K)             | 0.11 | 1  | -    | Iron (Fe)                    | 29.3 | 1 -     |
| Sodium (Na)               | 0.01 | 1  | -    | Copper (Cu)                  | 3.01 | 1 -     |
| Chlorine (Cl)             | -    | -  | -    | Zinc (Zn)                    | 22.0 | 1 -     |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -     |
| Magnesium (Mg)            | 0.03 | 1  | -    |                              |      |         |
| Total Calcium (Ca)        | 0.04 | 4  | 0.05 |                              |      |         |
| Total Phosphorus (P)      | 0.07 | 4  | 0.01 |                              |      |         |
| Phytate P                 | 0.05 | 1  | -    |                              |      |         |
| Available P (Pav)         | 0.02 |    |      |                              |      |         |
| Coef. Dig. P Poultry      | 28.0 |    |      |                              |      |         |
| Std. Dig. P Poultry       | 0.02 |    |      |                              |      |         |
| Coef. Dig. P Swine        | 28.0 |    |      |                              |      |         |
| Std. Dig. P Swine         | 0.02 |    |      |                              |      |         |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Flour**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 11.7                                 | 100   | 11.2             | 95.3  | 11.2             | 95.6  |
| Lysine, %                      | 0.30                                 | 2.57  | 0.28             | 93.2  | 0.28             | 92.0  |
| Methionine, %                  | 0.20                                 | 1.71  | 0.19             | 95.2  | 0.19             | 95.0  |
| Met + Cys, %                   | 0.49                                 | 4.19  | 0.46             | 93.3  | 0.45             | 92.6  |
| Threonine, %                   | 0.35                                 | 3.00  | 0.30             | 87.1  | 0.32             | 90.0  |
| Tryptophan, %                  | 0.14                                 | 1.20  | 0.13             | 92.9  | 0.13             | 91.0  |
| Arginine, %                    | 0.52                                 | 4.45  | 0.50             | 96.4  | 0.50             | 96.0  |
| Gly + Ser, %                   | 1.04                                 | 8.90  | 0.97             | 93.3  |                  |       |
| Valine, %                      | 0.50                                 | 4.28  | 0.46             | 92.8  | 0.46             | 92.0  |
| Isoleucine, %                  | 0.48                                 | 4.11  | 0.46             | 95.0  | 0.45             | 94.0  |
| Leucine, %                     | 0.85                                 | 7.27  | 0.80             | 94.3  | 0.81             | 95.0  |
| Histidine, %                   | 0.28                                 | 2.40  | 0.26             | 94.2  | 0.27             | 96.0  |
| Phenylalanine, %               | 0.60                                 | 5.14  | 0.56             | 93.3  | 0.58             | 96.0  |
| Phe + Tyr, %                   | 0.88                                 | 7.53  | 0.82             | 92.7  | 0.84             | 95.4  |
| Alanine, %                     | 0.34                                 | 2.91  | 0.29             | 84.5  | 0.31             | 90.3  |
| Cysteine, %                    | 0.29                                 | 2.48  | 0.27             | 92.0  | 0.26             | 91.0  |
| Tyrosine, %                    | 0.28                                 | 2.40  | 0.26             | 91.5  | 0.26             | 94.0  |
| Glycine, %                     | 0.48                                 | 4.11  | 0.43             | 89.4  | 0.45             | 94.2  |
| Serine, %                      | 0.56                                 | 4.79  | 0.54             | 96.6  | 0.53             | 93.9  |
| Proline, %                     | 1.48                                 | 12.7  | 1.45             | 98.0  | 1.45             | 97.9  |
| Glutamine <sup>2</sup> , %     | 2.80                                 | 21.4  | 2.47             | 98.9  | 2.46             | 98.4  |
| Glutamic Acid <sup>2</sup> , % | 1.57                                 | 13.4  | 1.55             | 98.9  | 1.54             | 98.4  |
| Asparagine <sup>2</sup> , %    | 0.22                                 | 1.88  | 0.19             | 88.0  | 0.20             | 89.9  |
| Aspartic Acid <sup>2</sup> , % | 0.27                                 | 2.31  | 0.24             | 88.0  | 0.24             | 89.9  |
| Total Nitrogen (PB/6.25), %    | 1.87                                 | 16.0  | 1.78             | 95.3  | 1.79             | 95.6  |
| Essential Nitrogen Poultry, %  | 0.80                                 | 46.2* | 0.75             | 93.6  |                  |       |
| Essential Nitrogen Swine, %    | 0.63                                 | 33.8* |                  |       | 0.60             | 94.1  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 20           | 20     | 20       |           |           |
| Practical Maximum                                           | 40           | 40     | 40       |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 20           | 20     | 20       | 20        | 20        |
| Practical Maximum                                           | 40           | 40     | 40       | 40        | 40        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Germ**

| Main Components (%)       |       |   |      |                              |       |        |
|---------------------------|-------|---|------|------------------------------|-------|--------|
|                           | Mean  | n | SD   |                              | Mean  | n SD   |
| Dry Matter                | 88.9  | 3 | 0.83 | Organic Matter (OM)          | 84.9  |        |
| Crude Protein (CP)        | 27.6  | 4 | 0.85 | Coef. Dig. OM Swine          | 88.8  |        |
| Starch                    | 15.5  | 1 | -    | Digestible OM Swine          | 75.4  |        |
| Crude Fiber (CF)          | 2.43  | 2 | 0.11 | Undig. OM Pigs               | 9.51  |        |
| Coef. Dig. CF Swine       | -     |   |      | Ether Extract (EE)           | 8.33  | 3 0.75 |
| NDF                       | 11.5  | 3 | 3.87 | Coef. Dig. EE Poultry        | 64.0  |        |
| Coef. Dig. NDF Swine      | 38.8  |   |      | Digestible EE Poultry        | 5.33  |        |
| ADF                       | 3.52  | 3 | 1.25 | Coef. Dig. EE Swine          | 60.0  |        |
| Coef. Dig. ADF Swine      | 35.9  |   |      | Digestible EE Swine          | 5.00  |        |
| N-Free Extract (NFE)      | 46.6  |   |      | Linoleic Acid                | 3.43  | 1 -    |
| Coef. Dig. NFE Poultry    | 49.5  |   |      | Linolenic Acid               | -     | - -    |
| Digestible NFE Poultry    | 23.1  |   |      |                              |       |        |
| Undig. NFE + CF Poultry   | 26.0  |   |      |                              |       |        |
| Energy (kcal/kg)          |       |   |      |                              |       |        |
|                           | Mean  | n | SD   |                              | Mean  | n SD   |
| Gross Energy              | 4331  | 2 | 17   | <b>Swine</b>                 |       |        |
| <b>Poultry</b>            |       |   |      | Digestible Energy            | 3700  |        |
| Metabolizable Energy      | 2536  |   |      | Metabolizable Energy         | 3578  |        |
| Std. Metab. Energy        | 2718  |   |      | Net Energy                   | 2570  |        |
| Net Energy                | 2034  |   |      | <b>Sows</b>                  |       |        |
| <b>Hens</b>               |       |   |      | Digestible Energy            | 3842  |        |
| Metabolizable Energy      | 2619  |   |      | Metabolizable Energy         | 3652  |        |
| Net Energy                | 2117  |   |      | Net Energy                   | 2624  |        |
| Minerals                  |       |   |      |                              |       |        |
|                           | Means | n | SD   |                              | Means | n SD   |
| Ash, %                    | 3.97  | 3 | 0.16 | <b>Trace Minerals, mg/kg</b> |       |        |
| <b>Macro Minerals (%)</b> |       |   |      | Manganese (Mn)               | 134.5 | 1 -    |
| Potassium (K)             | 0.73  | 1 | -    | Iron (Fe)                    | 110.3 | 1 -    |
| Sodium (Na)               | 0.01  | 1 | -    | Copper (Cu)                  | 4.80  | 1 -    |
| Chlorine (Cl)             | 0.07  | 1 | -    | Zinc (Zn)                    | 197.4 | 1 -    |
| Sulfur (S)                | -     | - | -    | Selenium (Se)                | -     | - -    |
| Magnesium (Mg)            | 0.25  | 1 | -    |                              |       |        |
| Total Calcium (Ca)        | 0.09  | 1 | -    |                              |       |        |
| Total Phosphorus (P)      | 0.88  | 1 | -    |                              |       |        |
| Phytate P                 | 0.58  | 1 | -    |                              |       |        |
| Available P (Pav)         | 0.30  |   |      |                              |       |        |
| Coef. Dig. P Poultry      | 28.0  |   |      |                              |       |        |
| Std. Dig. P Poultry       | 0.25  |   |      |                              |       |        |
| Coef. Dig. P Swine        | 28.0  |   |      |                              |       |        |
| Std. Dig. P Swine         | 0.25  |   |      |                              |       |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Germ**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 27.6                                 | 100   | 25.3             | 91.8  | 23.8             | 86.4  |
| Lysine, %                      | 1.75                                 | 6.35  | 1.64             | 93.8  | 1.52             | 86.9  |
| Methionine, %                  | 0.49                                 | 1.78  | 0.46             | 94.4  | 0.44             | 89.8  |
| Met + Cys, %                   | 0.91                                 | 3.30  | 0.84             | 91.8  | 0.76             | 83.2  |
| Threonine, %                   | 1.04                                 | 3.77  | 0.92             | 88.3  | 0.81             | 77.5  |
| Tryptophan, %                  | 0.30                                 | 1.09  | 0.26             | 86.7  | 0.22             | 73.3  |
| Arginine, %                    | 2.07                                 | 7.51  | 1.96             | 94.6  | 1.93             | 93.1  |
| Gly + Ser, %                   | 2.39                                 | 8.67  | 2.17             | 90.7  |                  |       |
| Valine, %                      | 1.35                                 | 4.90  | 1.21             | 89.6  | 1.11             | 82.4  |
| Isoleucine, %                  | 0.92                                 | 3.34  | 0.84             | 91.5  | 0.76             | 82.4  |
| Leucine, %                     | 1.70                                 | 6.17  | 1.56             | 91.5  | 1.43             | 84.0  |
| Histidine, %                   | 0.67                                 | 2.43  | 0.63             | 93.7  | 0.62             | 92.2  |
| Phenylalanine, %               | 0.99                                 | 3.59  | 0.90             | 91.1  | 0.85             | 86.0  |
| Phe + Tyr, %                   | 1.67                                 | 6.09  | 1.53             | 91.6  | 1.46             | 87.3  |
| Alanine, %                     | 1.55                                 | 5.62  | 1.40             | 90.5  | 1.24             | 80.0  |
| Cysteine, %                    | 0.42                                 | 1.52  | 0.37             | 88.8  | 0.32             | 75.4  |
| Tyrosine, %                    | 0.68                                 | 2.47  | 0.63             | 92.3  | 0.61             | 89.2  |
| Glycine, %                     | 1.28                                 | 4.64  | 1.16             | 90.7  | 1.08             | 84.0  |
| Serine, %                      | 1.11                                 | 4.03  | 1.01             | 90.7  | 0.99             | 89.0  |
| Proline, %                     | 1.45                                 | 5.26  | 1.24             | 85.7  | 1.35             | 93.0  |
| Glutamine <sup>2</sup> , %     | 2.29                                 | 8.32  | 2.18             | 95.3  | 2.13             | 93.0  |
| Glutamic Acid <sup>2</sup> , % | 1.44                                 | 5.22  | 1.37             | 95.3  | 1.34             | 93.0  |
| Asparagine <sup>2</sup> , %    | 0.99                                 | 3.60  | 0.91             | 91.7  | 0.79             | 80.0  |
| Aspartic Acid <sup>2</sup> , % | 1.22                                 | 4.42  | 1.12             | 91.7  | 0.97             | 80.0  |
| Total Nitrogen (PB/6.25), %    | 4.41                                 | 16.0  | 4.05             | 91.8  | 3.81             | 86.4  |
| Essential Nitrogen Poultry, %  | 2.30                                 | 52.2* | 2.11             | 91.8  |                  |       |
| Essential Nitrogen Swine, %    | 1.92                                 | 43.5* |                  |       | 1.65             | 85.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 5                   | 8      | 8           |             |           |
| <b>Practical Maximum</b>                                    | 15                  | 15     | 15          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 10                  | 20     | 25          | 25          | 20        |
| <b>Practical Maximum</b>                                    | 15                  | 30     | 30          | 30          | 30        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Gluten**

| Main Components (%)       |      |    |      |                              |      |        |
|---------------------------|------|----|------|------------------------------|------|--------|
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Dry Matter                | 91.7 | 30 | 1.36 | Organic Matter (OM)          | 90.9 |        |
| Crude Protein (CP)        | 74.4 | 26 | 1.61 | Coef. Dig. OM Swine          | -    |        |
| Starch                    | -    | -  | -    | Digestible OM Swine          | -    |        |
| Crude Fiber (CF)          | 1.13 | 1  | -    | Undig. OM Pigs               | -    |        |
| Coef. Dig. CF Swine       | -    |    |      | Ether Extract (EE)           | 1.06 | 3 0.69 |
| NDF                       | 5.27 | 1  | -    | Coef. Dig. EE Poultry        | -    |        |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poultry        | -    |        |
| ADF                       | -    | -  | -    | Coef. Dig. EE Swine          | -    |        |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | -    |        |
| N-Free Extract (NFE)      | 14.3 |    |      | Linoleic Acid                | -    | - -    |
| Coef. Dig. NFE Poultry    | -    |    |      | Linolenic Acid               | -    | - -    |
| Digestible NFE Poultry    | -    |    |      |                              |      |        |
| Undig. NFE + CF Poultry   | -    |    |      |                              |      |        |
| Energy (kcal/kg)          |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Gross Energy              | 5123 | 2  | 248  | <b>Swine</b>                 |      |        |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | -    |        |
| Metabolizable Energy      | 3493 |    |      | Metabolizable Energy         | -    |        |
| Std. Metab. Energy        | -    |    |      | Net Energy                   | -    |        |
| Net Energy                | -    |    |      | <b>Sows</b>                  |      |        |
| <b>Hens</b>               |      |    |      | Digestible Energy            | -    |        |
| Metabolizable Energy      | -    |    |      | Metabolizable Energy         | -    |        |
| Net Energy                | -    |    |      | Net Energy                   | -    |        |
| Minerals                  |      |    |      |                              |      |        |
|                           | Mean | n  | SD   |                              | Mean | n SD   |
| Ash, %                    | 0.78 | 4  | 0.28 | <b>Trace Minerals, mg/kg</b> |      |        |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | -    | - -    |
| Potassium (K)             | -    | -  | -    | Iron (Fe)                    | -    | - -    |
| Sodium (Na)               | -    | -  | -    | Copper (Cu)                  | -    | - -    |
| Chlorine (Cl)             | -    | -  | -    | Zinc (Zn)                    | -    | - -    |
| Sulfur (S)                | -    | -  | -    | Selenium (Se)                | -    | - -    |
| Magnesium (Mg)            | -    | -  | -    |                              |      |        |
| Total Calcium (Ca)        | 0.12 | 2  | 0.03 |                              |      |        |
| Total Phosphorus (P)      | 0.18 | 5  | 0.03 |                              |      |        |
| Phytate P                 | 0.13 | 3  | 0.01 |                              |      |        |
| Available P (Pav)         | 0.05 |    |      |                              |      |        |
| Coef. Dig. P Poultry      | -    |    |      |                              |      |        |
| Std. Dig. P Poultry       | -    |    |      |                              |      |        |
| Coef. Dig. P Swine        | -    |    |      |                              |      |        |
| Std. Dig. P Swine         | -    |    |      |                              |      |        |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Gluten**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 74.4                                 | 100   | 65.2             | 88.2  | 66.0             | 88.6  |
| Lysine, %                      | 1.24                                 | 1.67  | 1.11             | 89.6  | 0.99             | 80.0  |
| Methionine, %                  | 1.20                                 | 1.61  | 1.15             | 95.7  | 1.02             | 85.0  |
| Met + Cys, %                   | 2.81                                 | 3.78  | 2.66             | 94.8  | 2.30             | 82.0  |
| Threonine, %                   | 1.95                                 | 2.62  | 1.83             | 93.6  | 1.40             | 72.0  |
| Tryptophan, %                  | 0.73                                 | 0.98  | 0.72             | 98.1  | 0.61             | 83.0  |
| Arginine, %                    | 2.59                                 | 3.48  | 2.14             | 82.5  | 2.20             | 85.0  |
| Gly + Ser, %                   | 6.09                                 | 8.19  | 5.54             | 90.9  |                  |       |
| Valine, %                      | 3.02                                 | 4.06  | 2.76             | 91.3  | 2.57             | 85.0  |
| Isoleucine, %                  | 2.70                                 | 3.63  | 2.47             | 91.4  | 2.35             | 87.0  |
| Leucine, %                     | 5.18                                 | 6.96  | 4.52             | 87.3  | 4.71             | 91.0  |
| Histidine, %                   | 1.59                                 | 2.14  | 1.50             | 94.6  | 1.38             | 87.0  |
| Phenylalanine, %               | 3.76                                 | 5.05  | 3.47             | 92.3  | 3.35             | 89.0  |
| Phe + Tyr, %                   | 6.43                                 | 8.64  | 6.08             | 94.5  | 5.46             | 84.9  |
| Alanine, %                     | 2.01                                 | 2.70  | 1.81             | 90.2  | 1.57             | 78.0  |
| Cysteine, %                    | 1.61                                 | 2.16  | 1.52             | 94.1  | 1.37             | 85.0  |
| Tyrosine, %                    | 2.67                                 | 3.59  | 2.60             | 97.5  | 2.43             | 91.0  |
| Glycine, %                     | 2.56                                 | 3.44  | 2.29             | 89.6  | 2.23             | 87.0  |
| Serine, %                      | 3.53                                 | 4.74  | 3.24             | 91.9  | 3.07             | 87.0  |
| Proline, %                     | 9.67                                 | 13.0  | 8.18             | 84.6  | 8.90             | 92.0  |
| Glutamine <sup>2</sup> , %     | 16.2                                 | 21.8  | 13.9             | 85.7  | 15.1             | 93.0  |
| Glutamic Acid <sup>2</sup> , % | 10.2                                 | 13.7  | 8.72             | 85.7  | 9.47             | 93.0  |
| Asparagine <sup>2</sup> , %    | 1.12                                 | 1.50  | 0.96             | 85.5  | 0.76             | 68.0  |
| Aspartic Acid <sup>2</sup> , % | 1.37                                 | 1.85  | 1.17             | 85.5  | 0.93             | 68.0  |
| Total Nitrogen (PB/6.25), %    | 11.9                                 | 16.0  | 10.5             | 88.2  | 10.6             | 88.6  |
| Essential Nitrogen Poultry, %  | 4.41                                 | 37.1* | 3.99             | 90.5  |                  |       |
| Essential Nitrogen Swine, %    | 3.46                                 | 29.1* |                  |       | 2.98             | 85.9  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 3                   | -      |             |             |           |
| <b>Practical</b>                                            | 3                   | -      |             |             |           |
| <b>Maximum</b>                                              | 6                   | -      |             |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 3                   | -      | -           | -           | -         |
| <b>Practical</b>                                            | 3                   | -      | -           | -           | -         |
| <b>Maximum</b>                                              | 6                   | -      | -           | -           | -         |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Grain**

| Main Components (%)       |      |    |      |                              |       |         |
|---------------------------|------|----|------|------------------------------|-------|---------|
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Dry Matter                | 88.0 | 54 | 0.64 | Organic Matter (OM)          | 86.5  |         |
| Crude Protein (CP)        | 13.6 | 54 | 1.03 | Coef. Dig. OM Swine          | 85.9  |         |
| Starch                    | 56.7 | 4  | 3.10 | Digestible OM Swine          | 74.3  |         |
| Crude Fiber (CF)          | 2.08 | 54 | 0.33 | Undig. OM Pigs               | 12.2  |         |
| Coef. Dig. CF Swine       | 17.0 |    |      | Ether Extract (EE)           | 1.80  | 51 0.37 |
| NDF                       | 11.3 | 5  | 1.39 | Coef. Dig. EE Poult.         | 68.0  |         |
| Coef. Dig. NDF Swine      | -    |    |      | Digestible EE Poult.         | 1.23  |         |
| ADF                       | 3.09 | 5  | 0.32 | Coef. Dig. EE Swine          | 70.0  |         |
| Coef. Dig. ADF Swine      | -    |    |      | Digestible EE Swine          | 1.26  |         |
| N-Free Extract (NFE)      | 69.0 |    |      | Linoleic Acid                | 0.68  | 1 -     |
| Coef. Dig. NFE Poultry    | 83.8 |    |      | Linolenic Acid               | 0.05  | 1 -     |
| Digestible NFE Poultry    | 57.8 |    |      |                              |       |         |
| Undig. NFE + CF Poultry   | 13.3 |    |      |                              |       |         |
| Energy (kcal/kg)          |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Gross Energy              | 3835 | 16 | 27   | <b>Swine</b>                 |       |         |
| <b>Poultry</b>            |      |    |      | Digestible Energy            | 3340  |         |
| Metabolizable Energy      | 3039 |    |      | Metabolizable Energy         | 3243  |         |
| Std. Metab. Energy        | 3124 |    |      | Net Energy                   | 2489  |         |
| Net Energy                | 2422 |    |      | <b>Sows</b>                  |       |         |
| <b>Hens</b>               |      |    |      | Digestible Energy            | 3448  |         |
| Metabolizable Energy      | 3084 |    |      | Metabolizable Energy         | 3332  |         |
| Net Energy                | 2462 |    |      | Net Energy                   | 2555  |         |
| Minerals                  |      |    |      |                              |       |         |
|                           | Mean | n  | SD   |                              | Mean  | n SD    |
| Ash, %                    | 1.51 | 54 | 0.20 | <b>Trace Minerals, mg/kg</b> |       |         |
| <b>Macro Minerals (%)</b> |      |    |      | Manganese (Mn)               | 22.93 | 5 1.30  |
| Potassium (K)             | 0.39 | 8  | 0.03 | Iron (Fe)                    | 42.69 | 5 6.44  |
| Sodium (Na)               | 0.01 | 8  | 0.00 | Copper (Cu)                  | 3.36  | 5 0.42  |
| Chlorine (Cl)             | 0.08 | 4  | 0.01 | Zinc (Zn)                    | 28.51 | 5 2.67  |
| Sulfur (S)                | 0.15 | 3  | 0.01 | Selenium (Se)                | -     | - -     |
| Magnesium (Mg)            | 0.11 | 7  | 0.01 |                              |       |         |
| Total Calcium (Ca)        | 0.05 | 12 | 0.01 |                              |       |         |
| Total Phosphorus (P)      | 0.30 | 12 | 0.03 |                              |       |         |
| Phytate P                 | 0.22 | 4  | 0.01 |                              |       |         |
| Available P (Pav)         | 0.08 |    |      |                              |       |         |
| Coef. Dig. P Poultry      | 50.0 |    |      |                              |       |         |
| Std. Dig. P Poultry       | 0.15 |    |      |                              |       |         |
| Coef. Dig. P Swine        | 49.0 |    |      |                              |       |         |
| Std. Dig. P Swine         | 0.15 |    |      |                              |       |         |

Pav = Non Phytate P (Total P – Phytate P).

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Grain**

| Amino Acid Content and Digestibility |       |       |                  |       |                  |       |
|--------------------------------------|-------|-------|------------------|-------|------------------|-------|
|                                      | Total | % CP  | Poultry          |       | Swine            |       |
|                                      |       |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %                     | 13.6  | 100   | 12.3             | 90.5  | 12.3             | 90.5  |
| Lysine, %                            | 0.35  | 2.57  | 0.29             | 82.3  | 0.29             | 82.2  |
| Methionine, %                        | 0.20  | 1.47  | 0.18             | 89.5  | 0.18             | 89.8  |
| Met + Cys, %                         | 0.48  | 3.53  | 0.43             | 88.8  | 0.43             | 89.9  |
| Threonine, %                         | 0.36  | 2.65  | 0.29             | 81.6  | 0.30             | 82.6  |
| Tryptophan, %                        | 0.15  | 1.10  | 0.12             | 80.0  | 0.13             | 87.0  |
| Arginine, %                          | 0.59  | 4.34  | 0.53             | 90.2  | 0.52             | 87.6  |
| Gly + Ser, %                         | 1.09  | 8.01  | 0.93             | 85.7  |                  |       |
| Valine, %                            | 0.53  | 3.90  | 0.45             | 85.8  | 0.46             | 86.7  |
| Isoleucine, %                        | 0.44  | 3.23  | 0.39             | 89.0  | 0.39             | 88.8  |
| Leucine, %                           | 0.84  | 6.17  | 0.76             | 89.9  | 0.75             | 89.5  |
| Histidine, %                         | 0.30  | 2.21  | 0.27             | 86.9  | 0.27             | 89.3  |
| Phenylalanine, %                     | 0.57  | 4.19  | 0.52             | 90.7  | 0.52             | 91.4  |
| Phe + Tyr, %                         | 0.80  | 5.88  | 0.72             | 90.1  | 0.73             | 91.1  |
| Alanine, %                           | 0.43  | 3.16  | 0.34             | 78.6  | 0.35             | 81.6  |
| Cysteine, %                          | 0.28  | 2.06  | 0.25             | 88.3  | 0.25             | 90.0  |
| Tyrosine, %                          | 0.23  | 1.69  | 0.20             | 88.6  | 0.21             | 90.3  |
| Glycine, %                           | 0.54  | 3.97  | 0.44             | 82.0  | 0.46             | 84.7  |
| Serine, %                            | 0.55  | 4.04  | 0.49             | 89.4  | 0.48             | 87.3  |
| Proline, %                           | 1.29  | 9.48  | 1.24             | 96.0  | 1.27             | 98.5  |
| Glutamine <sup>2</sup> , %           | 2.14  | 15.8  | 2.06             | 96.0  | 2.04             | 94.9  |
| Glutamic Acid <sup>2</sup> , %       | 1.35  | 9.89  | 1.29             | 96.0  | 1.27             | 94.7  |
| Asparagine <sup>2</sup> , %          | 0.28  | 2.08  | 0.24             | 85.0  | 0.23             | 83.0  |
| Aspartic Acid <sup>2</sup> , %       | 0.35  | 2.55  | 0.30             | 85.0  | 0.29             | 83.0  |
| Total Nitrogen (PB/6.25), %          | 2.18  | 16.0  | 1.97             | 90.5  | 1.97             | 90.5  |
| Essential Nitrogen Poultry, %        | 0.84  | 38.7* | 0.74             | 87.4  |                  |       |
| Essential Nitrogen Swine, %          | 0.67  | 30.7* |                  |       | 0.59             | 87.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 12           | 20     |          | 20        |           |
|                                                             | 20           | 30     |          | 30        |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 10           | 20     | 20       | 20        | 20        |
|                                                             | 25           | 35     | 35       | 35        | 35        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Screenings**

| Main Components (%)       |      |   |    |                              |      |      |
|---------------------------|------|---|----|------------------------------|------|------|
|                           | Mean | n | SD |                              | Mean | n SD |
| Dry Matter                | 88.2 | 1 | -  | Organic Matter (OM)          | 85.4 |      |
| Crude Protein (CP)        | 13.6 | 1 | -  | Coef. Dig. OM Swine          | 81.1 |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 69.3 |      |
| Crude Fiber (CF)          | 6.55 | 1 | -  | Undig. OM Pigs               | 16.2 |      |
| Coef. Dig. CF Swine       | 60.0 |   |    | Ether Extract (EE)           | 2.11 | 1 -  |
| NDF                       | 18.7 | 1 | -  | Coef. Dig. EE Poultry        | 60.0 |      |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 1.27 |      |
| ADF                       | 8.85 | 1 | -  | Coef. Dig. EE Swine          | 60.0 |      |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 1.27 |      |
| N-Free Extract (NFE)      | 63.2 |   |    | Linoleic Acid                | 0.79 | 1 -  |
| Coef. Dig. NFE Poultry    | 81.5 |   |    | Linolenic Acid               | -    | - -  |
| Digestible NFE Poultry    | 51.5 |   |    |                              |      |      |
| Undig. NFE + CF Poultry   | 18.2 |   |    |                              |      |      |
| Energy (kcal/kg)          |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Gross Energy              | 3875 | 1 | -  | <b>Swine</b>                 |      |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3141 |      |
| Metabolizable Energy      | 2783 |   |    | Metabolizable Energy         | 3027 |      |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | -    |      |
| Net Energy                | 2217 |   |    | <b>Sows</b>                  |      |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3268 |      |
| Metabolizable Energy      | 2837 |   |    | Metabolizable Energy         | 3149 |      |
| Net Energy                | 2271 |   |    | Net Energy                   | -    |      |
| Minerals                  |      |   |    |                              |      |      |
|                           | Mean | n | SD |                              | Mean | n SD |
| Ash, %                    | 2.76 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 44.6 | 1 -  |
| Potassium (K)             | 0.43 | 1 | -  | Iron (Fe)                    | 156  | 1 -  |
| Sodium (Na)               | 0.02 | 1 | -  | Copper (Cu)                  | 21.8 | 1 -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | 64.1 | 1 -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - -  |
| Magnesium (Mg)            | 0.17 | 1 | -  |                              |      |      |
| Total Calcium (Ca)        | 0.12 | 1 | -  |                              |      |      |
| Total Phosphorus (P)      | 0.43 | 1 | -  |                              |      |      |
| Phytate P                 | 0.29 | 1 | -  |                              |      |      |
| Available P (Pav)         | 0.14 |   |    |                              |      |      |
| Coef. Dig. P Poultry      | 50.0 |   |    |                              |      |      |
| Std. Dig. P Poultry       | 0.22 |   |    |                              |      |      |
| Coef. Dig. P Swine        | 49.0 |   |    |                              |      |      |
| Std. Dig. P Swine         | 0.21 |   |    |                              |      |      |

Pav = Non Phytate P (Total P – Phytate P);

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Wheat, Screenings**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 13.6                                 | 100   | 12.4             | 90.8  | 11.2             | 82.0  |
| Lysine, %                      | 0.46                                 | 3.38  | 0.38             | 83.5  | -                | -     |
| Methionine, %                  | 0.21                                 | 1.54  | 0.18             | 86.9  | -                | -     |
| Met + Cys, %                   | 0.50                                 | 3.68  | 0.45             | 90.3  | -                | -     |
| Threonine, %                   | 0.42                                 | 3.09  | 0.38             | 90.4  | -                | -     |
| Tryptophan, %                  | 0.17                                 | 1.25  | 0.15             | 90.5  | -                | -     |
| Arginine, %                    | 0.67                                 | 4.93  | 0.66             | 98.5  | -                | -     |
| Gly + Ser, %                   | 1.22                                 | 8.97  | 1.05             | 85.9  | -                | -     |
| Valine, %                      | 0.60                                 | 4.41  | 0.52             | 87.3  | -                | -     |
| Isoleucine, %                  | 0.48                                 | 3.53  | 0.43             | 90.4  | -                | -     |
| Leucine, %                     | 0.89                                 | 6.54  | 0.81             | 91.2  | -                | -     |
| Histidine, %                   | 0.32                                 | 2.35  | 0.26             | 80.6  | -                | -     |
| Phenylalanine, %               | 0.55                                 | 4.04  | 0.52             | 94.5  | -                | -     |
| Phe + Tyr, %                   | 0.89                                 | 6.54  | 0.84             | 94.6  | -                | -     |
| Alanine, %                     | 0.50                                 | 3.68  | 0.38             | 76.7  | -                | -     |
| Cysteine, %                    | 0.29                                 | 2.13  | 0.27             | 92.7  | -                | -     |
| Tyrosine, %                    | 0.34                                 | 2.50  | 0.32             | 94.7  | -                | -     |
| Glycine, %                     | 0.63                                 | 4.63  | 0.49             | 77.7  | -                | -     |
| Serine, %                      | 0.59                                 | 4.34  | 0.56             | 94.7  | -                | -     |
| Proline, %                     | -                                    | -     | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | 2.16                                 | 15.7  | 2.08             | 96.3  | -                | -     |
| Glutamic Acid <sup>2</sup> , % | 1.35                                 | 10.1  | 1.30             | 96.3  | -                | -     |
| Asparagine <sup>2</sup> , %    | 0.34                                 | 2.50  | 0.28             | 83.8  | -                | -     |
| Aspartic Acid <sup>2</sup> , % | 0.41                                 | 3.01  | 0.35             | 83.8  | -                | -     |
| Total Nitrogen (PB/6.25), %    | 2.18                                 | 16.0  | 1.98             | 90.8  | 1.78             | 82.0  |
| Essential Nitrogen Poultry, %  | 0.94                                 | 43.4* | 0.84             | 89.4  | -                | -     |
| Essential Nitrogen Swine, %    | 0.75                                 | 34.3* | -                | -     | -                | -     |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |                     |        |             |             |           |
|-------------------------------------------------------------|---------------------|--------|-------------|-------------|-----------|
|                                                             | <b>Broilers</b>     |        | <b>Hens</b> |             |           |
|                                                             | Starter             | Grower |             |             |           |
|                                                             | 10                  | 12     | 15          |             |           |
| <b>Practical</b>                                            | 10                  | 12     | 15          |             |           |
| <b>Maximum</b>                                              | 20                  | 25     | 30          |             |           |
|                                                             | <b>Growing Pigs</b> |        |             | <b>Sows</b> |           |
|                                                             | Starter             | Grower | Finisher    | Gestation   | Lactation |
|                                                             | 10                  | 15     | 15          | 15          | 15        |
| <b>Practical</b>                                            | 10                  | 15     | 15          | 15          | 15        |
| <b>Maximum</b>                                              | 20                  | 30     | 30          | 30          | 30        |

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Yeast, Alcohol Distiller's**

| Main Components (%)       |      |   |    |                              |       |      |
|---------------------------|------|---|----|------------------------------|-------|------|
|                           | Mean | n | SD |                              | Mean  | n SD |
| Dry Matter                | 91.2 | 1 | -  | Organic Matter (OM)          | 87.8  |      |
| Crude Protein (CP)        | 37.2 | 1 | -  | Coef. Dig. OM Swine          | 80.0  |      |
| Starch                    | -    | - | -  | Digestible OM Swine          | 70.2  |      |
| Crude Fiber (CF)          | -    | - | -  | Undig. OM Pigs               | 17.6  |      |
| Coef. Dig. CF Swine       | -    | - | -  | Ether Extract (EE)           | 0.48  | 1 -  |
| NDF                       | -    | - | -  | Coef. Dig. EE Poultry        | 70.0  |      |
| Coef. Dig. NDF Swine      | -    | - | -  | Digestible EE Poultry        | 0.34  |      |
| ADF                       | -    | - | -  | Coef. Dig. EE Swine          | 80.0  |      |
| Coef. Dig. ADF Swine      | -    | - | -  | Digestible EE Swine          | 0.38  |      |
| N-Free Extract (NFE)      | 50.2 |   |    | Linoleic Acid                | -     | - -  |
| Coef. Dig. NFE Poultry    | 76.0 |   |    | Linolenic Acid               | -     | - -  |
| Digestible NFE Poultry    | 38.1 |   |    |                              |       |      |
| Undig. NFE + CF Poultry   | 12.0 |   |    |                              |       |      |
| Energy (kcal/kg)          |      |   |    |                              |       |      |
|                           | Mean | n | SD |                              | Mean  | n SD |
| Gross Energy              | 4157 | 1 | -  | <b>Swine</b>                 |       |      |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3370  |      |
| Metabolizable Energy      | 2506 |   |    | Metabolizable Energy         | 3164  |      |
| Std. Metab. Energy        | 2615 |   |    | Net Energy                   | 2067  |      |
| Net Energy                | 1974 |   |    | <b>Sows</b>                  |       |      |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3538  |      |
| Metabolizable Energy      | 2535 |   |    | Metabolizable Energy         | 3292  |      |
| Net Energy                | 2003 |   |    | Net Energy                   | 2161  |      |
| Minerals                  |      |   |    |                              |       |      |
|                           | Mean | n | SD |                              | Mean  | n SD |
| Ash, %                    | 3.36 | 1 | -  | <b>Trace Minerals, mg/kg</b> |       |      |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | 14.0  | 1 -  |
| Potassium (K)             | 1.13 | 1 | -  | Iron (Fe)                    | 191.0 | 1 -  |
| Sodium (Na)               | 0.20 | 1 | -  | Copper (Cu)                  | 30.0  | 1 -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | 108.0 | 1 -  |
| Sulfur (S)                | 4.00 | 1 | -  | Selenium (Se)                | 0.55  | 1 -  |
| Magnesium (Mg)            | 0.09 | 1 | -  |                              |       |      |
| Total Calcium (Ca)        | 0.29 | 1 | -  |                              |       |      |
| Total Phosphorus (P)      | 0.82 | 1 | -  |                              |       |      |
| Phytate P                 | -    | - | -  |                              |       |      |
| Available P (Pav)         | 0.27 |   |    |                              |       |      |
| Coef. Dig. P Poultry      | 45.9 |   |    |                              |       |      |
| Std. Dig. P Poultry       | 0.38 |   |    |                              |       |      |
| Coef. Dig. P Swine        | 45.9 |   |    |                              |       |      |
| Std. Dig. P Swine         | 0.38 |   |    |                              |       |      |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Yeast, Alcohol Distiller's**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 37.2                                 | 100   | 20.6             | 55.5  | 28.8             | 77.5  |
| Lysine, %                      | 2.99                                 | 8.0   | 2.11             | 70.6  | 2.48             | 83.0  |
| Methionine, %                  | 0.61                                 | 1.6   | 0.35             | 57.5  | 0.47             | 77.1  |
| Met + Cys, %                   | 0.89                                 | 2.4   | 0.46             | 52.2  | 0.66             | 74.2  |
| Threonine, %                   | 2.14                                 | 5.8   | 1.07             | 49.8  | 1.51             | 70.4  |
| Tryptophan, %                  | 0.48                                 | 1.3   | 0.26             | 53.6  | 0.38             | 78.4  |
| Arginine, %                    | 1.75                                 | 4.7   | 1.25             | 71.5  | 1.47             | 83.8  |
| Gly + Ser, %                   | 3.77                                 | 10.1  | 2.41             | 64.0  |                  |       |
| Valine, %                      | 2.24                                 | 6.0   | 1.26             | 56.3  | 1.63             | 72.7  |
| Isoleucine, %                  | 1.92                                 | 5.2   | 1.04             | 54.3  | 1.43             | 74.6  |
| Leucine, %                     | 2.69                                 | 7.2   | 1.53             | 57.0  | 2.04             | 75.7  |
| Histidine, %                   | 0.83                                 | 2.2   | 0.47             | 56.8  | 0.67             | 80.5  |
| Phenylalanine, %               | 1.64                                 | 4.4   | 0.84             | 51.2  | 1.22             | 74.2  |
| Phe + Tyr, %                   | 2.53                                 | 6.8   | 1.29             | 51.1  | 1.95             | 77.1  |
| Alanine, %                     | 2.51                                 | 6.75  | -                | -     | 1.90             | 75.7  |
| Cysteine, %                    | 0.28                                 | 0.75  | 0.11             | 40.5  | 0.19             | 67.9  |
| Tyrosine, %                    | 0.89                                 | 2.39  | 0.45             | 51.0  | 0.73             | 82.4  |
| Glycine, %                     | 1.66                                 | 4.46  | -                | -     | 1.35             | 81.2  |
| Serine, %                      | 2.25                                 | 6.05  | -                | -     | 1.71             | 76.1  |
| Proline, %                     | -                                    | -     | -                | -     | -                | -     |
| Glutamine <sup>2</sup> , %     | 2.63                                 | 7.02  | -                | -     | 2.07             | 78.7  |
| Glutamic Acid <sup>2</sup> , % | 1.65                                 | 4.49  | -                | -     | 1.30             | 78.7  |
| Asparagine <sup>2</sup> , %    | 1.91                                 | 5.16  | -                | -     | 1.50             | 78.7  |
| Aspartic Acid <sup>2</sup> , % | 2.35                                 | 6.29  | -                | -     | 1.85             | 78.7  |
| Total Nitrogen (PB/6.25), %    | 5.95                                 | 16.0  |                  |       | 4.61             | 77.5  |
| Essential Nitrogen Poultry, %  | 3.24                                 | 54.5* | 1.79             | 55.5  |                  |       |
| Essential Nitrogen Swine, %    | 2.63                                 | 44.3* |                  |       | 2.02             | 76.8  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
| Practical<br>Maximum                                        | Broilers     |        |          | Hens      |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 2            | 3      |          | 3         |           |
|                                                             | 3            | 4      |          | 4         |           |
| Practical<br>Maximum                                        | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 3      | 4        | 3         | 4         |
|                                                             | 6            | 8      | 12       | 10        | 10        |



Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Yeast, Brewer's**

| Main Components (%)       |      |   |    |                              |      |   |    |
|---------------------------|------|---|----|------------------------------|------|---|----|
|                           | Mean | n | SD |                              | Mean | n | SD |
| Dry Matter                | 90.0 | 1 | -  | Organic Matter (OM)          | 86.4 |   |    |
| Crude Protein (CP)        | 41.8 | 1 | -  | Coef. Dig. OM Swine          | 81.2 |   |    |
| Starch                    | 1.00 | 1 | -  | Digestible OM Swine          | 70.1 |   |    |
| Crude Fiber (CF)          | 1.33 | 1 | -  | Undig. OM Pigs               | 16.2 |   |    |
| Coef. Dig. CF Swine       | -    |   |    | Ether Extract (EE)           | 1.38 | 1 | -  |
| NDF                       | 6.20 | 1 | -  | Coef. Dig. EE Poultry        | 75.0 |   |    |
| Coef. Dig. NDF Swine      | -    |   |    | Digestible EE Poultry        | 1.04 |   |    |
| ADF                       | 1.80 | 1 | -  | Coef. Dig. EE Swine          | 82.0 |   |    |
| Coef. Dig. ADF Swine      | -    |   |    | Digestible EE Swine          | 1.13 |   |    |
| N-Free Extract (NFE)      | 41.9 |   |    | Linoleic Acid                | -    | - | -  |
| Coef. Dig. NFE Poultry    | 77.4 |   |    | Linolenic Acid               | -    | - | -  |
| Digestible NFE Poultry    | 32.4 |   |    |                              |      |   |    |
| Undig. NFE + CF Poultry   | 10.8 |   |    |                              |      |   |    |
| Energy (kcal/kg)          |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Gross Energy              | 4339 | 1 | -  | <b>Swine</b>                 |      |   |    |
| <b>Poultry</b>            |      |   |    | Digestible Energy            | 3474 |   |    |
| Metabolizable Energy      | 2590 |   |    | Metabolizable Energy         | 3240 |   |    |
| Std. Metab. Energy        | -    |   |    | Net Energy                   | 2094 |   |    |
| Net Energy                | 2035 |   |    | <b>Sows</b>                  |      |   |    |
| <b>Hens</b>               |      |   |    | Digestible Energy            | 3638 |   |    |
| Metabolizable Energy      | 2624 |   |    | Metabolizable Energy         | 3360 |   |    |
| Net Energy                | 2069 |   |    | Net Energy                   | 2182 |   |    |
| Minerals                  |      |   |    |                              |      |   |    |
|                           | Mean | n | SD |                              | Mean | n | SD |
| Ash, %                    | 3.64 | 1 | -  | <b>Trace Minerals, mg/kg</b> |      |   |    |
| <b>Macro Minerals (%)</b> |      |   |    | Manganese (Mn)               | -    | - | -  |
| Potassium (K)             | 1.32 | 1 | -  | Iron (Fe)                    | -    | - | -  |
| Sodium (Na)               | 0.19 | 1 | -  | Copper (Cu)                  | -    | - | -  |
| Chlorine (Cl)             | -    | - | -  | Zinc (Zn)                    | -    | - | -  |
| Sulfur (S)                | -    | - | -  | Selenium (Se)                | -    | - | -  |
| Magnesium (Mg)            | -    | - | -  |                              |      |   |    |
| Total Calcium (Ca)        | 0.26 | 1 | -  |                              |      |   |    |
| Total Phosphorus (P)      | 0.77 | 1 | -  |                              |      |   |    |
| Phytate P                 | 0.52 | - | -  |                              |      |   |    |
| Available P (Pav)         | 0.25 |   |    |                              |      |   |    |
| Coef. Dig. P Poultry      | 45.9 |   |    |                              |      |   |    |
| Std. Dig. P Poultry       | 0.35 |   |    |                              |      |   |    |
| Coef. Dig. P Swine        | 45.9 |   |    |                              |      |   |    |
| Std. Dig. P Swine         | 0.35 |   |    |                              |      |   |    |

Pav = Non Phytate P (Total P – Phytate P)

Table 1.01 - Chemical Composition, Digestibility, and Energy Values of Poultry and Swine Feedstuffs (as-fed) cont.

**Yeast, Brewer's**

|                                | Amino Acid Content and Digestibility |       |                  |       |                  |       |
|--------------------------------|--------------------------------------|-------|------------------|-------|------------------|-------|
|                                | Total                                | % CP  | Poultry          |       | Swine            |       |
|                                |                                      |       | SID <sup>1</sup> | Coef. | SID <sup>1</sup> | Coef. |
| Crude Protein, %               | 41.8                                 | 100   | 26.8             | 64.0  | 34.0             | 81.4  |
| Lysine, %                      | 3.54                                 | 8.47  | 2.57             | 72.5  | 2.94             | 83.0  |
| Methionine, %                  | 0.69                                 | 1.65  | 0.42             | 60.7  | 0.53             | 77.1  |
| Met + Cys, %                   | 1.05                                 | 2.51  | 0.51             | 49.0  | 0.78             | 73.9  |
| Threonine, %                   | 2.31                                 | 5.53  | 1.23             | 53.4  | 1.63             | 70.4  |
| Tryptophan, %                  | 0.51                                 | 1.22  | 0.30             | 58.7  | 0.40             | 78.4  |
| Arginine, %                    | 2.14                                 | 5.12  | 1.59             | 74.5  | 1.79             | 83.8  |
| Gly + Ser, %                   | 4.20                                 | 10.1  | 2.70             | 64.4  |                  |       |
| Valine, %                      | 2.36                                 | 5.65  | 1.49             | 63.0  | 1.72             | 72.7  |
| Isoleucine, %                  | 2.45                                 | 5.86  | 1.59             | 65.0  | 1.83             | 74.6  |
| Leucine, %                     | 3.16                                 | 7.56  | 2.15             | 67.9  | 2.39             | 75.7  |
| Histidine, %                   | 0.96                                 | 2.30  | 0.65             | 67.8  | 0.77             | 80.5  |
| Phenylalanine, %               | 1.84                                 | 4.40  | 1.29             | 70.3  | 1.37             | 74.2  |
| Phe + Tyr, %                   | 3.05                                 | 7.30  | 2.14             | 70.3  | 2.36             | 77.5  |
| Alanine, %                     | 2.69                                 | 6.44  | -                | -     | 2.27             | 84.3  |
| Cysteine, %                    | 0.36                                 | 0.86  | -                | -     | 0.24             | 67.9  |
| Tyrosine, %                    | 1.21                                 | 2.89  | 0.85             | 70.3  | 1.00             | 82.4  |
| Glycine, %                     | 1.98                                 | 4.74  | -                | -     | 1.76             | 88.9  |
| Serine, %                      | 2.22                                 | 5.31  | -                | -     | 1.81             | 81.4  |
| Proline, %                     | 3.93                                 | 9.40  | -                | -     | 3.30             | 84.1  |
| Glutamine <sup>2</sup> , %     | 2.96                                 | 7.07  | -                | -     | 2.63             | 88.9  |
| Glutamic Acid <sup>2</sup> , % | 1.85                                 | 4.44  | -                | -     | 1.65             | 88.9  |
| Asparagine <sup>2</sup> , %    | 1.93                                 | 4.63  | -                | -     | 1.68             | 86.9  |
| Aspartic Acid <sup>2</sup> , % | 2.38                                 | 5.68  | -                | -     | 2.06             | 86.9  |
| Total Nitrogen (PB/6.25), %    | 6.69                                 | 16.0  | -                | -     | 5.45             | 81.4  |
| Essential Nitrogen Poultry, %  | 3.74                                 | 55.9* | -                | -     |                  |       |
| Essential Nitrogen Swine, %    | 3.07                                 | 45.9* |                  |       | 2.36             | 77.0  |

<sup>1</sup>SID = Standardized Ileal Digestibility.<sup>2</sup>Values estimated using data from Li et al. (2011) and Li e Wu (2020).

\*Essential Nitrogen for Poultry and Swine calculated as a percentage of Total Nitrogen.

| Recommended Inclusion Levels in Poultry and Swine Feeds (%) |              |        |          |           |           |
|-------------------------------------------------------------|--------------|--------|----------|-----------|-----------|
|                                                             | Broilers     |        | Hens     |           |           |
|                                                             | Starter      | Grower |          |           |           |
|                                                             | 2            | 3      | 3        |           |           |
| Practical Maximum                                           | 3            | 4      | 4        |           |           |
|                                                             | Growing Pigs |        |          | Sows      |           |
|                                                             | Starter      | Grower | Finisher | Gestation | Lactation |
|                                                             | 2            | 4      | 4        | 4         | 4         |
| Practical Maximum                                           | 8            | 10     | 15       | 15        | 10        |

Table 1.02 - Equations to Estimate the Metabolizable Energy Values of Feedstuffs for Young and Mature Poultry.

**VEGETAL FEEDSTUFFS****Poultry: Broilers and Young Birds**

$$ME_{\text{Poultry}} = 4.31 \text{ CPd} + 9.29 \text{ EEd} + 4.14 \text{ NFEd}$$

$$NE_{\text{Poultry}} = ME_{\text{Poultry}} - (4.31 \text{ CPd} \times 0.24) - (9.29 \text{ EEd} \times 0.10) - (4.14 \text{ NFEd} \times 0.20)$$

**Hens and Mature Poultry**

$$ME_{\text{Hens}} = 4.31 \text{ CPd} + 9.29 \text{ EEd} + 4.14 \text{ NFEd} + 0.3 \text{ UDEF}$$

$$NE_{\text{Hens}} = ME_{\text{Hens}} - (4.31 \text{ CPd} \times 0.24) - (9.29 \text{ EEd} \times 0.10) - (4.14 \text{ NFEd} \times 0.20)$$

**ANIMAL BY-PRODUCTS AND FATS****Poultry: Young and Mature**

$$ME_{\text{Poultry}} = 4.31 \text{ CPd} + 9.29 \text{ EEd}$$

$$NE_{\text{Poultry}} = ME_{\text{Poultry}} - (4.31 \text{ CPd} \times 0.24) - (9.29 \text{ EEd} \times 0.10)$$

$ME_{\text{Poultry}}$  = Metabolizable Energy Poultry, kcal/kg.

$ME_{\text{Hens}}$  = Metabolizable Energy Hens, kcal/kg.

$NE_{\text{Poultry}}$  = Net Energy Poultry, kcal/kg.

$NE_{\text{Hens}}$  = Net Energy Hens, kcal/kg.

CPd = Digestible Crude Protein Poultry, g/kg

EEd = Digestible Ether Extract Poultry, g/kg

NFEd = Digestible N-Free Extract Poultry, g/kg

UDEF = Undigestible N-Free Extract + Crude Fiber Poultry, g/kg

Data from UFV Theses and Dissertations.

Carré, B; M. Lessire and H. Juin. Prediction of the net energy value of broiler diets. *Animal*. 8:9, pp 1395–1401. 2014.

De Groote, G. A comparison of a new net energy system with the metabolizable energy system in broiler diet formulation, performance and profitability. *Br. Poultry Sci.* 15:75-95. 1974.

Janssen, W. M. European Table of Energy Values for Poultry Feedstuffs. Wageningen, Holland. 1989, 104p.

Titus, H. W. Alimentación Científica de las Gallinas. Ed. Acribia, Espanha. 1960, 290p.

Table 1.03 - Equations to Estimate the Energy Values of Feedstuffs for Swine in General

---

**DIGESTIBLE ENERGY - Swine****Vegetable Feedstuffs and Dairy Products**

$$DE_{\text{Swine}} = 5.65 \text{ CPd} + 9.45 \text{ EEd} + 4.14 (\text{OMd} - \text{CPd} - \text{EEd})$$

**Animal By-Products and Fats**

$$DE = 5.65 \text{ CPd} + 9.45 \text{ EEd}$$

**METABOLIZABLE ENERGY - Swine****Vegetable Feedstuffs and Dairy Products**

$$ME_{\text{Swine}} = 4.952 \text{ CPd} + 9.45 \text{ EEd} + 4.14 (\text{OMd} - \text{CPd} - \text{EEd})$$

**Animal By-Products**

$$ME = 4.952 \text{ CPd} + 9.45 \text{ EEd}$$

**Fat and Carbohydrate Feedstuffs**

$$ME_{\text{Swine}} = 0.965 \text{ DE}$$

**NET ENERGY - Swine**

$$NE_{\text{Swine}} = 0.73 ME_{\text{Swine}} + 13.1 \text{ EE} + 3.7 \text{ S} - 6.7 \text{ CP} - 9.7 \text{ CF}$$

$DE_{\text{Swine}}$  = Dig. Energy Swine, kcal/kg

$ME_{\text{Swine}}$  = Metab. Energy Swine, kcal/kg

$CPd$  = Dig. Crude Protein Swine, g/kg

$EEd$  = Dig. Ether Extract Swine, g/kg

$OMd$  = Dig. Organic Matter Swine, g/kg

$NE_{\text{Swine}}$  = Net Energy Swine, kcal/kg

$EE$  = Ether Extract, %

$S$  = Starch, %

$CP$  = Crude Protein, %

$CF$  = Crude Fiber, %

---

Data from UFV Theses and Dissertations.

Noblet, J. H. Fortune. X.S. Shi. S. Dubois. Prediction of net energy value of feeds for growing pigs. J. Anim.Sci. 72, 344-354. 1994.

Coutinho, R. Noções de Fisiologia da Nutrição. Ed. O Cruzeiro. Rio de Janeiro. 1966, 471p.

Sauvant, D., Perez, J. M. and Tran, G. (Editors). Tablas de Composición y de Valor Nutritivo de las Materias Primas Destinadas a los Animales de Interés Ganadero. Ed. Mundi-Prensa. Espanha. 2004, 310p.

Table 1.04 - Equations to Estimate the Energy Values of Feedstuffs for Sows and Mature Swine

---

**DIGESTIBLE ENERGY - Sows**

**Vegetable Feedstuffs**

$$DE_{\text{Sows}} = 5.65 \text{ CPd} + 9.45 \text{ EEd} + 4.14 (\text{OMd} - \text{CPd} - \text{EEd}) + 1 \text{ UDOM}$$

**METABOLIZABLE ENERGY - Sows**

**Vegetable Feedstuffs**

$$ME_{\text{Sows}} = 4.952 \text{ CPd} + 9.45 \text{ EEd} + 4.14 (\text{OMd} - \text{CPd} - \text{EEd}) + 0.75 \text{ UDOM}$$

**NET ENERGY - Sows**

**Vegetable Feedstuffs**

$$NE_{\text{Sows}} = 0.73 ME_{\text{Sows}} + 13.1 \text{ EE} + 3.7 \text{ S} - 6.7 \text{ CP} - 9.7 \text{ CF}$$

$DE_{\text{Sows}}$  = Dig. Energy Sows, kcal/kg

$ME_{\text{Sows}}$  = Metab. Energy Sows, kcal/kg

$CPd$  = Dig. Crude Protein Swine, g/kg

$EEd$  = Dig. Ether Extract Swine, g/kg

$OMd$  = Dig. Organic Matter Swine, g/kg

$UDOM$  = Undigestible Organic Matter Swine, g/kg

$NE_{\text{Sows}}$  = Net Energy Sows, kcal/kg

$EE$  = Ether Extract, %

$S$  = Starch, %

$CP$  = Crude Protein, %

$CF$  = Crude Fiber %

---

Data from UFV Theses and Dissertations.

Coutinho, R. *Noções de Fisiologia da Nutrição*. Ed. O Cruzeiro. Rio de Janeiro. 1966, 471p.

Sauvant, D., Perez, J. M. and Tran, G. (Editors). *Tablas de Composición y de Valor Nutritivo de las Materias Primas Destinadas a los Animales de Interés Ganadero*. Ed. Mundi-Prensa. Espanha. 2004, 310p.

Table 1.05 - Equation to Estimate Metabolizable Energy Lost (ME<sub>L</sub>) for Poultry as a Function of Corn Classification<sup>1</sup>

$$\text{ME}_L = -0.064 + 1.62 \text{ BRK} + 6.98 \text{ FRIM} + 10.06 \text{ MOLD} + 12.28 \text{ INS} + 5.87 \text{ ADC}$$

ME<sub>L</sub> = Metabolizable Energy Lost by Poultry, Kcal/kg.

BRK = Broken Grains, %

FRIM = Fragmented Grains and Impurities, %

MOLD = Grains Contaminated by Molds, %

INS = Grains Attacked by Insects, %

ADC = Grains Affected by Different Causes, %

Example:

| Classification            | "0"               | I    | II                | III  |
|---------------------------|-------------------|------|-------------------|------|
| BRK, %                    | 0                 | 0.16 | 1.32              | 5.88 |
| FRIM, %                   | 0                 | 0    | 1.18              | 1.96 |
| MOLD, %                   | 0                 | 2.60 | 3.64              | 6.32 |
| INS, %                    | 0                 | 0.24 | 0.12              | 0.16 |
| ADC, %                    | 0                 | 0    | 0                 | 0    |
| ME <sub>L</sub> , Kcal/kg | 0                 | - 29 | - 48              | - 89 |
| ME Poultry, Kcal/kg       | 3412 <sup>2</sup> | 3383 | 3364 <sup>2</sup> | 3323 |

<sup>1</sup> Equation developed by Barbarino and Rostagno (Barbarino, 2001).

<sup>2</sup> Considering corn type II with 3364 Kcal/kg (Table 1.01), then corn with 0 % of BRK, FRIM, MOLD, INS, and ADC has ME<sub>L</sub> = 0; then the ME Poultry value is 3364 + 48 = 3412 Kcal/kg.

Table 1.06 - Equation to Estimate Corn and Sorghum Amino Acid Content as a Function of Crude Protein (CP) Content

**AAsum** = Lys + Met + Met+Cys + Thr+ Trp + Arg + Gly+Ser + Val + Iso + Leu + His + Phe + Phe+Tyr

**Eq. Corn:**  $Y(\text{AAsum}, \%) = 0.3468 + 0.5757 (\% \text{CP})$ ;  $R^2 = 0.71$ ;  $n = 428$

**Eq. Sorghum:**  $Y(\text{AAsum}, \%) = 1.0723 + 0.4977 (\% \text{CP})$ ;  $R^2 = 0.75$ ;  $n = 118$

Procedure:

- 1 - Determine feedstuff crude protein.
- 2 - Use the equation to estimate the sum of amino acids (AAsum).
- 3 - Calculate the content (%) of each amino acid considering its percentage in the sum.

| Amino Acids      | Corn            |                   | Sorghum         |                       |
|------------------|-----------------|-------------------|-----------------|-----------------------|
|                  | % AA in the sum | E.g. Corn 7.1% CP | % AA in the sum | E.g. Sorghum 8.15% CP |
| Sum of AAs, %    | 100             | 4.434             | 100             | 5.129                 |
| Lysine, %        | 4.902           | 0.217             | 3.623           | 0.186                 |
| Methionine, %    | 3.137           | 0.139             | 2.717           | 0.139                 |
| Met+Cys, %       | 6.471           | 0.287             | 5.435           | 0.279                 |
| Threonine, %     | 5.882           | 0.261             | 5.072           | 0.260                 |
| Tryptophan, %    | 1.176           | 0.052             | 1.812           | 0.093                 |
| Arginine, %      | 7.647           | 0.339             | 6.341           | 0.325                 |
| Gly+Ser, %       | 14.118          | 0.626             | 12.681          | 0.650                 |
| Valine, %        | 7.843           | 0.348             | 7.971           | 0.409                 |
| Isoleucine, %    | 5.490           | 0.243             | 6.341           | 0.325                 |
| Leucine, %       | 18.824          | 0.835             | 21.196          | 1.087                 |
| Histidine, %     | 4.706           | 0.209             | 3.623           | 0.186                 |
| Phenylalanine, % | 7.059           | 0.313             | 8.333           | 0.427                 |
| Phe+Tyr, %       | 12.745          | 0.565             | 14.855          | 0.762                 |

**Example for Lysine:**

**Corn Determined CP: 7.10%**

$Y(\text{AAsum}) = 0.3468 + 0.5757 (7.10) = 4.434\%$

Calculation:  $4.902 \times 4.434 / 100 = 0.217\%$  Lysine

**Sorghum Determined CP: 8.15%**

$Y(\text{AAsum}) = 1.0723 + 0.4977 (8.15) = 5.129\%$

Calculation:  $3.623 \times 5.129 / 100 = 0.186\%$  Lysine

Table 1.07 - Equation to Estimate Soybean Amino Acid Content as a Function of Crude Protein Content

**AAsum**= Lys + Met + Met+Cys + Thr + Trp + Arg + Gly+Ser + Val + Iso + Leu + His + Phe + Phe+Tyr

**Eq. Soybeans (full fat and meal):**  $Y(\text{AAsum \%}) = -0.3850 + 0.6750 (\%CP)$ ;  $R^2=0.93$ ;  $n=299$

Procedure:

- 1 - Determine feedstuff crude protein.
- 2 - Use the equation to estimate the sum of amino acids (AAsum).
- 3 - Calculate the content (%) of each amino acid considering its percentage in the sum.

| Amino Acids      | % AA in the sum | Full-Fat Soybean (FFS) | Soybean Meal (SBM) |                 |
|------------------|-----------------|------------------------|--------------------|-----------------|
|                  |                 | E.g. FFS 35.1%CP       | E.g. SBM 43.7%CP   | Ex. SBM 47.2%CP |
| Sum of AAs, %    | 100             | 23.308                 | 29.113             | 31.475          |
| Lysine, %        | 9.441           | 2.200                  | 2.749              | 2.972           |
| Methionine, %    | 2.011           | 0.469                  | 0.586              | 0.633           |
| Met+Cys, %       | 4.146           | 0.966                  | 1.207              | 1.305           |
| Threonine, %     | 6.042           | 1.408                  | 1.759              | 1.902           |
| Tryptophan, %    | 2.102           | 0.490                  | 0.612              | 0.661           |
| Arginine, %      | 10.943          | 2.551                  | 3.186              | 3.444           |
| Gly+Ser, %       | 14.761          | 3.440                  | 4.297              | 4.646           |
| Valine, %        | 7.257           | 1.692                  | 2.113              | 2.284           |
| Isoleucine, %    | 6.871           | 1.602                  | 2.000              | 2.163           |
| Leucine, %       | 11.510          | 2.683                  | 3.351              | 3.623           |
| Histidine, %     | 3.941           | 0.918                  | 1.147              | 1.240           |
| Phenylalanine, % | 7.684           | 1.791                  | 2.237              | 2.419           |
| Phe+Tyr, %       | 13.291          | 3.098                  | 3.869              | 4.183           |

**Example for Lysine:**

**Full-Fat Soybean Determined CP: 35.1%**

$Y(\text{AAsum}) = -0.3850 + 0.6750 (35.1) = 23.308\%$

Calculation:  $9.441 \times 23.308 / 100 = 2.200\%$  Lysine

**Soybean Meal Determined CP: 43.7%**

$Y(\text{AAsum}) = -0.3850 + 0.6750 (43.7) = 29.113\%$

Calculation:  $9.441 \times 29.113 / 100 = 2.749\%$  Lysine



Table 1.08 - Composition, Digestibility, and Energy Values of Crystalline Amino Acids for Poultry (dry matter basis)

| Amino Acid   | N (%) | CP (N x 6.25) (%) | Standardized Digestibility <sup>1</sup> (%) | Gross Energy (kcal/kg) | Dig. Energy and Met. Standard. (kcal/kg) |                                 | Net Energy <sup>3</sup> |
|--------------|-------|-------------------|---------------------------------------------|------------------------|------------------------------------------|---------------------------------|-------------------------|
|              |       |                   |                                             |                        | DES                                      | MESn <sub>50</sub> <sup>2</sup> |                         |
| Alanine      | 15.72 | 98.26             | 99.7                                        | 4389                   | 4376                                     | 3730                            | 2890                    |
| Asparagine   | 21.20 | 132.52            | 100.0                                       | 3503                   | 3503                                     | 2632                            | 2039                    |
| Aspartic Ac. | 10.52 | 65.77             | 99.7                                        | 2854                   | 2845                                     | 2413                            | 1870                    |
| Arginine     | 32.16 | 201.02            | 100.0                                       | 4492                   | 4492                                     | 3616                            | 2802                    |
| Cystine      | 11.56 | 72.26             | 97.2                                        | 4325                   | 4204                                     | 3729                            | 2890                    |
| Phenylalan.  | 8.48  | 53.00             | 98.1                                        | 6932                   | 6800                                     | 6452                            | 5000                    |
| Glycine      | 18.66 | 116.63            | 97.0                                        | 3163                   | 3068                                     | 2301                            | 1783                    |
| Glutamic Ac. | 9.52  | 59.50             | 99.4                                        | 3686                   | 3664                                     | 3273                            | 2536                    |
| Glutamine    | 19.17 | 119.80            | 99.4                                        | 4206                   | 4181                                     | 3393                            | 2630                    |
| Histidine    | 27.08 | 169.27            | 99.0                                        | 4036                   | 3996                                     | 2883                            | 2234                    |
| Isoleucine   | 10.68 | 66.74             | 100.0                                       | 6605                   | 6605                                     | 6166                            | 4779                    |
| Leucine      | 10.68 | 66.74             | 99.5                                        | 6714                   | 6680                                     | 6242                            | 4837                    |
| Lysine       | 19.16 | 119.77            | 99.8                                        | 6204                   | 6191                                     | 5404                            | 4188                    |
| Lysine - HCl | 13.73 | 85.81             | 99.8                                        | 4901                   | 4891                                     | 4327                            | 3353                    |
| Methionine   | 9.39  | 58.67             | 99.2                                        | 5684                   | 5639                                     | 5253                            | 4071                    |
| Proline      | 12.17 | 76.04             | 99.1                                        | 5065                   | 5019                                     | 4519                            | 3503                    |
| Tyrosine     | 7.73  | 48.32             | 99.6                                        | 5990                   | 5966                                     | 5648                            | 4377                    |
| Threonine    | 11.76 | 73.49             | 98.1                                        | 4173                   | 4094                                     | 3610                            | 2798                    |
| Tryptophan   | 13.72 | 85.73             | 99.3                                        | 6506                   | 6460                                     | 5897                            | 4570                    |
| Serine       | 13.33 | 83.30             | 100.0                                       | 3306                   | 3306                                     | 2758                            | 2138                    |
| Valine       | 11.96 | 74.73             | 100.0                                       | 6026                   | 6026                                     | 5535                            | 4289                    |

<sup>1</sup> Determined with cecectomized cockerels and broiler chicks (standardized ileal digestibility).

<sup>2</sup> Considering 50% of nitrogen conversion to uric acid (except arginine into urea).

<sup>3</sup> Considering 70% the efficiency of amino acids utilization to protein deposition and 30% for deamination and catabolism. The utilization efficiency of standardized ME was considered 85% for deposition and 60% for amino acid deaminated and catabolized. NE = MESn x 0.595 + MESn x 0.18.

Table 1.09 - Composition, Digestibility, and Energy Values of Crystalline Amino Acids for Swine (dry matter basis)

| Amino Acid   | N (%) | CP (N x 6.25) (%) | Standardized Digestibility <sup>1</sup> (%) | Gross Energy (kcal/kg) | Dig. Energy and Met. Standard. (kcal/kg) |                                 | Net Energy <sup>3</sup> |
|--------------|-------|-------------------|---------------------------------------------|------------------------|------------------------------------------|---------------------------------|-------------------------|
|              |       |                   |                                             |                        | DES                                      | MESn <sub>35</sub> <sup>2</sup> |                         |
| Alanine      | 15.72 | 98.26             | 92.0                                        | 4389                   | 4038                                     | 3738                            | 2897                    |
| Asparagine   | 21.20 | 132.52            | 100.0                                       | 3503                   | 3503                                     | 3099                            | 2401                    |
| Aspartic Ac. | 10.52 | 65.77             | 93.5                                        | 2854                   | 2668                                     | 2468                            | 1913                    |
| Arginine     | 32.16 | 201.02            | 95.5                                        | 4492                   | 4290                                     | 3676                            | 2849                    |
| Cystine      | 11.56 | 72.26             | 92.4                                        | 4325                   | 3996                                     | 3776                            | 2926                    |
| Phenylalan.  | 8.48  | 53.00             | 95.2                                        | 6932                   | 6599                                     | 6438                            | 4989                    |
| Glycine      | 18.66 | 116.63            | 97.0                                        | 3163                   | 3068                                     | 2712                            | 2102                    |
| Glutamic Ac. | 9.52  | 59.50             | 99.2                                        | 3686                   | 3657                                     | 3475                            | 2693                    |
| Glutamine    | 19.17 | 119.80            | 100.0                                       | 4206                   | 4206                                     | 3840                            | 2976                    |
| Histidine    | 27.08 | 169.27            | 100.0                                       | 4036                   | 4036                                     | 3519                            | 2728                    |
| Isoleucine   | 10.68 | 66.74             | 97.1                                        | 6605                   | 6413                                     | 6210                            | 4813                    |
| Leucine      | 10.68 | 66.74             | 95.4                                        | 6714                   | 6405                                     | 6201                            | 4806                    |
| Lysine       | 19.16 | 119.77            | 98.1                                        | 6204                   | 6086                                     | 5720                            | 4433                    |
| Lysine - HCl | 13.73 | 85.81             | 98.1                                        | 4901                   | 4808                                     | 4546                            | 3523                    |
| Methionine   | 9.39  | 58.67             | 99.5                                        | 5684                   | 5656                                     | 5477                            | 4244                    |
| Proline      | 12.17 | 76.04             | 99.0                                        | 5065                   | 5014                                     | 4782                            | 3706                    |
| Tyrosine     | 7.73  | 48.32             | 98.0                                        | 5990                   | 5870                                     | 5723                            | 4435                    |
| Threonine    | 11.76 | 73.49             | 96.8                                        | 4173                   | 4039                                     | 3815                            | 2957                    |
| Tryptophan   | 13.72 | 85.73             | 99.0                                        | 6506                   | 6441                                     | 6179                            | 4789                    |
| Serine       | 13.33 | 83.30             | 100.0                                       | 3306                   | 3306                                     | 3052                            | 2365                    |
| Valine       | 11.96 | 74.73             | 95.5                                        | 6026                   | 5755                                     | 5527                            | 4283                    |

<sup>1</sup> Determined with cannulated pigs at the terminal ileum.<sup>2</sup> Considering 35% of nitrogen conversion into urea.<sup>3</sup> Considering 70% the efficiency of amino acids utilization to protein deposition and 30% for deamination and catabolism. The utilization efficiency of the standardized ME was considered 85% for deposition and 60% for amino acid deaminated and catabolized. NE= MESn x 0.595 + MESn x 0.18.

Table 1.10 - Inorganic Mineral Sources for Poultry and Swine (as-fed)

| Phosphorus Souces        | Minerals (%)         | Phosphorus (%)       |            |      |                   |                           |                |      | Fluorine (%) |
|--------------------------|----------------------|----------------------|------------|------|-------------------|---------------------------|----------------|------|--------------|
|                          |                      | Total (%)            | Avail. (%) |      | Dig. Broilers (%) |                           | Dig. Swine (%) |      |              |
|                          |                      |                      | Value      | Coef | Value             | Coef                      | Value          | Coef |              |
| Phosphoric Acid          |                      | 21.5                 | 25.8       | 120  |                   |                           | 19.4           | 90.0 | 0.16         |
| Bone Meal Steamed        | 25.0 Ca <sup>1</sup> | 11.4                 | 11.4       | 100  | 6.84              | 60.0                      | 6.84           | 60.0 |              |
| Bone Flour Ash           | 33.8 Ca              | 16.2                 | 14.9       | 92   | 9.72              | 60.0                      | 9.72           | 60.0 |              |
| Monocalcium Phosph.      | 18.9 Ca              | 21.4                 | 22.0       | 103  | 15.2              | 71.0                      | 16.4           | 78.2 | 0.25         |
| Dicalcium Phosph.        | 24.0 Ca              | 18.5                 | 18.5       | 100  | 12.9              | 70.0                      | 13.9           | 75.0 | 0.14         |
| Monodical. Phosph.       | 20.3 Ca              | 18.6                 | 19.6       | 105  | 13.8              | 74.0                      | 15.9           | 85.3 | 0.19         |
| Tricalcium Phosph.       | 35.2 Ca              | 17.9                 | 17.9       | 100  |                   |                           |                |      |              |
| Monosodium Phosph.       | 20.0 Na <sup>1</sup> | 24.0                 | 25.9       | 108  | 17.8              | 74                        | 23.6           | 98.2 |              |
| Disodium Phosph.         | 28.7 Na              | 21.3                 | 21.3       | 100  |                   |                           | 18.7           | 88.0 |              |
| Monoammon. Phosph.       | 12.2 N <sup>1</sup>  | 24.0                 | 25.9       | 108  |                   |                           |                |      | 0.22         |
| Diammonium Phosph.       | 21.2 N               | 23.1                 | 28.9       | 125  |                   |                           |                |      | 0.10         |
| Potassium Phosph.        | 28.7 K <sup>1</sup>  | 21.0                 |            |      |                   |                           |                |      |              |
| Araxá Rock Phosph.       | 26.0 Ca              | 12.1                 | 6.20       | 51.0 |                   |                           |                |      | 1.59         |
| Catalão Rock Phosph.     | 32.3 Ca              | 15.1                 | 7.90       | 52.0 |                   |                           | 9.56           | 63.3 | 2.17         |
| Jacupir. Rock Phosph.    | 34.8 Ca              | 13.2                 | 4.10       | 31.0 |                   |                           |                |      | 1.65         |
| Patos Rock Phosph.       | 20.8 Ca              | 10.6                 | 6.10       | 58.0 |                   |                           |                |      | 1.50         |
| Tapira Rock Phosph.      | 33.6 Ca              | 15.0                 | 7.80       | 52.0 |                   |                           |                |      | 1.10         |
| Semidefluor. Phosph.     | 30.3 Ca              | 16.7                 | 10.2       | 61.0 |                   |                           |                |      | 0.88         |
| Super Simple Phosph.     | 21.5 Ca              | 8.60                 | 17.6       | 82.0 |                   |                           |                |      | 1.31         |
| Super Triple Phosph.     | 17.9 Ca              | 20.4                 | 20.4       | 100  | 18.9              | 92.8                      | 15.7           | 76.9 | 0.74         |
| <b>Calcium Sources</b>   |                      | <b>Calcium (%)</b>   |            |      |                   | <b>Other Minerals (%)</b> |                |      |              |
| Limestone                |                      | 37.5                 |            |      |                   | 0.27 Mg <sup>1</sup>      |                |      |              |
| Dolomitic Limestone      |                      | 18.6                 |            |      |                   | 10.0 Mg                   |                |      |              |
| Calcium Carbonate        |                      | 43.3                 |            |      |                   |                           |                |      |              |
| Oyster Shell             |                      | 36.4                 |            |      |                   |                           |                |      |              |
| <b>Magnesium Sources</b> |                      | <b>Magnesium (%)</b> |            |      |                   | <b>Other Minerals (%)</b> |                |      |              |
| Magnesium Oxide          |                      | 52.8                 |            |      |                   |                           |                |      |              |
| Magnesium Sulfate        |                      | 20.2                 |            |      |                   | 26.6 S <sup>1</sup>       |                |      |              |
| Magnesium Chloride       |                      | 25.5                 |            |      |                   | 74.5 Cl <sup>1</sup>      |                |      |              |
| Magnesium Phosphate      |                      | 9.27                 |            |      |                   | 51.5 P <sup>1</sup>       |                |      |              |
| <b>Sodium Sources</b>    |                      | <b>Sodium (%)</b>    |            |      |                   | <b>Other Minerals (%)</b> |                |      |              |
| Salt                     |                      | 39.7                 |            |      |                   | 59.6 Cl                   |                |      |              |
| Sodium Bicarbonate       |                      | 27.0                 |            |      |                   |                           |                |      |              |
| Sodium Carbonate         |                      | 43.0                 |            |      |                   |                           |                |      |              |
| Sodium Sulfate           |                      | 32.4                 |            |      |                   | 22.6 S                    |                |      |              |
| <b>Potassium Sources</b> |                      | <b>Potassium (%)</b> |            |      |                   | <b>Other Minerals (%)</b> |                |      |              |
| Potassium Carbonate      |                      | 56.4                 |            |      |                   |                           |                |      |              |
| Potassium Bicarbonate    |                      | 38.9                 |            |      |                   |                           |                |      |              |
| Potassium Sulfate        |                      | 44.7                 |            |      |                   | 18.4 S                    |                |      |              |
| Potassium Chloride       |                      | 52.3                 |            |      |                   | 47.6 Cl                   |                |      |              |
| Potassium Phosphate      |                      | 28.7                 |            |      |                   | 22.8 P                    |                |      |              |

<sup>1</sup>Ca = Calcium; Na = Sodium; N = Nitrogen; K = Potassium; Mg = Magnesium; S = Sulfur; Cl = Chlorine; P = Phosphorus.

Table 1.11 - Mineral Content of Brazilian Phosphates (as-fed)

| Phosphates            | Mg <sup>1</sup> | Mn <sup>1</sup> | Zn <sup>1</sup> | Fe <sup>1</sup> | Cu <sup>1</sup> | Cr <sup>1</sup> | Pb <sup>1</sup> | Ni <sup>1</sup> | Cd <sup>1</sup> | Va <sup>1</sup> |
|-----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                       | %               | mg/kg           |                 |                 |                 |                 |                 |                 |                 |                 |
| Phosphoric Acid P A   | 0.37            | 0.7             | 0.6             | 31.3            | 1.8             | 3.7             | 12.6            | 0.5             | 2.0             | -               |
| Phosphoric Acid       | 0.56            | 29.7            | 7.3             | 39.3            | 4.9             | 8.1             | 13.6            | 5.1             | 2.1             | -               |
| Monocalcium Phosph.   |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
| Dicalcium Phosph.     | 0.91            | 284.2           | 40.3            | 4023            | 11.7            | 17.4            | 24.0            | 19.7            | 3.6             | 74.0            |
| Monodical. Phosph.    | 0.81            | 36.3            | 4.6             | 1432            | 7.80            | 5.90            | 18.5            | 9.60            | 2.0             | -               |
| Monoamm. Phosph.      | -               | 371             | 130             | 9000            | 79.0            | 50.0            | 10.0            | 27.0            | 4.60            | 54.0            |
| Araxá Rock Phosph.    | 0.54            | 52.5            | 208.8           | 6464            | 11.1            | 13.5            | 39.1            | 40.6            | 3.70            | -               |
| Catalão Pock Phosph.  | 0.81            | 405.0           | 36.7            | 8486            | 14.9            | 9.10            | 37.1            | 37.2            | 2.90            | -               |
| Jacupir. Rock Phosph. |                 | 321             | 11.0            | 6000            | 27.0            | 3.00            | 12.0            | 10.0            | 1.00            | 17.0            |
| Tapira Rock Phosph.   | 0.50            | 234             | 127             | 7520            | 9.80            | 5.40            | 28.7            | 16.3            | 3.50            | 70.0            |
| Semidefluor. Phosph.  | 0.81            | 19.0            | 3.80            | 913             | 139.6           | 5.90            | 48.5            | 22.2            | 3.30            | -               |
| Super Simple Phosph.  | 0.46            | 36.1            | 142.4           | 7010            | 13.9            | 17.5            | 18.9            | 28.6            | 3.00            | -               |
| Super Triple Phosph.  | 0.71            | 36.2            | 154.6           | 3298            | 38.0            | 93.4            | 19.0            | 25.2            | 4.90            | 41.0            |

<sup>1</sup> Mg = Magnesium; Mn = Manganese; Zn = Zinc; Fe = Iron; Cu = Copper; Cr = Chromium; Pb = Lead; Ni = Nickel; Cd = Cadmium; Va = Vanadium.

Table 1.12 - Average Available and Standardized Digestible Phosphorus Equivalence Values as a Function of Dietary Phytase Inclusion Levels (Maximum 1500 FTU) in Broiler Diets<sup>1</sup>

| FTU/kg                                | Inclusion level |         |         |         |         |         |
|---------------------------------------|-----------------|---------|---------|---------|---------|---------|
|                                       | 250             | 500     | 750     | 1000    | 1250    | 1500    |
| <b>Fungal phytases<sup>2</sup></b>    |                 |         |         |         |         |         |
| <b>1 to 21 days-old</b>               |                 |         |         |         |         |         |
| Available P (%)                       | 0.073           | 0.100   | 0.127   | 0.154   | 0.182   | 0.209   |
| Digestible P (%)                      | 0.048           | 0.067   | 0.086   | 0.106   | 0.125   | 0.144   |
| <b>22 to 42 days-old</b>              |                 |         |         |         |         |         |
| Available P (%)                       | 0.067           | 0.098   | 0.130   | 0.161   | 0.192   | 0.224   |
| Digestible P (%)                      | 0.051           | 0.073   | 0.096   | 0.119   | 0.142   | 0.164   |
| Available P                           | 0.070 ±         | 0.099 ± | 0.129 ± | 0.158 ± | 0.187 ± | 0.217 ± |
| Average ± σ (%)                       | 0.000           | 0.001   | 0.001   | 0.002   | 0.002   | 0.003   |
| Digestible P                          | 0.050 ±         | 0.070 ± | 0.091 ± | 0.113 ± | 0.134 ± | 0.154 ± |
| Average ± σ (%)                       | 0.009           | 0.013   | 0.016   | 0.020   | 0.024   | 0.028   |
| <b>Bacterial Phytases<sup>3</sup></b> |                 |         |         |         |         |         |
| <b>1 to 21 days-old</b>               |                 |         |         |         |         |         |
| Available P (%)                       | 0.076           | 0.110   | 0.144   | 0.179   | 0.213   | 0.248   |
| Digestible P (%)                      | 0.050           | 0.074   | 0.099   | 0.123   | 0.147   | 0.172   |
| <b>22 to 42 days-old</b>              |                 |         |         |         |         |         |
| Available P (%)                       | 0.047           | 0.090   | 0.133   | 0.176   | 0.219   | 0.261   |
| Digestible P (%)                      | 0.038           | 0.068   | 0.098   | 0.128   | 0.158   | 0.188   |
| Available P                           | 0.062 ±         | 0.102 ± | 0.139 ± | 0.178 ± | 0.216 ± | 0.255 ± |
| Average ± σ (%)                       | 0.001           | 0.002   | 0.002   | 0.003   | 0.004   | 0.005   |
| Digestible P                          | 0.045 ±         | 0.071 ± | 0.099 ± | 0.126 ± | 0.153 ± | 0.180 ± |
| Average ± σ (%)                       | 0.008           | 0.013   | 0.019   | 0.024   | 0.029   | 0.034   |

<sup>1</sup> Systematic review and meta-analysis of literature values (n = 106 articles).

<sup>2</sup> Linear equations for fungal phytases determined by bone ash percentage as response criterion:

$$Pav_{(1 \text{ a } 21 \text{ days})} = \frac{0.0460 + (0.00011 \times FTU)}{1.0098} \quad Pav_{(22 \text{ a } 42 \text{ days})} = \frac{0.0342 + (0.00012 \times FTU)}{0.9571}$$

$$Pdig_{(1 \text{ a } 21 \text{ days})} = \frac{0.0410 + (0.00011 \times FTU)}{1.4279} \quad Pdig_{(22 \text{ a } 42 \text{ days})} = \frac{0.0370 + (0.00012 \times FTU)}{1.3199}$$

<sup>3</sup> Linear equations for bacterial phytases determined by bone ash percentage as response criterion:

$$Pav_{(1 \text{ a } 21 \text{ days})} = \frac{0.0418 + (0.00014 \times FTU)}{1.0165} \quad Pav_{(22 \text{ a } 42 \text{ days})} = \frac{0.0044 + (0.00016 \times FTU)}{0.9348}$$

$$Pdig_{(1 \text{ a } 21 \text{ days})} = \frac{0.0367 + (0.00014 \times FTU)}{1.4371} \quad Pdig_{(22 \text{ a } 42 \text{ days})} = \frac{0.0109 + (0.00016 \times FTU)}{1.3370}$$

Table 1.13 - Average Available and Standardized Digestible Phosphorus Equivalence Values as a Function of Dietary Phytase Inclusion Levels (Maximum 1500 FTU) in Piglet Diets ( $9.92 \pm 2.75$  kg)<sup>1</sup>

| FTU/kg                                | Inclusion level |       |       |       |       |       |
|---------------------------------------|-----------------|-------|-------|-------|-------|-------|
|                                       | 250             | 500   | 750   | 1000  | 1250  | 1500  |
| <b>Fungal phytases<sup>2</sup></b>    |                 |       |       |       |       |       |
| Available P (%)                       | 0.082           | 0.107 | 0.132 | 0.157 | 0.182 | 0.206 |
| Digestible P (%)                      | 0.068           | 0.089 | 0.110 | 0.131 | 0.152 | 0.173 |
| <b>Bacterial Phytases<sup>3</sup></b> |                 |       |       |       |       |       |
| Available P (%)                       | 0.099           | 0.127 | 0.155 | 0.183 | 0.211 | 0.239 |
| Digestible P (%)                      | 0.083           | 0.106 | 0.130 | 0.153 | 0.177 | 0.200 |

<sup>1</sup>Systematic review and meta-analysis of literature values ( $n = 12$  articles).

<sup>2</sup>Linear equations for fungal phytases determined by bone ash percentage as response criterion:

$$Pav = \frac{0.0462 + (0.00008 \times FTU)}{0.8050}$$

$$Pdig = \frac{0.0455 + (0.00008 \times FTU)}{0.9581}$$

<sup>3</sup>Linear equations for bacterial phytases determined by bone ash percentage as response criterion:

$$Pav = \frac{0.0574 + (0.00009 \times FTU)}{0.8050}$$

$$Pdig = \frac{0.0567 + (0.00009 \times FTU)}{0.9581}$$

Table 1.14 - Feedstuff Non-Starch Polysaccharide Content (% on as-fed basis)<sup>1</sup>

| Bakery By-products |         |           |       |              |         |           |       |
|--------------------|---------|-----------|-------|--------------|---------|-----------|-------|
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.20    | 0.13      | 0.33  |
| Fucose             | -       | -         | -     | Galactose    | 0.14    | 0.24      | 0.38  |
| Arabinose          | 0.31    | 0.71      | 1.02  | Glucose      | 0.41    | 1.03      | 1.44  |
| Xylose             | 0.41    | 1.13      | 1.54  | Uronic Acids | 0.03    | -         | 0.03  |
| Barley Grain       |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.20    | 0.10      | 0.30  |
| Fucose             | -       | -         | -     | Galactose    | 0.20    | 0.40      | 0.60  |
| Arabinose          | 0.30    | 1.80      | 2.10  | Glucose      | 4.10    | 3.60      | 7.70  |
| Xylose             | 0.40    | 3.80      | 4.20  | Uronic Acids | 0.20    | -         | 0.20  |
| Canola Meal        |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | 0.05    | 0.15      | 0.20  | Manose       | 0.25    | 0.38      | 0.63  |
| Fucose             | 0.08    | -         | 0.08  | Galactose    | 0.40    | 1.18      | 1.58  |
| Arabinose          | 0.70    | 3.00      | 3.70  | Glucose      | 0.25    | 6.63      | 6.88  |
| Xylose             | 0.23    | 1.58      | 1.81  | Uronic Acids | 1.28    | 2.85      | 4.13  |
| Corn Germ          |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | -       | 0.30      | 0.30  |
| Fucose             | -       | -         | -     | Galactose    | 0.20    | 1.70      | 1.90  |
| Arabinose          | 0.60    | 6.70      | 7.30  | Glucose      | 0.50    | 8.20      | 8.70  |
| Xylose             | 0.40    | 9.70      | 10.10 | Uronic Acids | 0.80    | -         | 0.80  |
| Corn Gluten 21%    |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.23    | 0.83      | 1.06  |
| Fucose             | -       | -         | -     | Galactose    | 0.18    | 1.75      | 1.93  |
| Arabinose          | 0.35    | 6.28      | 6.63  | Glucose      | 0.35    | 9.38      | 9.73  |
| Xylose             | 0.35    | 9.43      | 9.78  | Uronic Acids | 0.35    | 0.78      | 1.13  |
| Corn Gluten 60%    |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.15    | 0.25      | 0.40  |
| Fucose             | -       | -         | -     | Galactose    | 0.15    | 0.23      | 0.38  |
| Arabinose          | 0.28    | 0.40      | 0.68  | Glucose      | 0.68    | 0.75      | 1.43  |
| Xylose             | 0.38    | 0.45      | 0.83  | Uronic Acids | 0.05    | 0.03      | 0.08  |
| Corn Grain         |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.11    | 0.13      | 0.24  |
| Fucose             | -       | -         | -     | Galactose    | 0.08    | 0.46      | 0.54  |
| Arabinose          | 0.08    | 1.47      | 1.55  | Glucose      | 0.46    | 1.88      | 2.34  |
| Xylose             | 0.05    | 2.02      | 2.07  | Uronic Acids | 0.07    | 0.02      | 0.09  |
| Corn Pre-Cooked    |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.30    | 0.07      | 0.37  |
| Fucose             | -       | -         | -     | Galactose    | 0.13    | 0.23      | 0.36  |
| Arabinose          | 0.07    | 0.80      | 0.87  | Glucose      | 0.67    | 0.87      | 1.54  |
| Xylose             | 0.07    | 0.97      | 1.04  | Uronic Acids | -       | -         | -     |

<sup>1</sup> Feedstuffs analyzed by AB Vista and expressed according to the methodology described by Englyst, Quingley and Hudson (1994).

Table 1.14 - Feedstuff Non-Starch Polysaccharide Content (% on as-fed basis)<sup>1</sup>

| Millet Grain       |         |           |       |              |         |           |       |
|--------------------|---------|-----------|-------|--------------|---------|-----------|-------|
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | 0.01    | -         | 0.01  | Manose       | 0.16    | 0.06      | 0.22  |
| Fucose             | -       | -         | -     | Galactose    | 0.08    | 0.27      | 0.35  |
| Arabinose          | 0.05    | 1.25      | 1.30  | Glucose      | 0.39    | 1.78      | 2.17  |
| Xylose             | 0.08    | 1.66      | 1.74  | Uronic Acids | 0.01    | -         | 0.01  |
| Oats Grain         |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.20    | 0.10      | 0.30  |
| Fucose             | 0.10    | -         | 0.10  | Galactose    | 0.10    | 0.40      | 0.50  |
| Arabinose          | 0.20    | 1.40      | 1.60  | Glucose      | 2.20    | 5.10      | 7.30  |
| Xylose             | -       | 4.80      | 4.80  | Uronic Acids | 0.10    | 0.10      | 0.20  |
| Peanut Meal        |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | 0.20      | 0.20  | Manose       | 0.20    | 0.50      | 0.70  |
| Fucose             | -       | -         | -     | Galactose    | 0.30    | 0.60      | 0.90  |
| Arabinose          | 0.70    | 0.70      | 3.00  | Glucose      | 0.20    | 9.10      | 9.30  |
| Xylose             | 0.10    | 2.90      | 3.00  | Uronic Acids | 1.50    | 1.50      | 3.00  |
| Rice Bran          |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | 0.01    | -         | 0.01  | Manose       | 0.23    | 0.16      | 0.39  |
| Fucose             | -       | -         | -     | Galactose    | 0.23    | 0.90      | 1.13  |
| Arabinose          | 0.28    | 3.21      | 3.49  | Glucose      | 0.47    | 5.93      | 6.40  |
| Xylose             | 0.12    | 3.97      | 4.09  | Uronic Acids | 0.22    | 0.08      | 0.30  |
| Rice Bran Defatted |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | 0.05    | -         | 0.05  | Manose       | 0.25    | 0.15      | 0.40  |
| Fucose             | -       | -         | -     | Galactose    | 0.30    | 1.10      | 1.40  |
| Arabinose          | 0.30    | 3.30      | 3.60  | Glucose      | 0.80    | 6.00      | 6.80  |
| Xylose             | 0.10    | 4.00      | 4.10  | Uronic Acids | 0.45    | 0.10      | 0.55  |
| Rice Broken        |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | -       | -         | -     | Manose       | 0.05    | 0.05      | 0.10  |
| Fucose             | -       | -         | -     | Galactose    | -       | 0.10      | 0.10  |
| Arabinose          | -       | 0.05      | 0.05  | Glucose      | 0.05    | 0.30      | 0.35  |
| Xylose             | -       | 0.10      | 0.10  | Uronic Acids | -       | -         | -     |
| Sorghum Grain      |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | 0.02    | 0.01      | 0.03  | Manose       | 0.13    | 0.13      | 0.26  |
| Fucose             | -       | -         | -     | Galactose    | 0.07    | 0.25      | 0.32  |
| Arabinose          | 0.05    | 1.27      | 1.32  | Glucose      | 0.27    | 2.29      | 2.56  |
| Xylose             | 0.04    | 1.19      | 1.23  | Uronic Acids | 0.04    | 0.01      | 0.05  |
| Soybean Full-Fat   |         |           |       |              |         |           |       |
|                    | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose           | 0.03    | 0.11      | 0.14  | Manose       | 0.30    | 0.50      | 0.80  |
| Fucose             | 0.03    | 0.17      | 0.20  | Galactose    | 0.81    | 2.44      | 3.25  |
| Arabinose          | 0.45    | 1.68      | 2.13  | Glucose      | 0.25    | 3.82      | 4.07  |
| Xylose             | 0.10    | 1.23      | 1.33  | Uronic Acids | 0.86    | 1.42      | 2.28  |

<sup>1</sup>Feedstuffs analyzed by AB Vista and expressed according to the methodology described by Englyst, Quingley and Hudson (1994).



Table 1.14 - Feedstuff Non-Starch Polysaccharide Content (% on as-fed basis)<sup>1</sup>

| Soybean Hulls                 |         |           |       |              |         |           |       |
|-------------------------------|---------|-----------|-------|--------------|---------|-----------|-------|
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | 0.23    | 0.28      | 0.51  | Manose       | 1.03    | 3.28      | 4.31  |
| Fucose                        | 0.05    | 0.06      | 0.11  | Galactose    | 0.84    | 1.43      | 2.27  |
| Arabinose                     | 0.75    | 3.24      | 3.99  | Glucose      | 2.23    | 26.53     | 28.76 |
| Xylose                        | 0.28    | 7.40      | 7.68  | Uronic Acids | 4.53    | 2.80      | 7.33  |
| Soybean Meal 45.6%            |         |           |       |              |         |           |       |
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | 0.07    | 0.13      | 0.20  | Manose       | 0.44    | 0.53      | 0.97  |
| Fucose                        | 0.07    | 0.10      | 0.17  | Galactose    | 1.06    | 2.86      | 3.87  |
| Arabinose                     | 0.61    | 1.79      | 2.39  | Glucose      | 0.33    | 4.51      | 4.84  |
| Xylose                        | 0.20    | 1.33      | 1.53  | UronicAcids  | 1.07    | 1.37      | 2.44  |
| Soybean Semi-defatted Roasted |         |           |       |              |         |           |       |
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | 0.10    | 0.10      | 0.20  | Manose       | 0.40    | 0.45      | 0.85  |
| Fucose                        | 0.10    | 0.10      | 0.20  | Galactose    | 0.85    | 2.50      | 3.35  |
| Arabinose                     | 0.45    | 1.75      | 2.20  | Glucose      | 0.05    | 6.15      | 6.20  |
| Xylose                        | 0.05    | 2.15      | 2.20  | Uronic Acids | 0.70    | 1.35      | 2.05  |
| Soybean Protein Concentrate   |         |           |       |              |         |           |       |
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | 0.10    | 0.20      | 0.30  | Manose       | 0.60    | 0.40      | 1.00  |
| Fucose                        | 0.10    | 0.20      | 0.30  | Galactose    | 1.20    | 3.90      | 5.10  |
| Arabinose                     | 0.70    | 2.20      | 2.90  | Glucose      | 0.20    | 4.10      | 4.30  |
| Xylose                        | 0.20    | 1.30      | 1.50  | Uronic Acids | 1.00    | 1.80      | 2.80  |
| Sunflower Meal                |         |           |       |              |         |           |       |
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | 0.10    | 0.20      | 0.30  | Manose       | -       | 1.30      | 1.30  |
| Fucose                        | -       | -         | -     | Galactose    | 0.30    | 0.70      | 1.00  |
| Arabinose                     | 0.50    | 2.10      | 2.60  | Glucose      | 1.90    | 15.70     | 17.60 |
| Xylose                        | 0.20    | 8.10      | 8.30  | Uronic Acids | 2.20    | 1.30      | 3.50  |
| Wheat Bran                    |         |           |       |              |         |           |       |
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | 0.01    | 0.02      | 0.03  | Manose       | 0.31    | 0.19      | 0.50  |
| Fucose                        | 0.01    | 0.02      | 0.03  | Galactose    | 0.22    | 0.63      | 0.85  |
| Arabinose                     | 0.61    | 5.88      | 6.49  | Glucose      | 0.65    | 7.34      | 7.99  |
| Xylose                        | 1.04    | 9.72      | 10.76 | Uronic Acids | 0.19    | 0.20      | 0.39  |
| Wheat Grain                   |         |           |       |              |         |           |       |
|                               | Soluble | Insoluble | Total |              | Soluble | Insoluble | Total |
| Rhamnose                      | -       | -         | -     | Manose       | 0.21    | 0.23      | 0.44  |
| Fucose                        | -       | -         | -     | Galactose    | 0.16    | 0.26      | 0.42  |
| Arabinose                     | 0.39    | 1.70      | 2.09  | Glucose      | 0.56    | 2.39      | 2.95  |
| Xylose                        | 0.44    | 2.80      | 3.24  | Uronic Acids | 0.01    | -         | 0.01  |

<sup>1</sup> Feedstuffs analyzed by AB Vista and expressed according to the methodology described by Englyst, Quingley and Hudson (1994).

Table 1.15 - Fatty Acid Content of Fats and Oils (% on as-fed basis)

|             | ≤10   | Lauric<br>C12:0 | Myristic<br>C14:0 | Palmitic<br>C16:0 | Palmitolei<br>c C16:1 | Stearic<br>C18:0 | Oleic<br>C18:1 | Linoleic<br>C18:2 | Linolenic<br>C18:3 n6 | Arachidonic<br>C20:4 n6 | ≥20   |
|-------------|-------|-----------------|-------------------|-------------------|-----------------------|------------------|----------------|-------------------|-----------------------|-------------------------|-------|
| <b>Fats</b> |       |                 |                   |                   |                       |                  |                |                   |                       |                         |       |
| Coconut     | 14.10 | 44.60           | 16.80             | 8.20              | -                     | 2.80             | 5.80           | 1.80              | -                     | -                       | -     |
| Fish        | -     | 0.20            | 6.11              | 14.34             | 10.00                 | 3.04             | 15.08          | 1.36              | 0.74                  | 0.73                    | 56.52 |
| Lard        | 0.10  | 0.15            | 1.35              | 24.05             | 2.80                  | 13.95            | 41.84          | 9.70              | 0.95                  | 1.70                    | 1.30  |
| Poultry     | -     | 0.10            | 1.00              | 20.74             | 5.40                  | 6.74             | 42.68          | 20.68             | 1.30                  | 0.10                    | 1.63  |
| Tallow      | 0.20  | 0.15            | 3.00              | 23.90             | 4.43                  | 19.05            | 38.20          | 3.10              | 0.60                  | 0.20                    | 1.80  |
| <b>Oils</b> |       |                 |                   |                   |                       |                  |                |                   |                       |                         |       |
| Canola      | -     | 0.20            | 0.10              | 3.94              | 0.17                  | 1.76             | 60.00          | 18.82             | 9.55                  | -                       | 4.07  |
| Corn        | -     | -               | -                 | 10.85             | 0.11                  | 1.69             | 36.38          | 52.45             | 0.70                  | -                       | 2.05  |
| Cottonseed  | -     | -               | 0.80              | 20.72             | 0.80                  | 2.45             | 17.56          | 54.08             | 0.20                  | -                       | 0.91  |
| Soybean     | -     | -               | 0.10              | 9.76              | 0.20                  | 3.77             | 23.32          | 52.78             | 6.97                  | -                       | 2.13  |
| Sunflower   | -     | 0.20            | 0.17              | 5.41              | 0.30                  | 3.60             | 32.19          | 51.98             | 0.25                  | -                       | 3.15  |
| Palm        | -     | -               | 0.20              | 10.92             | 0.45                  | 4.35             | 36.85          | 9.50              | 0.25                  | -                       | 0.50  |