

CHAPTER 2

Nutritional Requirements of Broiler Chickens

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INTRODUCTION

The continuous genetic improvement on performance of broiler chickens, obtained from better daily weight gain and feed conversion, makes it necessary to periodically update nutritional requirements to allow the expression of the animals' genetic potential.

The objective of this 5th edition is to update the nutritional requirements for broilers, taking into account the recent advances in genetics, production research, management practices, and nutrition in particular.

The broiler requirements presented in this chapter were established according to the systems and procedures of the 4th edition of the Brazilian Tables for Poultry and Swine (Rostagno et al., 2017), using integrated factorial and empirical models. The changes to calculate estimates and indices of equation parameters relative to the 4th edition are described below.

Among the many factors that affect the nutritional requirements of broilers, breed, genetic strain, sex, feed intake, feed energy level, nutritional availability, ambient temperature, air humidity, and health status are the most relevant. However, it is not yet possible to include all factors in models to estimate nutritional needs.

The recommendations consider the genetic growth potential of standard and high performance broilers as a function of age and sex, raised as separate sex or as hatched production systems.

Metabolizable energy, crude and digestible protein, total and digestible amino acids, minerals, total calcium, available and digestible phosphorus, sodium, potassium, chlorine, and linoleic acid requirements are presented. The recommendations for trace minerals and vitamins are assumed to be adequately met, provided the levels supplied are equivalent to those described in Chapter 7.

Mathematical models considering performance parameters were developed to allow nutritionists to accurately determine the daily nutritional requirements of broilers on an ongoing basis. Data obtained in several

experiments and manuals of different genetic strains were applied to Gompertz equations to estimate average weight and daily weight gain.

Based on those results, growth curves were calculated for standard and high performance male and female broilers. Additional performance curves can be incorporated as needed, and the models can be applied to determine broilers' daily metabolizable energy (ME) and standardized digestible lysine requirements.

The recommended nutritional levels were based on data obtained in dose-response experiments at the Federal University of Viçosa (UFV) and in scientific studies published in Brazil and abroad. In this 5th edition, data published between 2016 and 2023 was included from scientific articles of the Web of Science database and graduate MS and Ph.D theses carried out with broilers of different ages and production stages. Furthermore, the performance responses of commercial flocks in different regions of Brazil were considered.

After the database was built, equations for daily ME requirements were developed, considering the sum of ME requirements for maintenance and gain, using as parameters body weight (W) and body weight gain (G) of broilers of different ages and growing phases.

In addition to the model used by Rostagno et al. (2017), the ME requirement equations for maintenance (ME_m) utilized information from graduate theses from UNESP (Jaboticabal, SP) and UFV (Viçosa, MG) and by Sakomura & Rostagno (2016).

Daily ME requirement equations for production (ME_p) were based on data obtained in UFV experiments, graduate theses published in Brazil, and articles published between 2018 and 2023 retrieved from the Web of Science database. Performance, feed intake, and ME intake of broilers of different ages and production stages were considered. The ME intake obtained in experiments was recalculated considering the same feedstuffs nutritional composition and energy content.

A 4% increase in daily ME requirements was estimated for standard performance male and female broilers, assuming the management, environmental, and health challenges they experience.

The same correction published in the 4th edition (Rostagno et al., 2017) was applied to estimate the effect of environmental temperature on ME requirements. However, it is suggested to apply that correction starting at 17 days of age, as a function of metabolic weight ($W^{0.75}$). Furthermore, the proposed correction should be applied within daily average temperature limits of approximately $\pm 6^{\circ}\text{C}$ above or below the thermoneutral range, because higher values may impair broiler performance by overestimating feed intake and nutritional level corrections.

The target feed intake can be estimated by the ratio between ME requirement and dietary ME content. It should be noted that feed intake and feed conversion ratio, in particular, of broilers fed *ad libitum* largely depend on dietary energy content.

The Tables include examples of nutritional requirements of broilers fed diets containing the energy levels commonly used in Brazil and recommended in the manuals of the main genetic strains. Feed intake and other dietary nutrients should be adjusted when different dietary energy levels are used.

Most experiments used to determine nutritional requirements were carried out with mash feeds. The feed conversion ratio of broilers fed mash feeds is approximately 2-4% higher than those fed pelleted or crumbled diets.

In addition to the ME levels, the corresponding net energy (NE) levels of practical broiler feeds are mentioned in this edition.

Standardized ileal digestible lysine (SID Lys) levels were determined based on the results of dose-response experiments carried out at UFV and data obtained in the systematic review of graduate students theses and articles indexed in the Web of Science database published between 2016 and 2023. In order to standardize the database used to develop the equations, SID Lys intake values were recalculated to reflect feedstuff

chemical composition, digestibility coefficients, and SID amino acid levels, according to the 4th edition of the Brazilian Tables (2017).

In the equations to determine daily SID Lys requirements, the SID Lys requirement for maintenance was defined as 0.045 mg of SID Lys per kg of metabolic weight ($W^{0.75}$), the average value obtained in experiments carried out at UNESP Jaboticabal (Siqueira et al., 2011; Dorigam et al., 2020).

The determination of SID Lys requirements for production was based on weekly and total period results of dose-response experiments to different levels of lysine carried out at UFV and published in graduate theses and articles indexed in the Web of Science database between 2016 and 2023. The results were compiled, and daily SID Lys intake was determined. Next, SID Lys requirements for maintenance and per kg weight gain were calculated for the different production phases and were used to estimate SID Lys requirements for male and female broilers according to their performance.

Total lysine requirements were calculated considering an average standardized ileal lysine digestibility of 90.7%.

According to Rostagno et al. (2017), using equations to estimate daily SID Lys requirements allows greater precision in feed formulation, because they can be calculated as a function of broiler performance and feed intake.

The nutritional requirements of the other essential amino acids were calculated by applying the ideal protein concept, i.e., by maintaining the ratio of each amino acid to lysine and expressed in standardized ileal digestibility (SID) and total content. The SID and total amino acid ratios in the ideal protein were updated considering three production phases as a function of age: from 1 to 17, from 17 to 35, and from 35 to 56 days of age, since genetic advances may change the essential amino acids requirements for maintenance and production.

The methionine + cysteine requirements were established to ensure at least 55% of methionine in total sulfur amino acids. Phenylalanine +

tyrosine requirements considered a minimum ratio of 55% phenylalanine. Glycine and serine requirements are presented together, as these two amino acids are interconvertible.

As mentioned in the 4th edition, when the crystalline amino acids lysine, methionine, threonine, and valine are included in broiler diets based on corn and soybean meal, the requirements for the essential amino acids arginine, glycine + serine, isoleucine, leucine, histidine, and phenylalanine + tyrosine are commonly met. However, new cost-effective crystalline amino acids allow the formulation of diets with lower crude protein content, reducing the environmental impact of excessive nutrient excretion. Such diets have shown promising results in experimental trials and commercial flocks. However, essential amino acid levels should be maintained, and adequate values of essential and nonessential digestible amino acids or the ratio between essential nitrogen and total nitrogen (Ne: Total N) are recommended to achieve greater formulation precision.

To ensure that nonessential amino acids are not limiting when crystalline amino acids are included in reduced-crude protein diets, the 50% Ne: Total N ratio established in research carried out at UFV by Maia (2014) and Maia et al. (2021) was considered. Nonessential nitrogen (Nne) can become limiting in low crude protein diets, and therefore, the Ne: Total N or Ne:Nne ratio should be maintained to optimize broiler performance and improve protein utilization efficiency.

The Ne: Total N ratios presented in the Tables, were determined by calculating the digestible essential nitrogen (dig. Ne) and total essential nitrogen (Net) levels, considering the essential nitrogen requirements and its content in the amino acids. The essential amino acids used to calculate those ratios were lysine, methionine, threonine, tryptophan, arginine, glycine + serine (proportional to molecular weight), valine, isoleucine, leucine, histidine, and phenylalanine. Subsequently, total digestible nitrogen (total dig. N) and total nitrogen (Total N) were calculated based on dig. Ne:Total dig. N and total Ne:Total N ratios. The recommended ratio for broilers is 50%.

Total protein and digestible protein dietary levels were calculated by multiplying the obtained total N and total digestible N values by 6.25, considering that protein contains 16% N, on average. Digestible protein requirements should be met to prevent broilers from using essential amino acid nitrogen to synthesize nonessential amino acids, impairing their performance.

The minimum levels of dietary crude and digestible protein may also be estimated by applying 5.5 and 6.0% proportions of digestible lysine in crude and digestible protein, respectively. For instance, for a 31-d-old broiler with a 1.202% digestible lysine requirement, crude protein requirement is calculated as $(\% \text{ SID lysine} \times 100)/5.5 = (1.202 \times 100)/5.5 = 21.85\%$; and the digestible protein requirement as $(\% \text{ SID lysine} \times 100)/6.0 = (1.202 \times 100)/6.0 = 20.03\%$. The 6.0% SID lysine content in dietary digestible protein is in agreement on the body composition of broiler chicks, which was determined by Wu (2014) as 6.15 g of lysine/100 g of protein.

Precision Nutrition recommends formulating diets based on the standardized ileal digestible amino acid, which allows for reducing dietary crude protein and crude amino acid content. Digestible protein requirements should be met to ensure the supply of nonessential amino acids when reduced-protein diets are formulated. According to Pesti (2009), although formulating diets based on crude protein requirements is controversial, most experiments demonstrate better broiler performance when high dietary crude protein levels are fed. When determining the nutritional levels of broiler diets, the nutritionist should consider the cost-benefit ratio and the production system sustainability.

Phosphorus (P) requirements for broilers were estimated according to the procedure applied in the 4th edition. However, literature data published between 2016 and 2023 and the results of Angel (2017, 2019) were added to calculate available P and dig. P intake. The phosphorus requirement for maintenance was established considering the endogenous P losses estimated by Bunzen (2009) as 0.026 per kg metabolic weight ($W^{0.75}$). Subsequently, the results of dose-response experiments were used

to calculate available and dig. P requirements per kg of weight gain for each broiler production phase. Finally, considering the high growth rate of modern broiler strains, requirement equations were developed for three production phases. Bioavailability differences among inorganic P sources should be considered to meet available P requirements.

Experiments with broilers, evaluating alternative feedstuffs fed diets based on digestible nutrients, such as digestible protein and amino acids, showed more consistent performance and lower production costs than when diets were formulated on a total nutrient basis (Rostagno et al., 1995). Therefore, the dig. P requirement should be used in feed formulation, as it represents the P content in the feedstuff that is truly utilized and meets the requirements more accurately. The equations obtained to estimate available P and digestible P requirements in g/bird/day are presented in the tables below. Dietary available P and digestible P content are expressed in % as a function of feed intake.

Including the enzyme phytase in broiler diets to meet available P and digestible P requirements and reduce phytic P excretion in the environment is emphasized. In Chapter 1, the average phosphorus equivalence values of phytases in broiler diets are described.

Total calcium (Ca) levels were defined based on research results carried out at UFV and the recommendations of Angel (2017, 2019). Considering that Ca levels may compromise the utilization of P and other nutrients, total Ca to available P and digestible P ratios should be maintained at 2.10 and 2.32, respectively. Total Ca requirements were calculated using available P and digestible P levels multiplied by the respective ratios.

Due to the lack of scientific updates, sodium, potassium, chlorine, essential fatty acids, and linoleic acid requirements were determined using the same equations as those published in the 4th edition (Rostagno et al., 2017). Sodium, potassium, chlorine, and linoleic acid requirements, in mg/bird/day, were calculated as a function of broiler age in each production

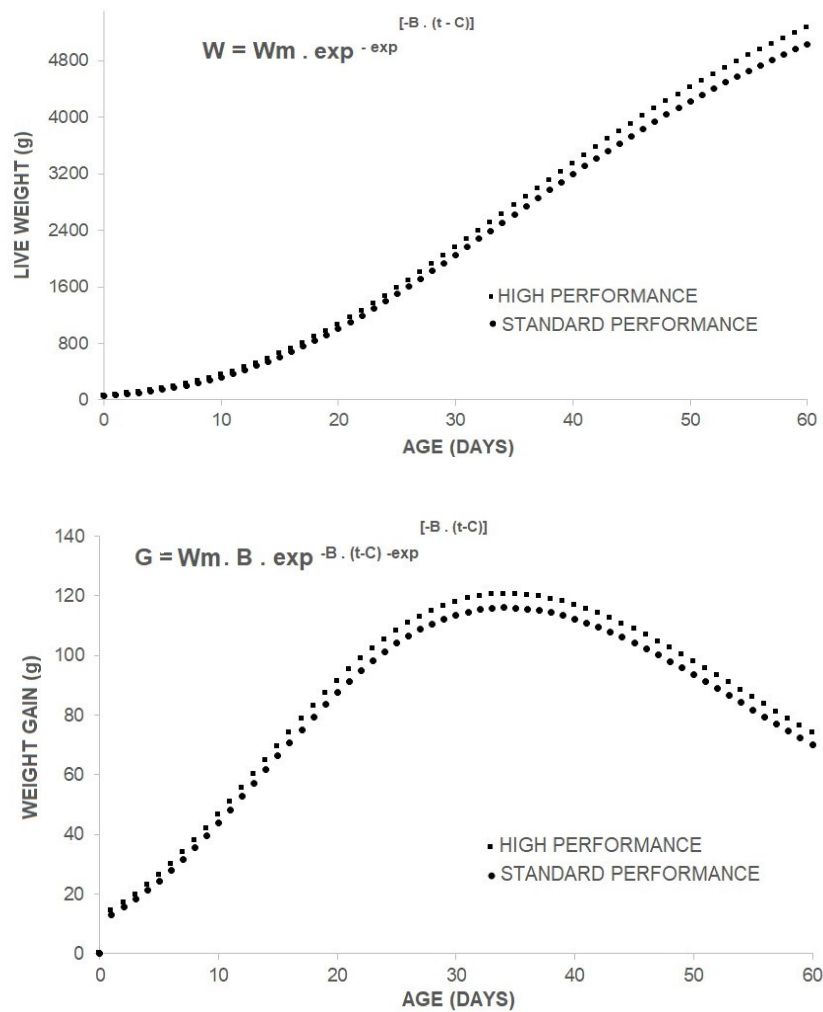
phase, and the value obtained was multiplied by dietary ME content expressed in Mcal.

Performance growth curves of male and female broilers with standard and high performance were used to estimate average weight and daily weight gain in each production phase. Based on these curves, equations to estimate ME and SID Lys requirements can be applied, and the requirements for other nutrients can be subsequently calculated. Similarly, considering the data of males and females of standard and high performance, respectively, response curves (weight, daily gain, and intake) were estimated for mixed-sex broilers, and ME and SID Lys requirements were estimated.

Such nutritional requirement calculations, allow nutritionists to apply the concept of precision nutrition, defined as supplying an animal's nutritional requirements under specific conditions, with no excesses or deficiencies of energy or any individual nutrients (Lee and Rochell, 2021). Precision nutrition aims to provide a specific diet as a function of animal growth and feed intake. It can be implemented using models and equations developed as a function of different production system characteristics. Examples of the nutritional requirements of standard and high performance male and female broilers and as hatched broiler flocks are provided to support the utilization of the Brazilian Tables.

Practical diets are those based on corn and soybean meal. Balanced diets formulated with other feedstuffs should contain adequate nutrients and pigments, such as xanthophyll, to obtain adequate carcass pigmentation. Crude fiber, neutral detergent fiber, and acid detergent fiber contents should be considered in diet formulation, as they may influence feed intake and nutrient utilization and promote gut health benefits. The inclusion of functional nutrients, such as fiber and amino acids, was not considered in these Tables and should be contemplated in specific feeding programs.

Table 2.01 - Live Weight and Daily Weight Gain Curves According to Gompertz Equation and the Derivative for Standard and High Performance Male Broilers



Equation parameters for high performance male broilers: $W_m = 7104.878$; $B = 4.771161$; $C = 0.04613019$; $R^2 = 0.98$; $P < 0.001$. Standard performance male broilers: $W_m = 6745.407$; $B = 4.845155$; $C = 0.04676116$; $R^2 = 0.99$; $P < 0.001$. W = weight (g); G = weight gain (g/day); t = age (days); W_m = mature weight (g); B = relative growth at the inflection point (g/day), C = age at the inflection point (days).

Table 2.02 - Equations Used to Estimate Metabolizable Energy (ME) Requirements of Male Broilers (kcal/bird/day)¹**ME Requirements of High Performance Male Broilers¹**

$$ME = (113 W^{0.75}) + ((2098 + 961.31 W - 167.87 W^2) G); R^2 = 0.78$$

¹ Considering the growth curve and ME of high performance male broilers

ME Requirements of Standard Performance Male Broilers²

$$ME = ((113 W^{0.75}) + ((2098 + 961.31 W - 167.87 W^2) G)) 1.04$$

² Considering the growth curve of standard performance male broilers and increasing ME requirement by 4%.

$$\text{Correction for temperature}^3 = 2.6 W^{0.75} (TN - T)$$

W = Average Body Weight (kg); G = Weight Gain (kg/bird/day);

T = Average Temperature (°C); TN = Thermoneutral Temperature (°C)

³ The equation was obtained based on data from MS and Ph.D. theses carried out at UNESP (Jaboticabal) and from Sakomura and Rostagno (2016)

Suggested temperatures for the correction of ME requirements

Age (days)	TN (°C)	Temperature Range (°C)
17 – 33	23	18 to 28
34 – 56	20	16 to 27

Higher temperature values may negatively influence broiler performance and overestimate corrections for feed intake and nutritional levels.

Example: High Performance Male Broilers (31 days)

W = 2.268 kg; $W^{0.75} = 1.848$ kg; G = 0.119 kg/bird/day; Dietary ME = 3100 kcal/kg

$$ME \text{ Req.} = (113 \times 1.848) + ((2098 + 961.31 \times 2.268 - 167.87 \times 2.268^2) 0.119)$$

ME Req. = 615.3 kcal/day; Estimated Feed Intake = 198.5 g/day

Correction for the average temperature of 26°C (TN = 23°C)

Correction for T° = $2.6 \times 1.848 (23 - 26) = -14.4$ kcal/day

ME Req. for 26 °C = 615.3 – 14.4 = 600.9 kcal/day; Estimated FI = 193.8 g/day

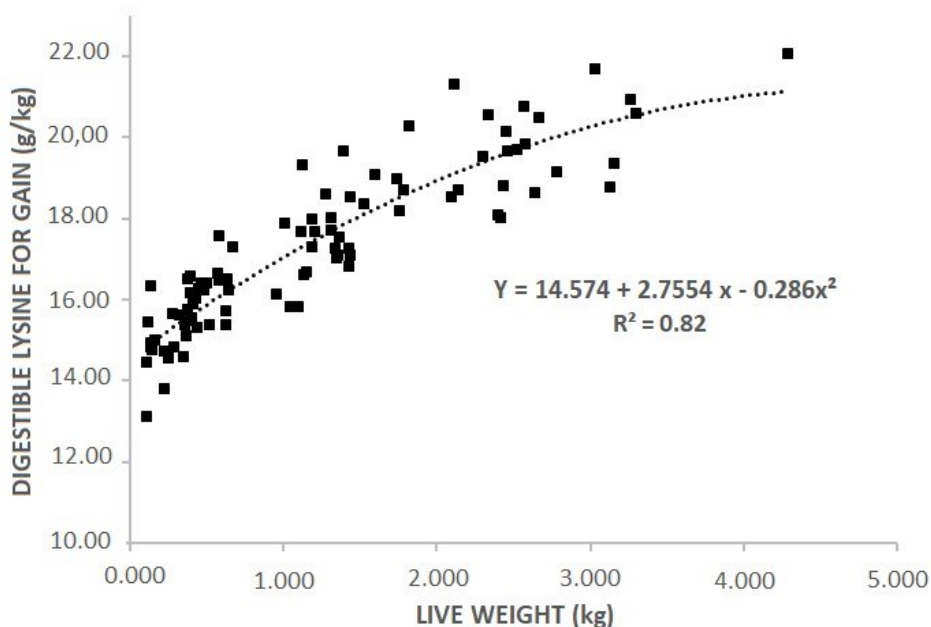
Table 2.03 - Methodology Applied to Obtain the Equation to Calculate the Standardized Digestible Lysine Requirements/kg Weight Gain of Male Broilers

Weight Range, kg	0.04–0.40	0.40–0.70	0.70–1.40	1.40–2.20	2.20–3.00	3.00–4.30
Experimental Data ¹	24	18	19	14	13	6
Avg. Weight in Period, kg	0.249	0.525	1.208	1.717	2.507	3.366
Feed Intake, g/day	38.161	74.93	130.50	171.14	197.79	229.97
SID Lys Intake, g/day	0.452	0.871	1.418	1.716	2.013	2.180
Maint. SID Lys g/day ²	0.0156	0.0277	0.0518	0.0673	0.0971	0.1117
SID Lys for G, g/day	0.437	0.844	1.366	1.649	1.923	2.068
Mean G, kg/day	0.0288	0.0522	0.0784	0.0888	0.0989	0.1009
g SID Lys/ kg G	15.17	16.11	17.35	18.59	19.47	20.55
Equation, g Lys/ kg G	15.24	15.94	17.49	18.46	19.68	20.61

Eq: Y (g SID Lys/kg G) = $14.574 + 2.7554$ (Average Weight, kg) – 0.286 (Av. Weight, kg)² $R^2 = 0.82$

¹ Total of 94 experimental data (week and total period) obtained in dose-response trials with different lysine levels.

² Daily requirements of digestible lysine for maintenance = $0.045 \times (\text{Average Weight})^{0.75}$. Estimated according to the values of Siqueira, 2009 (Ph.D. thesis) and Dorigam et al. (2020).



Equation to estimate SID lysine values, in grams of SID Lys / kg of weight gain of male broilers as a function of body weight (0.040 to 4.300 kg).

Table 2.04 - Equation Used to Estimate the Standardized Digestible Lysine (SID Lys) Requirements of Male Broilers

$$\text{SID Lys Req. (g/day)} = (\text{SID Lys for Maintenance}) + (\text{SID Lys for Gain})$$

$$\text{SID Lys Req. (g/day)} = (0.045 W^{0.75}) + ((14.574 + 2.7554 W - 0.286 W^2) G)$$

W = Average Body Weight (kg); G = Weight Gain (kg/bird/day)

Example:

High Performance Male Broilers (31 days)

Average Weight = 2.268 kg, $W^{0.75} = 1.848$ kg

G = 0.119 kg/bird/day

$$\text{SID Lys Req.} = (0.045 \times 1.848) + ((14.574 + 2.7554 \times 2.268 - 0.286 \times 2.268^2) \times 0.119)$$

$$\text{SID Lys Req.} = (0.083) + (19.436 \times 0.119) = 2.387 \text{ g/day}$$

Estimated Feed Intake = 198.5 g/day (Table 2.02)

% Dietary SID Lys = 1.202%

Correction for average temperature of 26°C (TN = 23°C)

Weight = 2.268 kg; Gain = 0.119 kg/day

SID Lysine Req. = 2.387 g/day

Estimated Feed Intake = 193.8 g/day (Table 2.02)

% Dietary SID Lys = 1.231%

Table 2.05 - Performance and Standardized Digestible Lysine (SID Lys) and Metabolizable Energy (ME) Requirements of Standard Performance Male Broilers Using the Equations in Tables 2.01, 2.02, and 2.04

Age, Days	Weight, Kg	Gain, g/day	SID Lys Req., g/day	ME Req., kcal/day ¹	Intake, g/day	Cumulative Intake, g	Lys/ME Ratio, %/Mcal	SID Lys Diet, %
1	0.066	13.1	0.200	44.9	15.3	15	0.445	1.305
2	0.082	15.6	0.237	53.2	18.2	33	0.446	1.307
3	0.100	18.3	0.279	62.6	21.3	55	0.446	1.308
4	0.121	21.2	0.326	73.0	24.9	80	0.446	1.307
5	0.146	24.4	0.376	84.5	28.8	109	0.445	1.305
6	0.174	27.9	0.432	97.2	33.2	142	0.444	1.302
7	0.205	31.6	0.492	111.0	37.9	180	0.443	1.298
8	0.241	35.5	0.556	126.0	42.4	222	0.441	1.310
9	0.280	39.6	0.624	142.2	47.9	270	0.439	1.303
10	0.324	43.8	0.696	159.5	53.7	324	0.436	1.296
11	0.372	48.2	0.772	178.0	59.9	384	0.434	1.288
12	0.425	52.7	0.850	197.5	66.5	450	0.431	1.279
13	0.482	57.2	0.932	218.1	73.4	524	0.427	1.269
14	0.544	61.8	1.016	239.6	80.7	604	0.424	1.259
15	0.610	66.3	1.102	262.0	88.2	692	0.421	1.249
16	0.681	70.8	1.189	285.1	96.0	788	0.417	1.239
17	0.756	75.2	1.277	308.8	102.3	891	0.414	1.249
18	0.836	79.5	1.365	333.0	110.3	1001	0.410	1.238
19	0.920	83.7	1.453	357.5	118.4	1119	0.407	1.228
20	1.007	87.6	1.540	382.1	126.5	1246	0.403	1.217
21	1.099	91.4	1.626	406.7	134.7	1380	0.400	1.207
22	1.194	95.0	1.709	431.1	142.8	1523	0.396	1.197
23	1.292	98.3	1.790	455.1	150.7	1674	0.393	1.188
24	1.393	101.3	1.867	478.6	158.5	1832	0.390	1.178
25	1.497	104.1	1.941	501.3	166.0	1998	0.387	1.169
26	1.604	106.6	2.010	523.1	173.2	2172	0.384	1.161
27	1.713	108.8	2.075	543.8	177.1	2349	0.382	1.171
28	1.823	110.7	2.135	563.4	183.5	2532	0.379	1.163
29	1.936	112.3	2.189	581.7	189.5	2722	0.376	1.155
30	2.049	113.6	2.238	598.6	195.0	2917	0.374	1.148
31	2.164	114.6	2.281	614.0	200.0	3117	0.371	1.140
32	2.279	115.4	2.318	628.0	204.5	3321	0.369	1.133
33	2.395	115.8	2.349	640.3	208.6	3530	0.367	1.126
34	2.511	116.0	2.374	651.1	212.1	3742	0.365	1.119
35	2.627	116.0	2.393	660.3	211.6	3954	0.362	1.131
36	2.743	115.6	2.407	668.0	214.1	4168	0.360	1.124
37	2.858	115.1	2.414	674.2	216.1	4384	0.358	1.117
38	2.972	114.4	2.416	679.0	217.6	4601	0.356	1.110
39	3.085	113.4	2.413	682.3	218.7	4820	0.354	1.103
40	3.198	112.2	2.404	684.4	219.4	5039	0.351	1.096
41	3.309	110.9	2.391	685.3	219.6	5259	0.349	1.089
42	3.418	109.4	2.373	685.0	219.5	5479	0.346	1.081
43	3.526	107.8	2.351	683.7	213.7	5692	0.344	1.100
44	3.632	106.1	2.325	681.5	213.0	5905	0.341	1.092
45	3.736	104.2	2.296	678.4	212.0	6117	0.338	1.083
46	3.838	102.2	2.263	674.6	210.8	6328	0.336	1.074
47	3.939	100.2	2.228	670.2	209.4	6538	0.332	1.064
48	4.037	98.0	2.190	665.3	207.9	6745	0.329	1.053
49	4.132	95.8	2.150	659.8	206.2	6952	0.326	1.043
50	4.226	93.6	2.108	654.1	204.4	7156	0.322	1.031
51	4.317	91.3	2.064	648.0	202.5	7359	0.318	1.019
52	4.406	88.9	2.019	641.7	200.5	7559	0.315	1.007
53	4.493	86.6	1.972	635.3	198.5	7758	0.310	0.993
54	4.577	84.2	1.925	628.8	196.5	7954	0.306	0.980
55	4.659	81.8	1.878	622.2	194.5	8149	0.302	0.966
56	4.738	79.4	1.829	615.7	192.4	8341	0.297	0.951

¹ Diets containing 2930, 2970, 3020, 3070, 3120, and 3200 kcal ME/kg for the phases 0-7, 8-16, 17-26, 27-34, 35-42, and 43-56 days of age.

Table 2.06 - Performance and Standardized Digestible Lysine (SID Lys) and Metabolizable Energy (ME) Requirements of High Performance Male Broilers Using the Equations in Tables 2.01, 2.02, and 2.04

Age, Days	Weight, Kg	Gain, g/day	SID Lys Req., g/day	ME Req., kcal/day ¹	Intake, g/day	Cumulative Intake, g	Lys/ME Ratio, %/Mcal	SID Lys Diet, %
1	0.075	14.4	0.220	47.5	16.1	16	0.463	1.367
2	0.092	17.0	0.260	56.0	19.0	35	0.464	1.368
3	0.111	19.9	0.304	65.6	22.2	57	0.464	1.369
4	0.134	23.0	0.353	76.2	25.8	83	0.464	1.367
5	0.161	26.3	0.407	87.9	29.8	113	0.463	1.365
6	0.191	29.9	0.465	100.8	34.2	147	0.461	1.361
7	0.225	33.8	0.528	114.8	38.9	186	0.460	1.356
8	0.262	37.8	0.595	129.9	43.3	229	0.458	1.373
9	0.304	42.1	0.666	146.2	48.7	278	0.455	1.366
10	0.351	46.5	0.741	163.7	54.6	333	0.453	1.358
11	0.402	51.0	0.820	182.3	60.8	393	0.450	1.349
12	0.457	55.6	0.901	201.9	67.3	461	0.446	1.339
13	0.518	60.2	0.986	222.5	74.2	535	0.443	1.330
14	0.583	64.9	1.073	244.1	81.4	616	0.440	1.319
15	0.652	69.5	1.162	266.5	88.8	705	0.436	1.309
16	0.726	74.1	1.253	289.6	96.5	802	0.433	1.298
17	0.805	78.6	1.344	313.3	102.7	904	0.429	1.309
18	0.888	83.0	1.436	337.4	110.6	1015	0.425	1.298
19	0.975	87.3	1.527	361.9	118.6	1134	0.422	1.287
20	1.066	91.3	1.617	386.4	126.7	1260	0.418	1.276
21	1.162	95.2	1.706	410.9	134.7	1395	0.415	1.266
22	1.260	98.8	1.792	435.1	142.7	1538	0.412	1.256
23	1.363	102.2	1.876	458.9	150.5	1688	0.409	1.246
24	1.468	105.3	1.956	482.2	158.1	1846	0.406	1.237
25	1.576	108.2	2.032	504.6	165.5	2012	0.403	1.228
26	1.687	110.7	2.105	526.2	172.5	2184	0.400	1.220
27	1.800	113.0	2.172	546.6	176.3	2360	0.397	1.232
28	1.915	114.9	2.234	565.9	182.5	2543	0.395	1.224
29	2.031	116.6	2.291	583.8	188.3	2731	0.392	1.216
30	2.149	118.0	2.342	600.3	193.7	2925	0.390	1.209
31	2.268	119.0	2.387	615.3	198.5	3123	0.388	1.202
32	2.388	119.8	2.426	628.8	202.8	3326	0.386	1.196
33	2.508	120.3	2.458	640.7	206.7	3533	0.384	1.189
34	2.629	120.5	2.485	651.0	210.0	3743	0.382	1.183
35	2.750	120.5	2.505	659.7	209.4	3952	0.380	1.196
36	2.870	120.2	2.519	666.9	211.7	4164	0.378	1.190
37	2.989	119.7	2.527	672.5	213.5	4378	0.376	1.184
38	3.108	119.0	2.530	676.7	214.8	4592	0.374	1.178
39	3.226	118.0	2.526	679.5	215.7	4808	0.372	1.171
40	3.343	116.9	2.518	681.0	216.2	5024	0.370	1.165
41	3.459	115.6	2.504	681.2	216.3	5241	0.368	1.158
42	3.573	114.1	2.486	680.4	216.0	5457	0.365	1.151
43	3.685	112.5	2.464	678.5	212.0	5669	0.363	1.162
44	3.796	110.7	2.437	675.7	211.2	5880	0.361	1.154
45	3.905	108.8	2.407	672.1	210.0	6090	0.358	1.146
46	4.012	106.8	2.373	667.7	208.7	6298	0.355	1.137
47	4.116	104.7	2.336	662.8	207.1	6506	0.353	1.128
48	4.219	102.5	2.297	657.3	205.4	6711	0.349	1.118
49	4.319	100.3	2.255	651.3	203.5	6915	0.346	1.108
50	4.417	98.0	2.211	645.1	201.6	7116	0.343	1.097
51	4.513	95.7	2.166	638.5	199.5	7316	0.339	1.085
52	4.606	93.3	2.119	631.8	197.4	7513	0.335	1.073
53	4.697	90.9	2.071	625.0	195.3	7708	0.331	1.060
54	4.786	88.5	2.022	618.1	193.1	7902	0.327	1.047
55	4.872	86.0	1.972	611.1	191.0	8093	0.323	1.033
56	4.955	83.6	1.922	604.3	188.8	8281	0.318	1.018

¹ Diets containing 2950, 3000, 3050, 3100, 3150, and 3200 kcal ME/kg for the phases 0-7, 8-16, 17-26, 27-34, 35-42, and 43-56 days of age.

Table 2.07 - Equations Used to Estimate Available Phosphorus (Pav), Standardized Digestible Phosphorus (Dig. P), and Calcium-to-Phosphorus Ratio Requirements of Male Broilers¹

Available Phosphorus Requirement

Pav Req. (g/day) = (Pav for Maintenance) + (Pav for Gain)

Equation 01 to 21 days: $Y \text{ (g Pav /day)} = (0.026 W^{0.75}) + 6.0 G$

Equation 22 to 42 days: $Y \text{ (g Pav /day)} = (0.026 W^{0.75}) + 5.0 G$

Equation 43 to 56 days: $Y \text{ (g Pav /day)} = (0.026 W^{0.75}) + 4.0 G$

W = Average Weight (kg); G = Daily Gain (kg/day)

Recommended Total Ca: Pav Ratio: 2.10

Example: High Performance Male Broilers with 31 days

Average Weight: 2.268 kg; Daily Gain: 0.119 kg/day; Feed Intake: 198.5 g/day

$\text{Pav (g/day)} = (0.026 \times 2.268^{0.75}) + 5.0 \times 0.119 = 0.643 \text{ g}$

$\% \text{ Pav} = (0.643 \times 100) / 198.5 = 0.324\%$;

$\% \text{ Ca in diet} = 0.324 \times 2.10 = 0.680\%$

Standardized Digestible Phosphorus Requirement

Dig. P Req. (g/day) = (Dig. P for Maintenance) + (Dig. P for Gain)

Equation 01 to 21 days: $Y \text{ (g Dig. P/day)} = (0.026 W^{0.75}) + 5.4 G$

Equation 22 to 42 days: $Y \text{ (g Dig. P/day)} = (0.026 W^{0.75}) + 4.5 G$

Equation 43 to 56 days: $Y \text{ (g Dig. P/day)} = (0.026 W^{0.75}) + 3.7 G$

W = Average Weight (kg); G = Daily Gain (kg/day)

Recommended Total Ca: Dig. P Ratio: 2.32

Example: High Performance Male Broilers (31 days)

Average Weight: 2.268 kg; Daily Gain: 0.119 kg/day; Feed Intake: 198.5 g/day

$\text{Dig. P (g/day)} = (0.026 \times 2.268^{0.75}) + 4.5 \times 0.119 = 0.584 \text{ g}$.

$\% \text{ Dig. P} = (0.584 \times 100) / 198.5 = 0.294\%$;

$\% \text{ Ca in diet} = 0.294 \times 2.32 = 0.682\%$

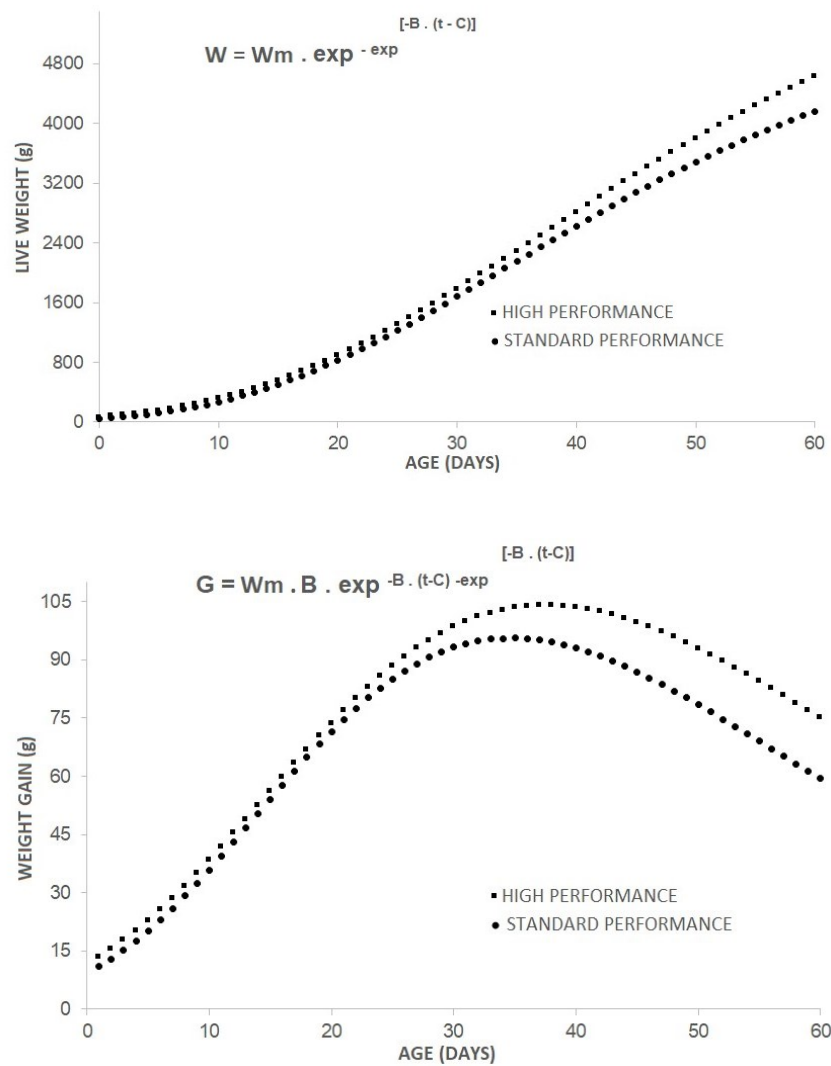
¹ Daily phosphorus requirements for maintenance and gain were estimated according to Bünzen 2009 (UFV Ph.D. Thesis), data from experiments carried out at UFV, and from Angel (2017) and Angel (2019).

Table 2.08 - Available Phosphorus (Pav), Standardized Digestible Phosphorus (Dig. P), and Calcium Requirements of Standard and High Performance Male Broilers Using the Equations in Table 2.07

Age, Days	Weight, Kg	Gain, g/day	Intake, g/day	Pav, g/day	Pav, %	Dig P, g/day	Dig P, %	Calcium ¹ , %
Standard Performance Male Broilers								
0-8	0.121	21.2	24.9	0.133	0.533	0.120	0.482	1.118
8	0.241	35.5	42.4	0.222	0.523	0.201	0.473	1.098
14	0.544	61.8	80.7	0.387	0.480	0.350	0.434	1.007
21	1.099	91.4	134.7	0.576	0.428	0.522	0.387	0.899
28	1.823	110.7	183.5	0.594	0.324	0.539	0.294	0.681
35	2.627	116.0	211.6	0.633	0.299	0.575	0.272	0.630
42	3.418	109.4	219.5	0.613	0.279	0.558	0.254	0.588
49	4.132	95.8	206.2	0.459	0.222	0.430	0.208	0.475
56	4.738	79.4	192.4	0.401	0.209	0.377	0.196	0.447
High Performance Male Broilers								
0-8	0.134	23.0	25.8	0.144	0.556	0.130	0.503	1.167
8	0.262	37.8	43.3	0.237	0.546	0.214	0.494	1.146
14	0.583	64.9	81.4	0.407	0.500	0.368	0.452	1.049
21	1.162	95.2	134.7	0.600	0.446	0.543	0.403	0.935
28	1.915	114.9	182.5	0.617	0.338	0.560	0.307	0.710
35	2.750	120.5	209.4	0.658	0.314	0.598	0.285	0.661
42	3.573	114.1	216.0	0.638	0.295	0.581	0.269	0.622
49	4.319	100.3	203.5	0.479	0.235	0.449	0.221	0.503
56	4.955	83.6	188.8	0.421	0.223	0.396	0.209	0.477

¹ Mean % Ca was calculated multiplying % Pav by the factor of 2.10 and % Dig. P by a factor of 2.32.

Table 2.09 - Live Weight and Daily Weight Gain Curves According to Gompertz Equation and the Derivative for Standard and High Performance Female Broilers



Equation parameters for high performance female broilers: $W_m = 6806.051$; $B = 4.667622$; $C = 0.04156387$; $R^2=0.99$; $P<0.001$. Standard performance female broilers: $W_m = 5652.758$; $B = 4.82316$; $C = 0.0459867$; $R^2=0.99$; $P<0.001$. W = weight (g); G = weight gain (g/day); t = age (days); W_m = mature weight (g); B = relative growth at the inflection point (g/day); C = age at the inflection point (days).

Table 2.10 - Equations Used to Estimate Metabolizable Energy (ME) Requirements of Female Broilers (kcal/bird/day)

ME Requirements of High Performance Female Broilers

$$ME = (113 W^{0.75}) + ((2158.2 + 1154.4 W - 227.78 W^2) G); R^2 = 0.83$$

ME Requirements of Standard Performance Female Broilers¹

$$ME = ((113 W^{0.75}) + ((2158.2 + 1154.4 W - 227.78 W^2) G)) 1.04$$

¹ Considering the growth curve of high performance female broilers and increasing ME requirement by 4%.

$$\text{Correction for temperature}^2 = 2.6 W^{0.75} (TN - T)$$

W = Average Body Weight (kg); G = Weight Gain (kg/bird/day);
T = Average Temperature (°C); TN = Thermoneutral Temperature (°C)

² The equation was obtained based on data from MS and Ph.D. theses carried out at UNESP (Jaboticabal) and on Sakomura and Rostagno (2016)

Suggested temperatures for the correction of ME requirements

Age (days)	TN (°C)	Temperature Range (°C)
17 – 33	23	18 to 28
34 – 56	20	16 to 27

Higher temperature values may negatively influence broiler performance and overestimate corrections for feed intake and nutritional levels.

Example: High Performance Female Broilers (31 days)

W = 1.880 kg; $W^{0.75} = 1.605$ kg; G=0.0999 kg/bird/day; Dietary ME= 3100 kcal/kg

$$ME \text{ Req.} = (113 \times 1.605) + ((2158.2 + 1154.4 \times 1.880 - 227.78 \times 1.880^2) \times 0.0999)$$

ME Req. = 533.3 kcal/bird/day; Estimated Feed Intake = 172.04 g/day

Correction for the average temperature of 26°C (TN=23°C)

Correction for T° = $2.6 \times 1.606 (23 - 26) = -12.52$ kcal/day

ME Req. for 26°C = $533.3 - 12.5 = 520.8$ kcal/day; Estimated FI = 168.0 g/day

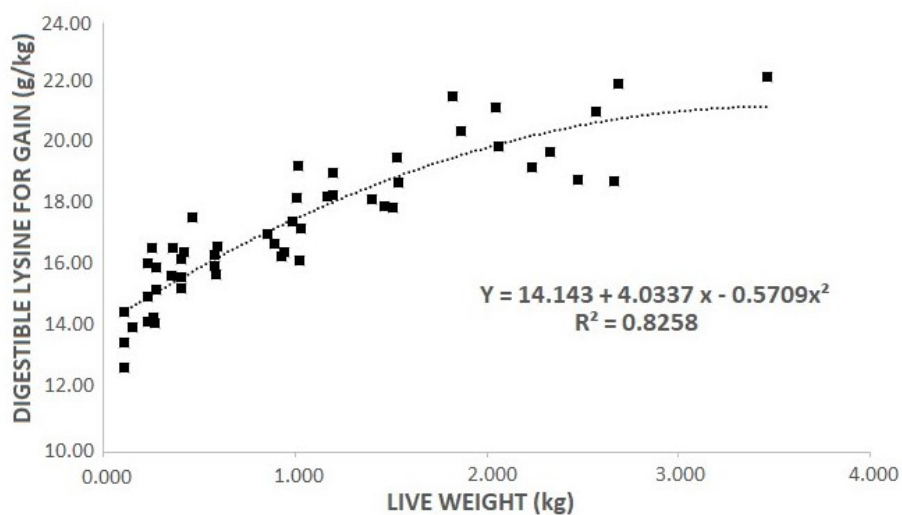
Table 2.11 - Methodology Applied to Obtain the Equation to Calculate Standardized Digestible Lysine Requirements / kg Weight Gain of Female Broilers

Weight Range, kg	0.04–0.30	0.30–0.60	0.60–1.30	1.30–2.00	2.00–2.50	2.50–4.00
Experimental Data ¹	12	11	12	7	5	4
Avg. Weight in Period, kg	0.207	0.468	1.020	1.591	2.230	2.846
Feed Intake, g/day	34.08	65.35	111.20	151.06	162.64	206.38
SID Lys Intake, g/day	0.421	0.729	1.196	1.404	1.697	1.720
Maint. SID Lys g/day ²	0.0137	0.0254	0.0456	0.0637	0.0821	0.0985
SID Lys for G, g/day	0.407	0.703	1.150	1.341	1.615	1.621
Mean G, kg/day	0.0274	0.0431	0.0653	0.0700	0.0816	0.0773
g SID Lys/ kg G	14.75	16.26	17.60	19.24	19.84	21.04
Equation, g Lys/ kg G	14.95	15.91	17.66	19.12	20.30	21.00

Eq: Y (g SID Lys/kg G) = $14.143 + 4.0337$ (Average Weight, kg) – 0.5709 (Average Weight, kg)² $R^2 = 0.83$

¹ Total of 51 experimental data (week and total period) obtained in dose-response trials with different lysine levels.

² Daily requirements of digestible lysine for maintenance = $0.045 \times (\text{Average Weight})^{0.75}$. Estimated according to the values of Siqueira, 2009 (Ph.D. thesis) and Dorigam et al. (2020).



Equation to estimate SID lysine values, in grams of SID Lys / kg of weight gain of female broilers as a function of body weight (0.040 to 4.000 kg).

Table 2.12 - Equation Used to Estimate the Standardized Digestible Lysine (SID Lys) Requirements of Female Broilers

$$\text{SID Lys Req. (g/day)} = (\text{SID Lys for Maintenance}) + (\text{SID Lys for Gain})$$

$$\text{SID Lys Req. (g/day)} = (0.045 W^{0.75}) + ((14.143 + 4.0337 W - 0.5709 W^2) G)$$

W = Average Body Weight (kg); G = Weight Gain (kg/bird/day)

Example:

High Performance Female Broilers (31 days)

Average Weight = 1.880 kg, with $W^{0.75} = 1.606$ kg

G = 0.0999 kg/bird/day

$$\text{SID Lys Req.} = (0.045 \times 1.606) + ((14.143 + 4.0337 \times 1.880 - 0.5709 \times 1.880^2) \times 0.0999)$$

$$\text{SID Lys Req.} = (0.072) + (19.708 \times 0.0999) = 2.041 \text{ g/day}$$

$$\text{Estimated Feed Intake} = 172.04 \text{ g/day (Table 2.10)}$$

$$\% \text{ Dietary SID Lys} = 1.186\%$$

Correction for average temperature of 26°C (TN=23°C)

Weight = 1.880 kg; Gain = 0.099 kg/day

SID Lys Req. = 2.041 g/day

Estimated Feed Intake = 168.0 g/day (Table 2.10)

$$\% \text{ Dietary SID Lys} = 1.215\%$$

Table 2.13 - Performance and Standardized Digestible Lysine (SID Lys) and Metabolizable Energy (ME) Requirements of Standard Performance Female Broilers Using the Equations in Tables 2.09, 2.10, and 2.12

Age, Days	Weight, Kg	Gain, g/day	SID Lys Req., g/day	ME Req., kcal/day ¹	Intake, g/day	Cumulative Intake, g	Lys/ME Ratio, %/Mcal	SID Lys Diet, %
1	0.057	11.0	0.163	39.0	13.3	13	0.418	1.226
2	0.069	13.0	0.193	46.1	15.7	29	0.419	1.229
3	0.085	15.2	0.227	54.0	18.4	48	0.420	1.230
4	0.102	17.6	0.264	62.8	21.4	69	0.420	1.231
5	0.122	20.2	0.305	72.6	24.8	94	0.420	1.231
6	0.145	23.0	0.349	83.2	28.4	122	0.420	1.230
7	0.171	26.0	0.397	94.9	32.4	155	0.419	1.227
8	0.201	29.2	0.449	107.4	36.2	191	0.418	1.241
9	0.233	32.5	0.504	121.0	40.7	231	0.417	1.237
10	0.269	35.9	0.562	135.5	45.6	277	0.415	1.232
11	0.309	39.5	0.624	150.9	50.8	328	0.413	1.227
12	0.352	43.1	0.688	167.3	56.3	384	0.411	1.221
13	0.398	46.7	0.754	184.4	62.1	446	0.409	1.215
14	0.449	50.4	0.823	202.4	68.1	514	0.407	1.208
15	0.503	54.1	0.894	221.1	74.4	589	0.404	1.201
16	0.561	57.8	0.966	240.4	80.9	670	0.402	1.194
17	0.622	61.4	1.040	260.2	86.2	756	0.400	1.207
18	0.687	64.9	1.113	280.5	92.9	849	0.397	1.199
19	0.755	68.2	1.187	301.0	99.7	948	0.394	1.191
20	0.827	71.5	1.261	321.7	106.5	1055	0.392	1.183
21	0.901	74.6	1.333	342.5	113.4	1168	0.389	1.176
22	0.979	77.5	1.404	363.2	120.2	1289	0.387	1.168
23	1.059	80.3	1.474	383.5	127.0	1416	0.384	1.160
24	1.142	82.8	1.540	403.6	133.6	1549	0.382	1.153
25	1.227	85.1	1.604	423.0	140.1	1689	0.379	1.145
26	1.314	87.2	1.665	441.9	146.3	1836	0.377	1.138
27	1.403	89.1	1.722	459.9	149.8	1986	0.374	1.149
28	1.494	90.7	1.774	477.0	155.4	2141	0.372	1.142
29	1.586	92.1	1.823	493.2	160.7	2302	0.370	1.135
30	1.679	93.2	1.866	508.3	165.6	2467	0.367	1.127
31	1.773	94.2	1.905	522.2	170.1	2637	0.365	1.120
32	1.868	94.8	1.939	535.0	174.3	2811	0.362	1.113
33	1.963	95.3	1.968	546.5	178.0	2989	0.360	1.105
34	2.059	95.6	1.991	556.8	181.4	3171	0.358	1.098
35	2.155	95.6	2.010	565.8	181.3	3352	0.355	1.108
36	2.250	95.5	2.023	573.5	183.8	3536	0.353	1.101
37	2.345	95.1	2.032	580.1	185.9	3722	0.350	1.093
38	2.440	94.6	2.035	585.4	187.6	3910	0.348	1.085
39	2.534	93.9	2.034	589.6	189.0	4099	0.345	1.076
40	2.627	93.1	2.028	592.7	190.0	4289	0.342	1.068
41	2.719	92.1	2.018	594.7	190.6	4479	0.339	1.059
42	2.810	90.9	2.004	595.8	191.0	4670	0.336	1.050
43	2.899	89.7	1.987	596.0	186.2	4856	0.333	1.067
44	2.988	88.3	1.966	595.3	186.0	5042	0.330	1.057
45	3.075	86.9	1.941	594.0	185.6	5228	0.327	1.046
46	3.160	85.3	1.914	591.9	185.0	5413	0.323	1.035
47	3.244	83.7	1.885	589.2	184.1	5597	0.320	1.024
48	3.326	82.0	1.853	586.0	183.1	5780	0.316	1.012
49	3.406	80.2	1.819	582.4	182.0	5962	0.312	0.999
50	3.484	78.4	1.783	578.3	180.7	6143	0.308	0.987
51	3.561	76.6	1.746	574.0	179.4	6322	0.304	0.973
52	3.636	74.7	1.708	569.4	177.9	6500	0.300	0.960
53	3.709	72.8	1.668	564.6	176.4	6677	0.295	0.946
54	3.779	70.9	1.628	559.6	174.9	6852	0.291	0.931
55	3.848	69.0	1.587	554.5	173.3	7025	0.286	0.916
56	3.916	67.1	1.546	549.4	171.7	7197	0.281	0.901

¹ Diets containing 2930, 2970, 3020, 3070, 3120, and 3200 kcal ME/kg for the phases 0-8, 8-17, 17-27, 27-35, 35-43, and 43-56 days of age.

Table 2.14 - Performance and Standardized Digestible Lysine (SID Lys) and Metabolizable Energy (ME) Requirements of High Performance Female Broilers Using the Equations in Tables 2.09, 2.10, and 2.12

Age, Days	Weight, Kg	Gain, g/day	SID Lys Req., g/day	ME Req., kcal/day ¹	Intake, g/day	Cumulative Intake, g	Lys/ME Ratio, %/Mcal	SID Lys Diet, %
1	0.077	13.4	0.200	46.6	15.8	16	0.429	1.265
2	0.093	15.5	0.232	54.0	18.3	34	0.430	1.267
3	0.111	17.7	0.267	62.1	21.1	55	0.430	1.268
4	0.131	20.2	0.306	71.1	24.1	79	0.430	1.268
5	0.154	22.8	0.348	80.9	27.4	107	0.430	1.268
6	0.179	25.6	0.393	91.5	31.0	138	0.429	1.266
7	0.208	28.6	0.441	103.1	34.9	173	0.428	1.264
8	0.239	31.7	0.493	115.5	38.5	211	0.427	1.282
9	0.274	35.0	0.549	128.8	42.9	254	0.426	1.278
10	0.313	38.3	0.607	142.9	47.6	302	0.425	1.274
11	0.355	41.8	0.668	158.0	52.7	354	0.423	1.269
12	0.400	45.3	0.732	173.9	58.0	412	0.421	1.264
13	0.449	48.9	0.799	190.6	63.5	476	0.419	1.258
14	0.501	52.5	0.868	208.1	69.4	545	0.417	1.252
15	0.557	56.2	0.940	226.3	75.4	621	0.415	1.246
16	0.617	59.8	1.013	245.1	81.7	702	0.413	1.239
17	0.681	63.4	1.087	264.5	86.7	789	0.411	1.253
18	0.747	66.9	1.162	284.4	93.2	882	0.409	1.247
19	0.818	70.3	1.239	304.6	99.9	982	0.407	1.240
20	0.892	73.7	1.315	325.2	106.6	1089	0.404	1.233
21	0.968	76.9	1.391	345.8	113.4	1202	0.402	1.227
22	1.048	80.0	1.466	366.6	120.2	1322	0.400	1.220
23	1.131	83.0	1.541	387.2	126.9	1449	0.398	1.214
24	1.217	85.7	1.613	407.5	133.6	1583	0.396	1.207
25	1.305	88.4	1.684	427.5	140.2	1723	0.394	1.201
26	1.396	90.8	1.752	447.1	146.6	1870	0.392	1.195
27	1.489	93.0	1.817	466.0	150.3	2020	0.390	1.209
28	1.584	95.0	1.879	484.2	156.2	2176	0.388	1.203
29	1.681	96.9	1.937	501.5	161.8	2338	0.386	1.197
30	1.780	98.5	1.991	517.9	167.1	2505	0.384	1.192
31	1.880	99.9	2.041	533.3	172.0	2677	0.383	1.186
32	1.981	101.1	2.086	547.6	176.7	2854	0.381	1.181
33	2.083	102.1	2.126	560.8	180.9	3035	0.379	1.176
34	2.186	102.9	2.162	572.7	184.7	3219	0.377	1.170
35	2.289	103.4	2.193	583.4	185.2	3405	0.376	1.184
36	2.393	103.8	2.218	592.9	188.2	3593	0.374	1.178
37	2.497	104.0	2.238	601.1	190.8	3784	0.372	1.173
38	2.601	104.0	2.253	608.0	193.0	3977	0.371	1.167
39	2.705	103.9	2.264	613.8	194.8	4172	0.369	1.162
40	2.808	103.5	2.269	618.3	196.3	4368	0.367	1.156
41	2.911	103.1	2.269	621.7	197.4	4565	0.365	1.150
42	3.014	102.4	2.265	623.9	198.1	4763	0.363	1.144
43	3.115	101.6	2.257	625.1	195.4	4959	0.361	1.155
44	3.216	100.7	2.244	625.4	195.4	5154	0.359	1.148
45	3.316	99.7	2.228	624.7	195.2	5349	0.357	1.141
46	3.414	98.5	2.207	623.1	194.7	5544	0.354	1.134
47	3.512	97.2	2.184	620.8	194.0	5738	0.352	1.126
48	3.607	95.9	2.157	617.8	193.1	5931	0.349	1.117
49	3.702	94.4	2.127	614.2	191.9	6123	0.346	1.108
50	3.795	92.9	2.095	610.1	190.6	6314	0.343	1.099
51	3.886	91.3	2.061	605.4	189.2	6503	0.340	1.089
52	3.976	89.7	2.024	600.4	187.6	6690	0.337	1.079
53	4.064	88.0	1.986	595.1	186.0	6876	0.334	1.068
54	4.150	86.2	1.946	589.5	184.2	7061	0.330	1.056
55	4.234	84.4	1.905	583.7	182.4	7243	0.326	1.044
56	4.317	82.6	1.863	577.7	180.5	7424	0.322	1.032

¹Diets containing 2950, 3000, 3050, 3100, 3150, and 3200 kcal ME/kg for the phases 0-8, 8-17, 17-27, 27-35, 35-43, and 43-56 days of age

Table 2.15 - Equations Used to Estimate Available Phosphorus (Pav), Standardized Digestible Phosphorus (Dig. P), and Calcium-to-Phosphorus Ratio Requirements of Female Broilers¹

Available Phosphorus Requirement

Pav Req. (g/day) = (Pav for Maintenance) + (Pav for Gain)

Equation 01 to 21 days: $Y \text{ (g Pav /day)} = (0.026 W^{0.75}) + 6.0 G$

Equation 22 to 42 days: $Y \text{ (g Pav /day)} = (0.026 W^{0.75}) + 5.0 G$

Equation 43 to 56 days: $Y \text{ (g Pav /day)} = (0.026 W^{0.75}) + 4.0 G$

W = Average Body Weight (kg); G = Daily Gain (kg/day)

Recommended Total Ca: Pav Ratio: 2.10

Example: High Performance Female Broilers (31 days)

Average Weight: 1.880 kg; Daily Gain: 0.0999 kg/day; Feed Intake: 172.0 g/day

$\text{Pav (g/day)} = (0.026 \times 1.880^{0.75}) + 5.0 \times 0.0999 = 0.541 \text{ g}$

$\% \text{ Pav} = (0.541 \times 100) / 172.0 = 0.315\%$

$\% \text{ Ca in diet} = 0.315 \times 2.10 = 0.661\%$

Standardized Digestible Phosphorus Requirement

Dig. P Req. (g/day) = (Dig. P for Maintenance) + (Dig. P for Gain)

Equation 01 to 21 days: $Y \text{ (g Dig. P/day)} = (0.026 P^{0.75}) + 5.4 G$

Equation 22 to 42 days: $Y \text{ (g Dig. P/day)} = (0.026 P^{0.75}) + 4.5 G$

Equation 43 to 56 days: $Y \text{ (g Dig. P/day)} = (0.026 P^{0.75}) + 3.7 G$

W = Average Body Weight (kg); G = Daily Gain (kg/day)

Recommended Total Ca: Dig. P Ratio: 2.32

Example: High Performance Female Broilers (31 days)

Average Weight: 1.880 kg; Daily Gain: 0.099 kg/day; Feed Intake: 172.0 g/day

$\text{Dig. P (g/day)} = (0.026 \times 1.880^{0.75}) + 4.5 \times 0.0999 = 0.491 \text{ g}$

$\% \text{ Dig. P} = (0.491 \times 100) / 172.0 = 0.286 \%$

$\% \text{ Ca in diet} = 0.286 \times 2.32 = 0.662 \%$

¹ Daily phosphorus requirements for maintenance and gain were estimated according to Bünzen 2009 (UFV Ph.D. Thesis), data from experiments carried out at UFV, and from Angel (2017) and Angel (2019).

Table 2.16 - Available Phosphorus (Pav), Standardized Digestible Phosphorus (Dig. P), and Calcium Requirements of Standard and High Performance Female Broilers Using the Equations in Table 2.15

Age, Days	Weight, Kg	Gain, g/day	Intake, g/day	Pav, g/day	Pav, %	Dig P, g/day	Dig P, %	Calcium ¹ , %
Standard Performance Female Broilers								
1 - 8	0.102	17.6	21.4	0.110	0.514	0.100	0.465	1.079
8	0.201	29.2	36.2	0.183	0.505	0.165	0.457	1.061
14	0.449	50.4	68.1	0.317	0.465	0.287	0.421	0.976
21	0.901	74.6	113.4	0.472	0.416	0.427	0.376	0.873
28	1.494	90.7	155.4	0.489	0.314	0.443	0.285	0.661
35	2.155	95.6	181.3	0.524	0.289	0.477	0.263	0.608
42	2.810	90.9	191.0	0.511	0.268	0.466	0.244	0.564
49	3.406	80.2	182.0	0.386	0.212	0.362	0.199	0.454
56	3.915	67.1	171.7	0.341	0.198	0.321	0.187	0.425
High Performance Female Broilers								
1 - 8	0.131	20.2	24.1	0.127	0.526	0.115	0.476	1.104
8	0.239	31.7	38.5	0.199	0.517	0.180	0.468	1.086
14	0.501	52.5	69.4	0.331	0.477	0.299	0.431	1.001
21	0.968	76.9	113.4	0.487	0.429	0.441	0.389	0.902
28	1.584	95.0	156.2	0.512	0.328	0.464	0.297	0.689
35	2.289	103.4	185.2	0.566	0.305	0.514	0.277	0.642
42	3.014	102.4	198.1	0.572	0.289	0.520	0.263	0.608
49	3.702	94.4	191.9	0.447	0.233	0.419	0.218	0.498
56	4.317	82.6	180.5	0.408	0.226	0.384	0.212	0.484

¹ Mean % Ca was calculated multiplying % Pav by the factor 2.10 and % Dig. P by the factor 2.32.

Table 2.17 - Performance and Standardized Digestible Lysine (SID Lys) and Metabolizable Energy (ME) Requirements of Standard Performance As Hatched Broilers Using the Equations in Tables 2.01, 2.02, 2.04, and 2.09

Age, Days	Weight, Kg	Gain, g/day	SID Lys Req., g/day	ME Req., kcal/day ¹	Intake, g/day	Cumulative Intake, g	Lys/ME Ratio, %/Mcal	SID Lys Diet, %
1	0.062	12.1	0.182	42.0	14.3	14	0.432	1.266
2	0.076	14.3	0.215	49.7	17.0	31	0.433	1.268
3	0.093	16.8	0.253	58.3	19.9	52	0.433	1.269
4	0.112	19.4	0.295	67.9	23.2	75	0.433	1.269
5	0.134	22.3	0.341	78.6	26.8	102	0.433	1.268
6	0.160	25.5	0.391	90.2	30.8	132	0.432	1.266
7	0.188	28.8	0.445	103.0	35.2	168	0.431	1.263
8	0.221	32.4	0.503	116.7	39.3	207	0.430	1.276
9	0.257	36.1	0.564	131.6	44.3	251	0.428	1.270
10	0.297	39.9	0.629	147.5	49.7	301	0.426	1.264
11	0.341	43.9	0.698	164.5	55.4	356	0.424	1.258
12	0.389	47.9	0.769	182.4	61.4	417	0.421	1.250
13	0.440	52.0	0.843	201.3	67.8	485	0.418	1.242
14	0.497	56.1	0.920	221.0	74.4	559	0.416	1.234
15	0.557	60.2	0.998	241.6	81.3	641	0.413	1.225
16	0.621	64.3	1.078	262.8	88.5	729	0.410	1.217
17	0.689	68.3	1.159	284.5	94.3	824	0.407	1.228
18	0.762	72.2	1.239	306.8	101.6	925	0.404	1.219
19	0.838	76.0	1.320	329.3	109.1	1034	0.401	1.210
20	0.917	79.6	1.401	351.9	116.5	1151	0.398	1.200
21	1.000	83.0	1.480	374.6	124.1	1274	0.395	1.192
22	1.087	86.3	1.557	397.2	131.5	1406	0.392	1.183
23	1.176	89.3	1.632	419.3	138.9	1545	0.389	1.174
24	1.268	92.1	1.704	441.1	146.1	1691	0.386	1.166
25	1.362	94.6	1.773	462.2	153.1	1844	0.383	1.157
26	1.459	96.9	1.838	482.5	159.8	2004	0.381	1.150
27	1.558	99.0	1.899	501.9	163.5	2168	0.378	1.160
28	1.659	100.7	1.955	520.2	169.5	2337	0.376	1.153
29	1.761	102.2	2.006	537.5	175.1	2512	0.373	1.145
30	1.864	103.4	2.052	553.5	180.3	2692	0.371	1.138
31	1.969	104.4	2.093	568.1	185.1	2877	0.368	1.130
32	2.074	105.1	2.129	581.5	189.4	3066	0.366	1.123
33	2.179	105.6	2.159	593.4	193.3	3260	0.364	1.116
34	2.285	105.8	2.183	604.0	196.8	3457	0.362	1.109
35	2.391	105.8	2.202	613.1	196.5	3653	0.359	1.120
36	2.497	105.6	2.215	620.8	199.0	3852	0.357	1.113
37	2.602	105.1	2.223	627.2	201.0	4053	0.354	1.105
38	2.706	104.5	2.226	632.2	202.6	4256	0.352	1.098
39	2.810	103.7	2.224	636.0	203.9	4460	0.350	1.090
40	2.913	102.7	2.216	638.6	204.7	4664	0.347	1.082
41	3.014	101.5	2.205	640.0	205.1	4869	0.344	1.074
42	3.114	100.2	2.189	640.4	205.3	5075	0.341	1.066
43	3.213	98.8	2.169	639.9	200.0	5274	0.339	1.084
44	3.310	97.2	2.146	638.4	199.5	5474	0.336	1.075
45	3.406	95.6	2.119	636.2	198.8	5673	0.333	1.065
46	3.499	93.8	2.089	633.3	197.9	5871	0.330	1.055
47	3.592	92.0	2.057	629.7	196.8	6068	0.326	1.044
48	3.682	90.0	2.022	625.7	195.5	6263	0.323	1.033
49	3.769	88.0	1.985	621.1	194.1	6457	0.319	1.021
50	3.855	86.0	1.946	616.2	192.6	6650	0.315	1.009
51	3.939	84.0	1.905	611.0	191.0	6841	0.311	0.996
52	4.021	81.8	1.864	605.6	189.2	7030	0.3075	0.984
53	4.101	79.7	1.820	600.0	187.5	7218	0.3025	0.970
54	4.178	77.6	1.777	594.2	185.7	7403	0.2985	0.956
55	4.254	75.4	1.733	588.4	183.9	7587	0.294	0.941
56	4.327	73.3	1.688	582.6	182.1	7769	0.289	0.926

¹Diets containing 2930, 2970, 3020, 3070, 3120, and 3200 kcal ME/kg for the phases 0-8, 8-17, 17-27, 27-35, 35-43, and 43-56 days of age.

Table 2.18 - Performance and Standardized Digestible Lysine (SID Lys) and Metabolizable Energy (ME) Requirements of High Performance As Hatched Broilers Using the Equations in Tables 2.01, 2.02, 2.04, and 2.09

Age, Days	Weight, Kg	Gain, g/day	SID Lys Req., g/day	ME Req., kcal/day ¹	Intake, g/day	Cumulative Intake, g	Lys/ME Ratio, %/Mcal	SID Lys Diet, %
1	0.076	13.9	0.210	47.1	16.0	16	0.446	1.316
2	0.093	16.3	0.246	55.0	18.7	35	0.447	1.318
3	0.111	18.8	0.286	63.9	21.7	56	0.447	1.319
4	0.133	21.6	0.330	73.7	25.0	81	0.447	1.318
5	0.158	24.6	0.378	84.4	28.6	110	0.447	1.317
6	0.185	27.8	0.429	96.2	32.6	143	0.445	1.314
7	0.217	31.2	0.485	109.0	36.9	180	0.444	1.310
8	0.251	34.8	0.544	122.7	40.9	220	0.443	1.328
9	0.289	38.6	0.608	137.5	45.8	266	0.441	1.322
10	0.332	42.4	0.674	153.3	51.1	318	0.439	1.316
11	0.379	46.4	0.744	170.2	56.8	374	0.437	1.309
12	0.429	50.5	0.817	187.9	62.7	437	0.434	1.302
13	0.484	54.6	0.893	206.6	68.9	506	0.431	1.294
14	0.542	58.7	0.971	226.1	75.4	581	0.429	1.286
15	0.605	62.9	1.051	246.4	82.1	663	0.426	1.278
16	0.672	67.0	1.133	267.4	89.1	752	0.423	1.269
17	0.743	71.0	1.216	288.9	94.7	847	0.420	1.281
18	0.818	75.0	1.299	310.9	101.9	949	0.417	1.273
19	0.897	78.8	1.383	333.3	109.3	1058	0.415	1.264
20	0.979	82.5	1.466	355.8	116.7	1175	0.411	1.255
21	1.065	86.1	1.549	378.4	124.1	1299	0.409	1.247
22	1.154	89.4	1.629	400.9	131.5	1430	0.406	1.238
23	1.247	92.6	1.709	423.1	138.7	1569	0.404	1.230
24	1.343	95.5	1.785	444.9	145.9	1715	0.401	1.222
25	1.441	98.3	1.858	466.1	152.9	1868	0.399	1.215
26	1.542	100.8	1.929	486.7	159.6	2027	0.396	1.208
27	1.645	103.0	1.995	506.3	163.3	2190	0.394	1.221
28	1.750	105.0	2.057	525.1	169.4	2360	0.392	1.214
29	1.856	106.8	2.114	542.7	175.1	2535	0.389	1.207
30	1.965	108.3	2.167	559.1	180.4	2715	0.387	1.201
31	2.074	109.5	2.214	574.3	185.3	2900	0.386	1.194
32	2.185	110.5	2.256	588.2	189.8	3090	0.384	1.189
33	2.296	111.2	2.292	600.8	193.8	3284	0.382	1.183
34	2.408	111.7	2.324	611.9	197.4	3481	0.380	1.177
35	2.520	112.0	2.349	621.6	197.3	3679	0.378	1.190
36	2.632	112.0	2.369	629.9	200.0	3879	0.376	1.184
37	2.743	111.9	2.383	636.8	202.2	4081	0.374	1.179
38	2.855	111.5	2.392	642.4	203.9	4285	0.373	1.173
39	2.966	111.0	2.395	646.7	205.3	4490	0.371	1.167
40	3.076	110.2	2.394	649.7	206.3	4696	0.369	1.161
41	3.185	109.4	2.387	651.5	206.9	4903	0.367	1.154
42	3.294	108.3	2.376	652.2	207.1	5110	0.364	1.148
43	3.400	107.1	2.361	651.8	203.7	5314	0.362	1.159
44	3.506	105.7	2.341	650.6	203.3	5517	0.360	1.151
45	3.611	104.3	2.318	648.4	202.6	5720	0.358	1.144
46	3.713	102.7	2.290	645.4	201.7	5921	0.355	1.136
47	3.814	101.0	2.260	641.8	200.6	6122	0.353	1.127
48	3.913	99.2	2.227	637.6	199.3	6321	0.349	1.118
49	4.011	97.4	2.191	632.8	197.7	6519	0.346	1.108
50	4.106	95.5	2.153	627.6	196.1	6715	0.343	1.098
51	4.200	93.5	2.114	622.0	194.4	6910	0.340	1.087
52	4.291	91.5	2.072	616.1	192.5	7102	0.336	1.076
53	4.381	89.5	2.029	610.1	190.7	7292	0.333	1.064
54	4.468	87.4	1.984	603.8	188.7	7482	0.329	1.052
55	4.553	85.2	1.939	597.4	186.7	7668	0.325	1.039
56	4.636	83.1	1.893	591.0	184.7	7853	0.320	1.025

¹Diets containing 2950, 3000, 3050, 3100, 3150, and 3200 kcal ME/kg for the phases 0-8, 8-17, 17-27, 27-35, 35-43, and 43-56 days of age.

Table 2.19 - Equations Used to Estimate the Nutritional Requirements (Y) of Broilers in % per Mcal ME as a Function of Average Age (X)¹

Male	Potassium	Female ²
$Y=0.2027 - 0.000454X$		$Y=0.1932 - 0.000454X$
	Sodium	
$Y=0.0773 - 0.00041X$		$Y=0.0732 - 0.00038X$
	Chlorine	
$Y=0.0694 - 0.00041X$		$Y=0.0665 - 0.00040X$
	Linoleic Acid	
$Y=0.3720 - 0.00134X$		$Y=0.3530 - 0.00128X$

¹ In order to determine the nutrient percentage in the diet of a nutritional program, use the equations above. Y = nutrient % per 1.0 Mcal of ME/kg and X = bird average age (days). The obtained value must be multiplied by dietary ME in Mcal; e.g.: sodium requirement of high performance male broilers in the period of 27 to 35 days (average age of 31 days) is: $Y = 0.0773 - 0.00041(31) = 0.065\%$ Mcal x 3.100 Mcal ME/kg diet = 0.200% of sodium.

² Nutrient level suggested for females corresponds approximately to 95% of male requirements.

Table 2.20 - Amino Acid / Lysine Ratio (%) Used to Estimate Broiler Amino Acid Requirements

Amino Acid		Phase / Age					
		Pre Starter and Starter		Grower I and II		Finisher I and II	
		0 - 8 - 17 days		17 - 27 - 35 days		35 - 43 - 56 days	
		SID	Total	SID	Total	SID	Total
Lysine	%	100	100	100	100	100	100
Methionine	%	40	40	42	42	43	43
Methionine + Cysteine	%	73	73	77	77	78	78
Threonine	%	66	69	66	69	66	69
Tryptophan	%	18	18	18	18	18	18
Arginine	%	108	106	107	105	105	103
Glycine + Serine	%	147	150	140	143	135	138
Valine	%	77	79	77	79	77	79
Isoleucine	%	67	67	67	68	68	68
Leucine	%	107	107	107	107	107	107
Histidine	%	37	37	37	37	35	35
Phenylalanine	%	63	63	63	63	63	63
Phenylalanine + Tyrosine	%	115	115	115	115	115	115

SID.: Standardized Ileal Digestibility

Table 2.21 - Example to Calculate the Digestible Essential Nitrogen (Dig. Ne) Total Essential Nitrogen (Net), and Digestible and Total Crude Protein Requirements of Broilers¹

Amino Acid	N (%)	SID AA Req. (%)	Dig. Ne (%)	Total AA Req. (%)	Net (%)
Lysine	19.16	1.202	0.230	1.326	0.254
Methionine	9.39	0.509	0.048	0.557	0.052
Threonine	11.76	0.794	0.093	0.915	0.108
Tryptophan	13.72	0.216	0.030	0.239	0.033
Arginine	32.16	1.287	0.414	1.392	0.448
Glycine + Serine ²	15.56	1.683	0.262	1.896	0.295
Valine	11.96	0.926	0.111	1.047	0.125
Isoleucine	10.68	0.806	0.086	0.901	0.096
Leucine	10.68	1.287	0.137	1.419	0.151
Histidine	27.08	0.445	0.120	0.491	0.133
Phenylalanine	8.48	0.761	0.064	0.835	0.071
Ne Req.		1.596		1.766	
Total N Req. ³		3.192		3.532	
Protein Req. ⁴		19.95		22.07	
SID Lys: Protein		6.03		5.45	

¹ Example for high performance male broilers (27 to 35 days of age).

² N from Glycine + Serine according to molecular weight (Gly, 41.67%; Ser, 58.33%).

³ Ne:Nt Ratio of 50%.

⁴ Conversion Factor of N to Protein: 6.25.

- Total lysine requirement was calculated considering 90.7% of dietary ileal digestibility which was used to determine the total amino acid to total lysine ratio (Table 2.20) to estimate each total amino acid requirement.

- Minimum levels of Crude Protein and Digestible Protein can be estimated in a simplified way using the average value of % SID Lys in the protein of 5.5% (5.40 - 5.53) and 6.0% (5.97 - 6.11), respectively.

Example:

Simplified calculation of Crude Protein and Digestible Protein Requirements using the % Dietary SID Lys.

High Performance Male Broilers (31 days)

Weight = 2.268 kg, Gain = 0.119 kg/bird/day, % Dietary SID Lys = 1.202%

% Crude Protein = (% SID Lys x 100) / 5.5 = (1.202 x 100) / 5.5 = 21.9%

% Digestible Protein = (% SID Lys x 100) / 6.0 = (1.202 x 100) / 6.0 = 20.0%

Table 2.22 - Nutritional Requirements of High Performance Male Broilers

Age	Days	0-8	8-17	17-27	27-35	35-43	43-49
Weight Range	kg	0.05-0.26	0.26-0.80	0.80-1.80	1.80-2.75	2.75-3.68	3.68-4.32
Average Weight	kg	0.134	0.488	1.260	2.268	3.226	4.012
Gain	g/day	23.0	57.9	98.8	119.0	118.0	106.8
SID Lysine	g/day	0.353	0.944	1.792	2.387	2.526	2.373
Available Phosphorus	g/day	0.144	0.362	0.525	0.643	0.653	0.501
Digestible Phosphorus	g/day	0.130	0.328	0.476	0.584	0.594	0.469
Metabolizable Energy	kcal/day	76.2	212.2	435.1	615.3	679.5	667.7
Diet Metabolizable Energy	kcal/kg	2950	3000	3050	3100	3150	3200
Diet Net Energy	kcal/kg	2331	2375	2400	2450	2470	2530
Intake	g/day	25.8	70.7	142.7	198.5	215.7	208.7
Nutrients							
Calcium	%	1.167	1.076	0.773	0.681	0.637	0.513
Available Phosphorus	%	0.556	0.513	0.368	0.324	0.303	0.240
Digestible Phosphorus	%	0.503	0.464	0.333	0.294	0.275	0.225
Potassium	%	0.593	0.591	0.588	0.585	0.583	0.582
Sodium	%	0.223	0.217	0.208	0.200	0.193	0.187
Chlorine	%	0.200	0.193	0.184	0.176	0.168	0.162
Linoleic Acid	%	1.082	1.066	1.045	1.024	1.007	0.993
Digestible Protein and Amino Acid							
Digestible Protein	%	22.89	22.34	20.84	19.95	19.17	18.61
Lysine	%	1.367	1.335	1.256	1.202	1.171	1.137
Methionine	%	0.549	0.536	0.532	0.509	0.502	0.488
Methionine + Cysteine	%	0.998	0.974	0.967	0.926	0.914	0.887
Threonine	%	0.903	0.881	0.829	0.794	0.773	0.751
Tryptophan	%	0.246	0.240	0.226	0.216	0.211	0.205
Arginine	%	1.477	1.441	1.344	1.287	1.230	1.194
Glycine + Serine	%	2.010	1.962	1.759	1.683	1.581	1.535
Valine	%	1.053	1.028	0.967	0.926	0.902	0.876
Isoleucine	%	0.916	0.894	0.842	0.806	0.796	0.773
Leucine	%	1.463	1.428	1.344	1.287	1.253	1.217
Histidine	%	0.506	0.494	0.465	0.445	0.410	0.398
Phenylalanine	%	0.865	0.844	0.794	0.761	0.741	0.719
Phenylalanine + Tyrosine	%	1.573	1.535	1.445	1.383	1.347	1.308
Digestible Essential Nitrogen	%	1.832	1.787	1.667	1.596	1.534	1.489
Total Protein and Amino Acid							
Crude Protein	%	25.31	24.70	23.06	22.07	21.20	20.59
Lysine	%	1.508	1.471	1.385	1.326	1.291	1.254
Methionine	%	0.603	0.588	0.582	0.557	0.555	0.539
Methionine + Cysteine	%	1.101	1.074	1.066	1.021	1.007	0.978
Threonine	%	1.040	1.015	0.956	0.915	0.891	0.865
Tryptophan	%	0.271	0.265	0.249	0.239	0.232	0.226
Arginine	%	1.598	1.560	1.454	1.392	1.330	1.292
Glycine + Serine	%	2.261	2.207	1.980	1.896	1.782	1.730
Valine	%	1.191	1.162	1.094	1.047	1.020	0.991
Isoleucine	%	1.010	0.986	0.942	0.901	0.878	0.853
Leucine	%	1.613	1.574	1.482	1.419	1.382	1.342
Histidine	%	0.558	0.544	0.512	0.491	0.452	0.439
Phenylalanine	%	0.950	0.926	0.872	0.835	0.814	0.790
Phenylalanine + Tyrosine	%	1.734	1.692	1.593	1.525	1.485	1.442
Total Essential Nitrogen	%	2.025	1.976	1.845	1.766	1.696	1.647

Table 2.23 - Nutritional Requirements of High Performance Male Broilers Grown at 26 °C (21-31 °C) Average Temperature

Age	Days	17-27	27-35	35-43	43-49
Weight Range	kg	0.80-1.80	1.80-2.75	2.75-3.68	3.68-4.32
Average Weight	kg	1.260	2.268	3.226	4.012
Gain	g/day	98.8	119.0	118.0	106.8
SID Lysine	g/day	1.792	2.387	2.526	2.373
Available Phosphorus	g/day	0.525	0.643	0.653	0.501
Digestible Phosphorus	g/day	0.476	0.584	0.594	0.469
Metabolizable Energy	kcal/day	425.8	600.9	641.9	623.5
Diet Metabolizable Energy	kcal/kg	3050	3100	3150	3200
Diet Net Energy	kcal/kg	2400	2450	2470	2530
Intake	g/day	139.6	193.8	203.8	194.8
Nutrients					
Calcium	%	0.790	0.698	0.674	0.549
Available Phosphorus	%	0.376	0.332	0.320	0.257
Digestible Phosphorus	%	0.341	0.301	0.291	0.241
Potassium	%	0.588	0.585	0.583	0.582
Sodium	%	0.208	0.200	0.193	0.187
Chlorine	%	0.184	0.176	0.168	0.162
Linoleic Acid	%	1.045	1.024	1.007	0.993
Digestible Protein and Amino Acid					
Digestible Protein	%	21.30	20.43	20.29	19.93
Lysine	%	1.283	1.231	1.240	1.218
Methionine	%	0.544	0.521	0.532	0.522
Methionine + Cysteine	%	0.988	0.948	0.967	0.950
Threonine	%	0.847	0.813	0.818	0.804
Tryptophan	%	0.231	0.222	0.223	0.219
Arginine	%	1.373	1.317	1.302	1.279
Glycine + Serine	%	1.797	1.724	1.674	1.644
Valine	%	0.988	0.948	0.955	0.938
Isoleucine	%	0.860	0.825	0.843	0.828
Leucine	%	1.373	1.317	1.327	1.303
Histidine	%	0.475	0.456	0.434	0.426
Phenylalanine	%	0.812	0.779	0.784	0.770
Phenylalanine + Tyrosine	%	1.476	1.416	1.426	1.401
Digestible Essential Nitrogen	%	1.704	1.634	1.623	1.595
Total Protein and Amino Acid					
Crude Protein	%	23.56	22.60	22.44	22.04
Lysine	%	1.415	1.358	1.367	1.343
Methionine	%	0.594	0.570	0.588	0.577
Methionine + Cysteine	%	1.090	1.045	1.066	1.047
Threonine	%	0.976	0.937	0.943	0.927
Tryptophan	%	0.255	0.244	0.246	0.242
Arginine	%	1.486	1.425	1.408	1.383
Glycine + Serine	%	2.024	1.941	1.886	1.853
Valine	%	1.118	1.072	1.080	1.061
Isoleucine	%	0.962	0.923	0.929	0.913
Leucine	%	1.514	1.453	1.463	1.437
Histidine	%	0.524	0.502	0.478	0.470
Phenylalanine	%	0.891	0.855	0.861	0.846
Phenylalanine + Tyrosine	%	1.627	1.561	1.572	1.544
Total Essential Nitrogen	%	1.885	1.808	1.795	1.764

Table 2.24 - Nutritional Requirements of Standard Performance Male Broilers

Age	Days	0-8	8-17	17-27	27-35	35-43	43-49
Weight Range	kg	0.05-0.24	0.24-0.76	0.76-1.71	1.71-2.63	2.63-3.53	3.53-4.13
Average Weight	kg	0.121	0.454	1.194	2.164	3.085	3.838
Gain	g/day	21.2	55.0	95.0	114.6	113.4	102.2
SID Lysine	g/day	0.326	0.891	1.709	2.281	2.413	2.263
Available Phosphorus	g/day	0.133	0.344	0.505	0.620	0.627	0.480
Digestible Phosphorus	g/day	0.120	0.311	0.457	0.562	0.571	0.449
Metabolizable Energy	kcal/day	73.0	207.8	431.1	614.0	682.3	674.6
Diet Metabolizable Energy	kcal/kg	2930	2970	3020	3070	3120	3200
Diet Net Energy	kcal/kg	2331	2375	2400	2450	2470	2530
Intake	g/day	24.9	70.0	142.8	200.0	218.7	210.8
Nutrients							
Calcium	%	1.118	1.032	0.742	0.651	0.604	0.486
Available Phosphorus	%	0.533	0.492	0.353	0.310	0.287	0.228
Digestible Phosphorus	%	0.482	0.445	0.320	0.281	0.261	0.213
Potassium	%	0.589	0.585	0.582	0.579	0.577	0.582
Sodium	%	0.222	0.214	0.206	0.198	0.191	0.187
Chlorine	%	0.199	0.191	0.182	0.174	0.167	0.162
Linoleic Acid	%	1.074	1.055	1.034	1.015	0.998	0.993
Digestible Protein and Amino Acid							
Digestible Protein	%	21.88	21.33	19.86	18.92	18.06	17.57
Lysine	%	1.307	1.274	1.197	1.140	1.103	1.074
Methionine	%	0.525	0.512	0.507	0.483	0.473	0.461
Methionine + Cysteine	%	0.954	0.930	0.922	0.878	0.860	0.837
Threonine	%	0.863	0.841	0.790	0.753	0.728	0.709
Tryptophan	%	0.235	0.229	0.216	0.205	0.199	0.193
Arginine	%	1.412	1.376	1.281	1.220	1.158	1.127
Glycine + Serine	%	1.921	1.873	1.676	1.596	1.489	1.449
Valine	%	1.006	0.981	0.922	0.878	0.849	0.827
Isoleucine	%	0.876	0.854	0.802	0.764	0.750	0.730
Leucine	%	1.399	1.363	1.281	1.220	1.180	1.149
Histidine	%	0.484	0.471	0.443	0.422	0.386	0.376
Phenylalanine	%	0.827	0.806	0.757	0.721	0.698	0.679
Phenylalanine + Tyrosine	%	1.503	1.465	1.377	1.311	1.269	1.235
Digestible Essential Nitrogen	%	1.751	1.706	1.589	1.514	1.444	1.406
Total Protein and Amino Acid							
Crude Protein	%	24.20	23.58	21.98	20.93	19.97	19.43
Lysine	%	1.441	1.405	1.320	1.257	1.216	1.184
Methionine	%	0.576	0.562	0.554	0.528	0.523	0.509
Methionine + Cysteine	%	1.052	1.025	1.016	0.968	0.949	0.923
Threonine	%	0.994	0.969	0.911	0.867	0.839	0.817
Tryptophan	%	0.259	0.253	0.238	0.226	0.219	0.213
Arginine	%	1.528	1.489	1.386	1.320	1.253	1.219
Glycine + Serine	%	2.162	2.107	1.888	1.798	1.679	1.634
Valine	%	1.138	1.110	1.043	0.993	0.961	0.935
Isoleucine	%	0.966	0.941	0.898	0.855	0.827	0.805
Leucine	%	1.542	1.503	1.412	1.345	1.301	1.267
Histidine	%	0.533	0.520	0.488	0.465	0.426	0.414
Phenylalanine	%	0.908	0.885	0.832	0.792	0.766	0.746
Phenylalanine + Tyrosine	%	1.657	1.615	1.518	1.446	1.399	1.361
Total Essential Nitrogen	%	1.936	1.887	1.758	1.675	1.597	1.555

Table 2.25 - Nutritional Requirements of High Performance Female Broilers

Age	Days	0-8	8-17	17-27	27-35	35-43	43-49
Weight Range	kg	0.05-0.24	0.24-0.68	0.68-1.49	1.49-2.29	2.29-3.11	3.11-3.70
Average Weight	kg	0.131	0.424	1.048	1.879	2.705	3.414
Gain	g/day	20.18	47.11	80.01	99.89	103.88	98.51
SID Lysine	g/day	0.306	0.766	1.466	2.041	2.264	2.207
Available Phosphorus	g/day	0.127	0.296	0.427	0.541	0.574	0.459
Digestible Phosphorus	g/day	0.115	0.268	0.387	0.491	0.522	0.430
Metabolizable Energy	kcal/day	71.1	182.2	366.6	533.3	613.8	623.1
Diet Metabolizable Energy	kcal/kg	2950	3000	3050	3100	3150	3200
Diet Net Energy	kcal/kg	2331	2375	2400	2450	2470	2530
Intake	g/day	24.10	60.75	120.18	172.04	194.85	194.73
Nutrients							
Calcium	%	1.104	1.024	0.747	0.662	0.620	0.504
Available Phosphorus	%	0.526	0.488	0.355	0.315	0.295	0.236
Digestible Phosphorus	%	0.476	0.441	0.322	0.286	0.268	0.221
Potassium	%	0.565	0.563	0.559	0.555	0.553	0.551
Sodium	%	0.211	0.205	0.198	0.190	0.184	0.178
Chlorine	%	0.191	0.185	0.176	0.168	0.160	0.154
Linoleic Acid	%	1.026	1.011	0.991	0.971	0.955	0.941
Digestible Protein and Amino Acid							
Digestible Protein	%	21.24	21.11	20.24	19.68	19.01	18.55
Lysine	%	1.268	1.261	1.220	1.186	1.162	1.134
Methionine	%	0.509	0.506	0.517	0.502	0.498	0.486
Methionine + Cysteine	%	0.926	0.920	0.939	0.913	0.906	0.884
Threonine	%	0.837	0.832	0.805	0.783	0.767	0.748
Tryptophan	%	0.228	0.227	0.220	0.214	0.209	0.204
Arginine	%	1.370	1.362	1.306	1.269	1.220	1.190
Glycine + Serine	%	1.865	1.854	1.708	1.661	1.568	1.530
Valine	%	0.977	0.971	0.939	0.913	0.895	0.873
Isoleucine	%	0.850	0.845	0.817	0.795	0.790	0.771
Leucine	%	1.357	1.349	1.306	1.269	1.243	1.213
Histidine	%	0.469	0.467	0.451	0.439	0.407	0.397
Phenylalanine	%	0.802	0.798	0.772	0.750	0.735	0.717
Phenylalanine + Tyrosine	%	1.459	1.450	1.403	1.364	1.336	1.304
Digestible Essential Nitrogen	%	1.699	1.689	1.620	1.575	1.521	1.484
Total Protein and Amino Acid							
Crude Protein	%	23.48	23.34	22.40	21.78	21.03	20.52
Lysine	%	1.399	1.390	1.345	1.308	1.281	1.250
Methionine	%	0.559	0.556	0.565	0.549	0.551	0.537
Methionine + Cysteine	%	1.021	1.015	1.036	1.007	0.999	0.975
Threonine	%	0.965	0.959	0.928	0.902	0.884	0.862
Tryptophan	%	0.252	0.250	0.242	0.235	0.231	0.225
Arginine	%	1.482	1.474	1.412	1.373	1.319	1.287
Glycine + Serine	%	2.098	2.085	1.924	1.870	1.768	1.725
Valine	%	1.105	1.098	1.063	1.033	1.012	0.987
Isoleucine	%	0.937	0.931	0.915	0.889	0.871	0.850
Leucine	%	1.496	1.488	1.439	1.399	1.370	1.337
Histidine	%	0.517	0.514	0.498	0.484	0.448	0.437
Phenylalanine	%	0.881	0.876	0.847	0.824	0.807	0.787
Phenylalanine + Tyrosine	%	1.608	1.599	1.547	1.504	1.473	1.437
Total Essential Nitrogen	%	1.879	1.867	1.792	1.742	1.682	1.641

Table 2.26 - Nutritional Requirements of High Performance Female Broilers Grown at 26 °C (21-31 °C) Average Temperature

Age	Days	17-27	27-35	35-43	43-49
Weight Range	kg	0.80-1.80	1.80-2.75	2.75-3.68	3.68-4.32
Average Weight	kg	1.048	1.879	2.705	3.414
Gain	g/day	80.0	99.9	103.9	98.5
SID Lysine	g/day	1.466	2.041	2.264	2.207
Available Phosphorus	g/day	0.427	0.541	0.574	0.459
Digestible Phosphorus	g/day	0.387	0.491	0.522	0.430
Metabolizable Energy	kcal/day	358.5	520.8	580.9	583.9
Diet Metabolizable Energy	kcal/kg	3050	3100	3150	3200
Diet Net Energy	kcal/kg	2400	2450	2470	2530
Intake	g/day	117.5	168.0	184.4	182.5
Nutrients					
Calcium	%	0.763	0.677	0.656	0.538
Available Phosphorus	%	0.363	0.322	0.311	0.252
Digestible Phosphorus	%	0.329	0.292	0.283	0.236
Potassium	%	0.559	0.555	0.553	0.551
Sodium	%	0.198	0.190	0.184	0.178
Chlorine	%	0.176	0.168	0.160	0.154
Linoleic Acid	%	0.991	0.971	0.955	0.941
Digestible Protein and Amino Acid					
Digestible Protein	%	20.70	20.16	20.09	19.80
Lysine	%	1.248	1.215	1.228	1.210
Methionine	%	0.528	0.514	0.527	0.519
Methionine + Cysteine	%	0.961	0.935	0.957	0.944
Threonine	%	0.823	0.802	0.810	0.798
Tryptophan	%	0.225	0.219	0.221	0.218
Arginine	%	1.335	1.300	1.289	1.270
Glycine + Serine	%	1.747	1.701	1.657	1.633
Valine	%	0.961	0.935	0.945	0.931
Isoleucine	%	0.836	0.814	0.835	0.823
Leucine	%	1.335	1.300	1.313	1.294
Histidine	%	0.462	0.449	0.430	0.423
Phenylalanine	%	0.789	0.768	0.776	0.765
Phenylalanine + Tyrosine	%	1.435	1.397	1.412	1.391
Digestible Essential Nitrogen	%	1.656	1.612	1.607	1.584
Total Protein and Amino Acid					
Crude Protein	%	22.90	22.30	22.22	21.89
Lysine	%	1.376	1.339	1.353	1.334
Methionine	%	0.578	0.563	0.582	0.573
Methionine + Cysteine	%	1.059	1.031	1.056	1.040
Threonine	%	0.949	0.924	0.934	0.920
Tryptophan	%	0.248	0.241	0.244	0.240
Arginine	%	1.444	1.406	1.394	1.374
Glycine + Serine	%	1.967	1.915	1.868	1.840
Valine	%	1.087	1.058	1.069	1.054
Isoleucine	%	0.935	0.911	0.920	0.907
Leucine	%	1.472	1.433	1.448	1.427
Histidine	%	0.509	0.496	0.474	0.467
Phenylalanine	%	0.867	0.844	0.853	0.840
Phenylalanine + Tyrosine	%	1.582	1.540	1.556	1.534
Total Essential Nitrogen	%	1.832	1.784	1.778	1.752

Table 2.27 - Nutritional Requirements of Standard Performance Female Broilers

Age	Days	0-8	8-17	17-27	27-35	35-43	43-49
Weight Range	kg	0.04-0.20	0.20-0.62	0.62-1.40	1.40-2.15	2.15-2.90	2.90-3.41
Average Weight	kg	0.102	0.375	0.979	1.773	2.534	3.160
Gain	g/day	17.59	44.91	77.53	94.15	93.90	85.32
SID Lysine	g/day	0.264	0.721	1.404	1.905	2.034	1.914
Available Phosphorus	g/day	0.110	0.282	0.413	0.511	0.522	0.403
Digestible Phosphorus	g/day	0.100	0.255	0.374	0.464	0.475	0.377
Metabolizable Energy	kcal/day	62.8	175.8	363.2	522.2	589.6	591.9
Diet Metabolizable Energy	kcal/kg	2930	2970	3020	3070	3120	3200
Diet Net Energy	kcal/kg	2331	2375	2400	2450	2470	2530
Intake	g/day	21.4	59.2	120.2	170.1	189.0	185.0
Nutrients							
Calcium	%	1.079	1.000	0.722	0.631	0.581	0.465
Available Phosphorus	%	0.514	0.476	0.344	0.300	0.276	0.218
Digestible Phosphorus	%	0.465	0.431	0.311	0.273	0.251	0.204
Potassium	%	0.561	0.557	0.553	0.550	0.548	0.551
Sodium	%	0.210	0.203	0.196	0.189	0.182	0.178
Chlorine	%	0.190	0.183	0.174	0.166	0.159	0.154
Linoleic Acid	%	1.019	1.001	0.981	0.962	0.946	0.941
Digestible Protein and Amino Acid							
Digestible Protein	%	20.61	20.40	19.38	18.58	17.62	16.94
Lysine	%	1.231	1.218	1.168	1.120	1.076	1.035
Methionine	%	0.494	0.489	0.495	0.474	0.462	0.444
Methionine + Cysteine	%	0.899	0.889	0.899	0.862	0.840	0.807
Threonine	%	0.813	0.804	0.771	0.739	0.710	0.683
Tryptophan	%	0.222	0.219	0.210	0.202	0.194	0.186
Arginine	%	1.330	1.316	1.250	1.198	1.130	1.087
Glycine + Serine	%	1.810	1.791	1.635	1.568	1.453	1.397
Valine	%	0.948	0.938	0.899	0.862	0.829	0.797
Isoleucine	%	0.825	0.816	0.783	0.750	0.732	0.704
Leucine	%	1.317	1.303	1.250	1.198	1.152	1.107
Histidine	%	0.456	0.451	0.432	0.414	0.377	0.362
Phenylalanine	%	0.779	0.771	0.739	0.708	0.681	0.655
Phenylalanine + Tyrosine	%	1.416	1.401	1.343	1.288	1.238	1.190
Digestible Essential Nitrogen	%	1.649	1.632	1.550	1.487	1.409	1.355
Total Protein and Amino Acid							
Crude Protein	%	22.79	22.55	21.44	20.56	19.48	18.73
Lysine	%	1.357	1.343	1.288	1.235	1.187	1.141
Methionine	%	0.543	0.537	0.541	0.519	0.510	0.491
Methionine + Cysteine	%	0.991	0.980	0.992	0.951	0.926	0.890
Threonine	%	0.937	0.927	0.888	0.852	0.819	0.787
Tryptophan	%	0.244	0.242	0.232	0.222	0.214	0.205
Arginine	%	1.439	1.424	1.352	1.297	1.222	1.175
Glycine + Serine	%	2.036	2.015	1.841	1.766	1.638	1.575
Valine	%	1.072	1.061	1.017	0.976	0.937	0.901
Isoleucine	%	0.909	0.900	0.876	0.840	0.807	0.776
Leucine	%	1.452	1.437	1.378	1.321	1.270	1.221
Histidine	%	0.502	0.497	0.476	0.457	0.415	0.399
Phenylalanine	%	0.855	0.846	0.811	0.778	0.748	0.719
Phenylalanine + Tyrosine	%	1.561	1.545	1.481	1.420	1.365	1.312
Total Essential Nitrogen	%	1.823	1.804	1.715	1.645	1.559	1.499

Table 2.28 - Nutritional Requirements of High Performance As Hatched Broilers

Age	Days	0-8	8-17	17-27	27-35	35-43	43-49
Weight Range	kg	0.05-0.24	0.24-0.68	0.68-1.49	1.49-2.29	2.29-3.11	3.11-3.70
Average Weight	kg	0.133	0.456	1.154	2.074	2.966	3.713
Gain	g/day	21.6	52.5	89.4	109.4	110.9	102.7
SID Lysine	g/day	0.330	0.855	1.629	2.214	2.395	2.290
Available Phosphorus	g/day	0.136	0.329	0.476	0.592	0.614	0.480
Digestible Phosphorus	g/day	0.123	0.298	0.432	0.538	0.558	0.450
Metabolizable Energy	kcal/day	73.7	197.2	400.9	574.3	646.7	645.4
Diet Metabolizable Energy	kcal/kg	2950	3000	3050	3100	3150	3200
Diet Net Energy	kcal/kg	2331	2375	2400	2450	2470	2530
Intake	g/day	25.0	65.7	131.4	185.3	205.3	201.7
Nutrients							
Calcium	%	1.136	1.050	0.760	0.672	0.629	0.509
Available Phosphorus	%	0.541	0.501	0.362	0.320	0.299	0.238
Digestible Phosphorus	%	0.490	0.453	0.328	0.290	0.272	0.223
Potassium	%	0.579	0.577	0.574	0.570	0.568	0.567
Sodium	%	0.217	0.211	0.203	0.195	0.189	0.183
Chlorine	%	0.196	0.189	0.180	0.172	0.164	0.158
Linoleic Acid	%	1.054	1.039	1.018	0.998	0.981	0.967
Digestible Protein and Amino Acid							
Digestible Protein	%	22.07	21.73	20.54	19.82	19.09	18.58
Lysine	%	1.318	1.298	1.238	1.194	1.167	1.136
Methionine	%	0.529	0.521	0.525	0.506	0.500	0.487
Methionine + Cysteine	%	0.962	0.947	0.953	0.920	0.910	0.886
Threonine	%	0.870	0.857	0.817	0.789	0.770	0.750
Tryptophan	%	0.237	0.234	0.223	0.215	0.210	0.205
Arginine	%	1.424	1.402	1.325	1.278	1.225	1.192
Glycine + Serine	%	1.938	1.908	1.734	1.672	1.575	1.533
Valine	%	1.015	1.000	0.953	0.920	0.899	0.875
Isoleucine	%	0.883	0.870	0.830	0.801	0.793	0.772
Leucine	%	1.410	1.389	1.325	1.278	1.248	1.215
Histidine	%	0.488	0.481	0.458	0.442	0.409	0.398
Phenylalanine	%	0.834	0.821	0.783	0.756	0.738	0.718
Phenylalanine + Tyrosine	%	1.516	1.493	1.424	1.374	1.342	1.306
Digestible Essential Nitrogen	%	1.766	1.738	1.644	1.586	1.528	1.487
Total Protein and Amino Acid							
Crude Protein	%	24.40	24.02	22.73	21.93	21.12	20.56
Lysine	%	1.454	1.431	1.365	1.317	1.286	1.252
Methionine	%	0.581	0.572	0.574	0.553	0.553	0.538
Methionine + Cysteine	%	1.061	1.045	1.051	1.014	1.003	0.977
Threonine	%	1.003	0.987	0.942	0.909	0.888	0.864
Tryptophan	%	0.262	0.258	0.246	0.237	0.232	0.226
Arginine	%	1.540	1.517	1.433	1.383	1.325	1.290
Glycine + Serine	%	2.180	2.146	1.952	1.883	1.775	1.728
Valine	%	1.148	1.130	1.079	1.040	1.016	0.989
Isoleucine	%	0.974	0.959	0.929	0.895	0.875	0.852
Leucine	%	1.555	1.531	1.461	1.409	1.376	1.340
Histidine	%	0.538	0.529	0.505	0.488	0.450	0.438
Phenylalanine	%	0.916	0.901	0.860	0.830	0.811	0.789
Phenylalanine + Tyrosine	%	1.671	1.646	1.570	1.515	1.479	1.440
Total Essential Nitrogen	%	1.952	1.922	1.819	1.754	1.689	1.644

Table 2.29 - Nutritional Requirements of High Performance As Hatched Broilers Grown at 26 °C (21-31 °C) Average Temperature

Age	Days	17-27	27-35	35-43	43-49
Weight Range	kg	0.80-1.80	1.80-2.75	2.75-3.68	3.68-4.32
Average Weight	kg	1.154	2.074	2.966	3.713
Gain	g/day	89.4	109.5	111.0	102.7
SID Lysine	g/day	1.629	2.214	2.395	2.290
Available Phosphorus	g/day	0.476	0.592	0.614	0.480
Digestible Phosphorus	g/day	0.432	0.538	0.558	0.450
Metabolizable Energy	kcal/day	392.2	560.9	611.4	603.7
Diet Metabolizable Energy	kcal/kg	3050	3100	3150	3200
Diet Net Energy	kcal/kg	2400	2450	2470	2530
Intake	g/day	128.6	180.9	194.1	188.7
Nutrients					
Calcium	%	0.777	0.688	0.665	0.544
Available Phosphorus	%	0.370	0.327	0.316	0.255
Digestible Phosphorus	%	0.335	0.297	0.287	0.239
Potassium	%	0.574	0.570	0.568	0.567
Sodium	%	0.203	0.195	0.189	0.183
Chlorine	%	0.180	0.172	0.164	0.158
Linoleic Acid	%	1.018	0.998	0.981	0.967
Digestible Protein and Amino Acid					
Digestible Protein	%	21.00	20.30	20.19	19.87
Lysine	%	1.266	1.223	1.234	1.214
Methionine	%	0.536	0.518	0.530	0.521
Methionine + Cysteine	%	0.975	0.942	0.962	0.947
Threonine	%	0.835	0.808	0.814	0.801
Tryptophan	%	0.228	0.221	0.222	0.219
Arginine	%	1.354	1.309	1.296	1.275
Glycine + Serine	%	1.772	1.713	1.666	1.639
Valine	%	0.975	0.942	0.950	0.935
Isoleucine	%	0.848	0.820	0.839	0.826
Leucine	%	1.354	1.309	1.320	1.299
Histidine	%	0.469	0.453	0.432	0.425
Phenylalanine	%	0.801	0.774	0.780	0.768
Phenylalanine + Tyrosine	%	1.456	1.407	1.419	1.396
Digestible Essential Nitrogen	%	1.680	1.623	1.615	1.590
Total Protein and Amino Acid					
Crude Protein	%	23.23	22.45	22.33	21.97
Lysine	%	1.396	1.349	1.360	1.339
Methionine	%	0.586	0.567	0.585	0.575
Methionine + Cysteine	%	1.075	1.038	1.061	1.044
Threonine	%	0.963	0.931	0.939	0.924
Tryptophan	%	0.252	0.243	0.245	0.241
Arginine	%	1.465	1.416	1.401	1.379
Glycine + Serine	%	1.996	1.928	1.877	1.847
Valine	%	1.103	1.065	1.075	1.058
Isoleucine	%	0.949	0.917	0.925	0.910
Leucine	%	1.493	1.443	1.456	1.432
Histidine	%	0.517	0.499	0.476	0.469
Phenylalanine	%	0.879	0.850	0.857	0.843
Phenylalanine + Tyrosine	%	1.605	1.551	1.564	1.539
Total Essential Nitrogen	%	1.859	1.796	1.787	1.758

Table 2.30 - Nutritional Requirements of Standard Performance As Hatched Broilers

Age	Days	0-8	8-17	17-27	27-35	35-43	43-49
Weight Range	kg	0.05-0.24	0.24-0.68	0.68-1.49	1.49-2.29	2.29-3.11	3.11-3.70
Average Weight	kg	0.112	0.415	1.087	1.969	2.810	3.499
Gain	g/day	19.4	50.0	86.3	104.4	103.7	93.8
SID Lysine	g/day	0.295	0.806	1.557	2.093	2.224	2.089
Available Phosphorus	g/day	0.122	0.313	0.459	0.566	0.575	0.442
Digestible Phosphorus	g/day	0.110	0.283	0.416	0.513	0.523	0.413
Metabolizable Energy	kcal/day	67.9	191.8	397.2	568.1	636.0	633.3
Diet Metabolizable Energy	kcal/kg	2930	2970	3020	3070	3120	3200
Diet Net Energy	kcal/kg	2331	2375	2400	2450	2470	2530
Intake	g/day	23.2	64.6	131.5	185.1	203.9	197.9
Nutrients							
Calcium	%	1.099	1.016	0.732	0.641	0.593	0.476
Available Phosphorus	%	0.524	0.484	0.349	0.305	0.282	0.223
Digestible Phosphorus	%	0.474	0.438	0.316	0.277	0.256	0.209
Potassium	%	0.575	0.571	0.568	0.565	0.563	0.567
Sodium	%	0.216	0.209	0.201	0.194	0.187	0.183
Chlorine	%	0.195	0.187	0.178	0.170	0.163	0.158
Linoleic Acid	%	1.047	1.028	1.008	0.989	0.972	0.967
Digestible Protein and Amino Acid							
Digestible Protein	%	21.25	20.87	19.62	18.75	17.84	17.26
Lysine	%	1.269	1.246	1.183	1.130	1.090	1.055
Methionine	%	0.510	0.501	0.501	0.479	0.468	0.453
Methionine + Cysteine	%	0.927	0.910	0.911	0.870	0.850	0.822
Threonine	%	0.838	0.823	0.781	0.746	0.719	0.696
Tryptophan	%	0.229	0.224	0.213	0.204	0.197	0.190
Arginine	%	1.371	1.346	1.266	1.209	1.144	1.107
Glycine + Serine	%	1.866	1.832	1.656	1.582	1.471	1.423
Valine	%	0.977	0.960	0.911	0.870	0.839	0.812
Isoleucine	%	0.851	0.835	0.793	0.757	0.741	0.717
Leucine	%	1.358	1.333	1.266	1.209	1.166	1.128
Histidine	%	0.470	0.461	0.438	0.418	0.382	0.369
Phenylalanine	%	0.803	0.789	0.748	0.715	0.690	0.667
Phenylalanine + Tyrosine	%	1.460	1.433	1.360	1.300	1.254	1.213
Digestible Essential Nitrogen	%	1.700	1.669	1.570	1.501	1.427	1.381
Total Protein and Amino Acid							
Crude Protein	%	23.50	23.07	21.71	20.75	19.73	19.08
Lysine	%	1.399	1.374	1.304	1.246	1.202	1.163
Methionine	%	0.560	0.550	0.548	0.524	0.517	0.500
Methionine + Cysteine	%	1.022	1.003	1.004	0.960	0.938	0.907
Threonine	%	0.966	0.948	0.900	0.860	0.829	0.802
Tryptophan	%	0.252	0.248	0.235	0.224	0.217	0.209
Arginine	%	1.484	1.457	1.369	1.309	1.238	1.197
Glycine + Serine	%	2.099	2.061	1.865	1.782	1.659	1.605
Valine	%	1.105	1.086	1.030	0.985	0.949	0.918
Isoleucine	%	0.938	0.921	0.887	0.848	0.817	0.791
Leucine	%	1.497	1.470	1.395	1.333	1.286	1.244
Histidine	%	0.518	0.509	0.482	0.461	0.421	0.407
Phenylalanine	%	0.882	0.866	0.822	0.785	0.757	0.733
Phenylalanine + Tyrosine	%	1.609	1.580	1.500	1.433	1.382	1.337
Total Essential Nitrogen	%	1.880	1.846	1.737	1.660	1.578	1.527