



Lysine Responses of Modern Commercial Male Broiler Strains From 28 to 42 days of age

Introduction

It is of great importance to fine-tune the optimum digestible Lysine [dLys] needs of rapidly evolving commercial broiler strains. Feeding diets either deficient or in excess of dLys needs can result in poor performance or increased diet cost, respectively. Today's high performing broiler consumes less feed per unit of bodyweight (BW) gain than birds of previous decades [1-2]. The modern broiler responds to higher dietary amino acid [AA] levels than the commercial broiler used in previous decades due to improvements in genetic selection such as decreased feed intake per unit of BW gain and greater accretion rate for meat yield [2-4].

Recent reports in the literature [5] clearly show how the dLys requirement of male broilers from 14 to 28 days of age is approximately 18% higher than what the current NRC [6] recommends. Moreover, the 14 to 28 day BW gain of the modern broiler is ~162% greater than that published by the NRC. Therefore, it is reasonable to assume that this increase in BW gain of the modern broiler may have resulted in an increase in AA needs.

In commercial practice, grower, finisher, and withdrawal periods range approximately from 14-17 to 28-35, 29-36 to 38-46, and 47 to 52-63 days of age, respectively. Product mix and anticoccidial programs often dictate feeding schedules. In addition, daily growth rate typically reaches a maximum from 4 to 6 weeks of age during the life cycle of the broiler [7]; this time interval often coincides with the finishing period. At this age, approximately 43% of the broilers marketed in the United States broiler industry are 2.9 kg or higher. Considering that over 43% of the broilers processed in the United States are marketed between 1.5 and 3.0 kg of BW, defining the dLys needs of broilers in this period of growth is of great value.

Objective

The aim of this report is to evaluate the dLys requirements of two modern commercial broiler strains, the male Ross × Ross TP16 and male Cobb × Cobb 700, for the 28-to-42 day

feeding period. The TP16 is an Aviagen test product designed for maximal breast meat yield and is somewhat similar to the Ross 708 in this regard.

Materials and Methods

Diets: Nine graded concentrations of dLys ranging from 0.64 to 1.20% in 0.07% increments were fed to the broilers from 28 to 42 days of age. Two diets consisting primarily of corn, soybean meal, animal protein meal, and peanut meal were fed. The 2 diets were blended in varying proportions to create the 9 dose-response dietary Lys graduations. Regardless of dLys level, other critically important AA such as total sulfurs, threonine, valine, isoleucine, arginine, and tryptophan, were all formulated at a set minimum ideal ratio to dLys. A control diet that used only conventional ingredients was formulated to contain 0.99% dLys; this diet was used to validate the dose-response diet. Corn, soybean meal, animal protein meals, and peanut meal were analyzed for total amino acids and CP composition prior to diet formulation. Upon formulation, diets were manufactured and pelleted.

Bird Husbandry: Day-of-hatch, high-yielding, male Ross × Ross TP16 and Cobb × Cobb 700 chicks were obtained from two commercial hatcheries, and vaccinated at the hatchery for Marek's disease, Newcastle disease, and infectious bronchitis. Chicks were reared in a solid-side wall facility and fed common diets until 28 days of age, at which time chicks were equalized among floor pens (0.09 m²/bird). Each pen was equipped with a hanging feeder, a nipple drinker line, and used litter. Birds consumed feed and water on an *ad libitum* basis and experimental diets were provided in whole pellet form. Ambient temperature set points consisted of 33°C at placement until 4 days of age, 32°C from 5 to 9 days of age, 29°C from 10 to 14 days of age, 27°C from 15 to 23 days of age, 25°C from 24 to 28 days of age, 23°C from 29 to 33 days of age, 21°C from 34 to 38 days of age, and 19°C from

39 to 42 days of age. Average ambient temperature during the experimental period was 23.4°C (± 1.2 SD). Photoperiod was a continuous schedule with lighting intensities of 30 lux from 0 to 7 days of age, 10 lux from 8 to 12 days of age, and 3 lux from 23 to 28 days of age for the Ross × Ross TP16 male broilers. The Cobb × Cobb 700 male broilers received a photoperiod consisting of 23 hours of light per 1 of dark (23L:1D), with an intensity of 30 lux from 0 to 7 days of age, 18L:6D photoperiod with an intensity of 10 lux from 8 to 12 d of age, 15L:9D photoperiod with an intensity of 5 lux from 13 to 28 days of age, 18L:6D photoperiod with an intensity of 2.5 lux from 29 to 40 days of age, and 23L:1D photoperiod with an intensity of 2.5 lux from 41 to 43 days of age. Five randomly selected birds per pen were weighed, placed in coops, and transported to a pilot poultry processing plant. Feed was removed 12 hours before processing. Birds were electrically stunned, bled, scalded, mechanically picked, and mechanically eviscerated. Whole carcass (without abdominal fat) and abdominal fat were weighed. Carcasses were split into front and

back halves and placed on ice for 18 hours. The front halves then were deboned to obtain weights of total breast meat (*Pectoralis major* and *minor* muscles). Carcass, abdominal fat and total breast meat yields were determined from 43-day BW of the broilers selected for processing.

Blood Plasma Analysis: On Day 39, blood was collected from Ross × Ross TP16 male broilers that had been fed dose-response diets corresponding to 0.64, 0.99, and 1.20% dLys and plasma concentrations of IGF-I were determined. With the Cobb × Cobb 700 male broilers, blood was collected and analyzed for plasma concentrations of blood urea nitrogen and uric acid.

Statistics: Gradient treatment structure was conducted as a randomized complete block design. The 9 dose-response diets were represented with 9 and 12 replicate pens for the Ross × Ross TP16 and the Cobb × Cobb broiler studies, respectively. Analysis was conducted by using a quadratic-broken line model [8].

TABLE 1: Digestible Lysine requirement estimates of Ross × Ross TP16 and Cobb × Cobb 700 based on quadratic broken line model analyses.

Response Criteria	Estimated Requirement ¹	95% CI ²	SEM	Probability value
Ross × Ross TP16				
BW Gain	0.99	0.91 - 1.07	0.039	0.001
FCR	1.05	0.94 - 1.16	0.055	0.001
Carcass weight	0.94	0.81 - 1.07	0.065	0.001
Carcass yield	0.92	0.78 - 1.06	0.070	0.001
Breast weight	0.96	0.79 - 1.13	0.085	0.001
Cobb × Cobb 700				
BW Gain	0.97	0.90 - 1.03	0.031	0.001
FCR	1.01	0.97 - 1.06	0.021	0.001
Carcass weight	1.03	0.90 - 1.16	0.065	0.001
Carcass yield	0.96	0.81 - 1.12	0.070	0.001
Breast weight	0.99	0.91 - 1.07	0.040	0.001
Breast yield	0.98	0.89 - 1.08	0.048	0.001

¹The quadratic broken-line model is $y = L + U * (R - x) * (R - x)$ where L is the ordinate, R is the abscissa of the breakpoint, and the value (R - x) is zero at values of $x > R$.

²95% confidence interval of the dLys requirement.

FIGURE 1: Live performance evaluation of Ross × Ross TP16 and Cobb × Cobb 700 broilers fed various dietary levels of digestible Lysine.

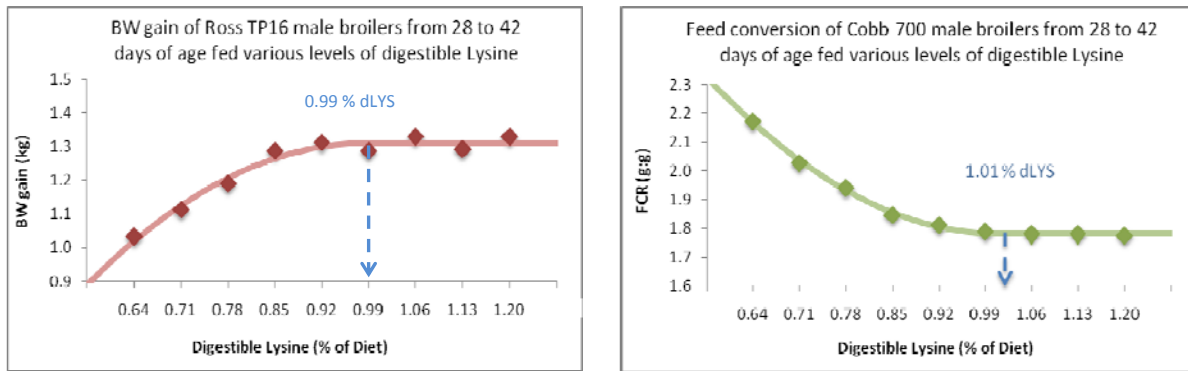


FIGURE 2: Carcass traits of Ross × Ross TP16 and Cobb × Cobb 700 broilers fed various dietary levels of digestible Lysine.

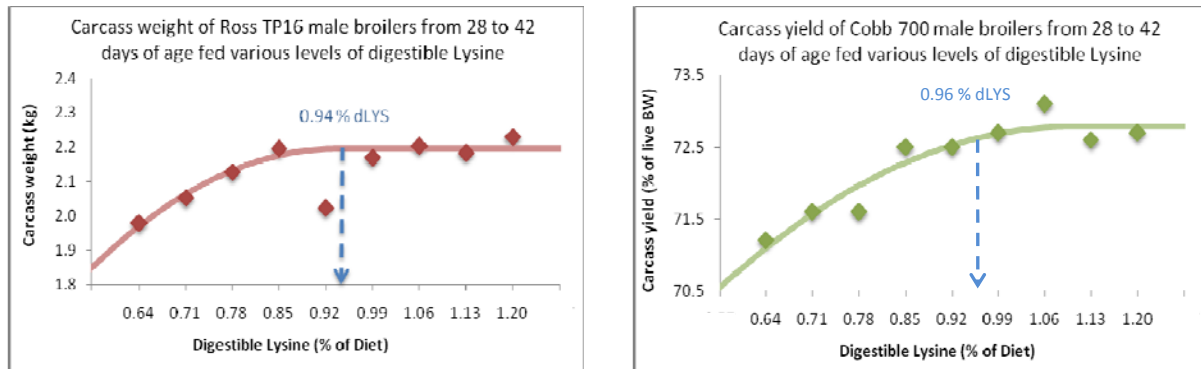
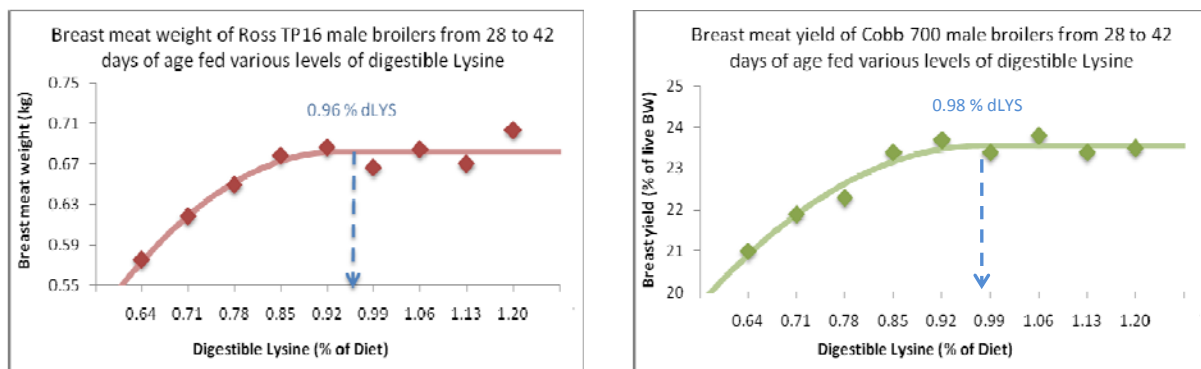


FIGURE 3: Breast meat traits of Ross × Ross TP16 and Cobb × Cobb 700 broilers fed various dietary levels of digestible Lysine.



Results

The Ross × Ross TP16 male broilers displayed significant ($P \leq 0.04$) quadratic responses for BW gain, feed intake, dLys intake, dLys intake/BW gain, feed conversion, carcass weight, and total breast meat weight (**FIGURES 1 – 3**). Plasma IGF-I concentrations were not different ($P \geq 0.05$) between treatments. Control fed broilers grew faster ($P \leq 0.002$) and consumed more feed ($P \leq 0.001$) than broilers fed the dose-response diet formulated to 0.99% dLys, but other variables measured were similar ($P \geq 0.05$). Requirement estimates can be observed in **TABLE 1**, and ranged between 0.92 and 1.05% dLys for the Ross × Ross TP16, depending on the variable evaluated.

When feeding Cobb × Cobb 700 broilers progressive concentrations of dLys, it resulted in quadratic responses ($P \leq 0.02$) for BW gain, feed intake, dLys intake, dLys intake/BW gain, feed conversion, carcass weight, carcass yield, total breast meat, and total breast meat yield. Plasma uric acid showed a linear response while plasma nitrogen concentration was similar among the dietary treatments. Broilers fed the dose-response diet had greater ($P \leq 0.03$) BW gain, and improved ($P \leq 0.001$) feed conversion versus the control-fed birds but meat yield criteria were not different. Requirement estimates for the Cobb × Cobb 700 broiler are displayed in **TABLE 1**, and ranged between 0.96 and 1.03% dLys, depending on the variable evaluated.

Conclusion

The good performance observed with the dose-response diets in both strains provides evidence that dLys requirements were not under estimated. The dLys requirement was more pronounced for feed conversion than growth rate or breast meat accretion. dLys requirement was estimated at 0.99% when averaged across experiments for feed conversion, growth rate, and total breast meat weight.

BW gain approximated 92 and 103 grams/day for the Ross × Ross TP16 and the Cobb × Cobb 700 birds, respectively, and this resulted in 10 to 12% higher dLys requirements when expressed as a percentage of the diet than birds used in previous research [1]. The requirement for feed conversion was approximately 6% higher than for BW gain and total breast meat weight when averaged across both strains.

Digestible Lysine intake required for optimizing the growth performance and meat yield of male broilers was higher with the Cobb × Cobb 700 than the Ross × Ross TP16. Because of this, it is likely that differences in feed intake attributed to the growth curve patterns.

The data in this report supports a higher dLys requirement (0.99%) of male broilers from 28 to 42 d of age than previous research [9-11]. This higher dLys requirement is supported by improved BW gain, improved feed conversion, enhanced carcass parameters and an overall greater breast meat accretion rate.

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