ISSN 1682-8356
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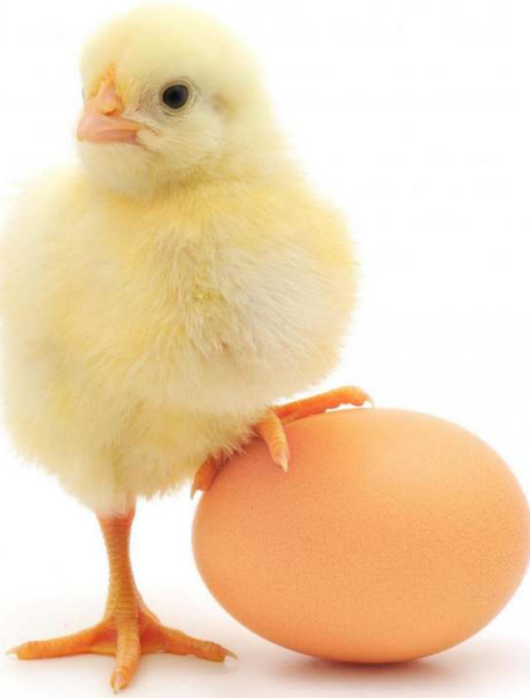

INTERNATIONAL JOURNAL OF POULTRY SCIENCE

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International Journal of Poultry Science 10 (7): 523-526, 2011
ISSN 1682-8356

Increasing Amino Acids Density Improves Broiler Live Weight

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Abstract: This research evaluates amino acid density in two phases throughout life in Arian male broilers to better understand the impact of increase and decrease dietary amino acids density in live weight performance. Four diets with different levels of amino acids density, High (H), Medium (M), Standard (S) and Low (L) were used in a completely randomized experimental design. All diets were isocaloric and isonitrogenous. Broilers fed H diet, body weight in 42 d was increased by 202 g compared with standard group ($p<0.05$). Levels of amino acids density had a significant effect on body weight in weeks 1, 2, 4, 5 and 6. Feeding broilers with H diet was significant highest in body weight in weeks 4, 5 and 6. H treatment was significant highest daily body weight gain from 22 to 42 (grower phase) and 1 to 42 day of age compared with S treatment ($p<0.05$). The results of this study suggest that high amino acids density throughout life optimized live weight and growth, whereas reductions in amino acids density reduced growth and live weight.

Key words: Amino acids, body weight, growth, performance

INTRODUCTION

Amino Acids (AA) requirements of broilers have been extensively studied, as well as related factors of influence, such as sex, age, genetic strain, heat stress, energy concentration and interactions with crude protein level (Acar *et al.*, 1991; Vazquez and Pesti, 1997; Garcia *et al.*, 2006; Sterling *et al.*, 2006). Methionine and Lysine are the first and second limiting amino acid, respectively, in poultry diets. Lysine (Lys) is one of the most limiting amino acids in practical corn-soybean meal and sorghum-soybean meal diets for broilers. In the past, poultry diets were formulated to meet crude protein requirements. However, the growth of the synthetic AA industry permitted the reduction of Crude Protein (CP) levels in diets and nutritionists were then able to formulate diets considering the specific requirements of essential AA. In commercial practice, formulating diets to adequate AA minimums is critical to optimize live production and meat yield of broiler chickens. Within the last 10 yr, demand for breast fillets and value-added products has contributed to increasing market weights of broiler chickens. Market weight, product mix, live cost and genetic strain are factors that may govern AA supplementation. Amino acids are critical for muscle development (Tesseraud *et al.*, 1996). Therefore, defining dietary AA needs for optimum growth and meat yield is of utmost importance. Lysine needed for optimizing breast meat yield may be higher than the amount needed for optimal body weight gain and feed efficiency (Acar *et al.*, 1991; Gorman and Balnave, 1995). It is well known that protein and Lys and its interaction is considered as an important factor which affects performance and carcass quality of growing chicks and so, dietary requirement of protein is actually a requirement for the Lys contained in the protein. The objective of the nutritionists has long been to optimize growth and tissue accretion by increasing nutrient density such as AA. The question remains about the potential benefits of AA beyond the protein synthesis for muscle developments. Essential amino acid recommendations for broilers by the NRC (1994) are largely based on experimentation conducted several decades ago. Therefore the objective of this study was to evaluate the four different amino acids density levels, with same crude protein and energy requirements recommended by NRC (1994) effects on the body weight and growth of Arian broilers.

MATERIALS AND METHODS

An experiment with Arian male broilers was conducted from 1 to 6 weeks of age. At day 1, 200 male chicks were placed in 24 floor pens (10 chicks per pen and 0.1 m^2 floor space/chick). Water and feed were also supplied *ad libitum*. The lighting regimen was continuous, with 24 h of light daily, throughout the experimental periods. The basic chemical composition of the feed materials was determined according to AOAC (1990). The total amino acid values of the ingredients were assayed by high-pressure liquid chromatography analysis.
A completely randomized experimental design was used. The following treatments were applied: The four treatments (six replicates) were applied: 1-Diet with High amino acids (H) requirement level, 2-Diet with Medium amino acids (M) requirement level, 3-Diet with Standard

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Table 1: Composition of experimental diets in starter (0-21) and grower (22-42 d) period

	Starter				Grower			
Ingredient	High	Medium	Standard	Low	High	Medium	Standard	Low
Corn, grain	55.36	55.00	56.32	60.10	65.00	66.00	64.98	67.00
Soybean meal 48%	37.00	35.56	36.00	32.00	28.50	28.72	29.30	27.00
Soybean oil	2.80	3.03	3.00	1.75	3.27	3.00	3.24	3.22
Fish meal	1.70	3.00	1.50	3.00	-	-	-	-
Oyster shells	1.00	1.80	1.88	1.83	1.50	1.60	1.70	1.80
Dical. Phos.	1.00	0.45	0.45	0.50	0.63	0.10	0.20	0.20
Common salt	0.10	0.20	0.20	0.20	0.20	0.20	0.20	0.25
Vitamin premix *	0.25	0.25	0.25	0.25	0.25	0.10	0.15	0.25
Mineral premix *	0.25	0.25	0.25	0.25	0.25	0.10	0.15	0.25
DL-methionine	0.24	0.18	0.10	0.07	0.20	0.10	0.06	0.03
L-lysine HCl	0.30	0.28	0.05	0.05	0.20	0.08	0.02	0.00
Compositin								
ME (Mcal/kg)	3.04	3.04	3.04	3.04	3.17	3.17	3.17	3.17
Protein (%)	22.50	22.50	22.50	22.50	18.97	18.97	18.97	18.97
Ether extract (%)	5.12	5.17	5.16	4.93	5.62	5.61	5.60	5.61
Linoleic acid (%)	2.58	2.74	2.63	2.54	3.21	3.10	3.20	3.22
Crude fiber (%)	4.62	4.45	4.43	4.52	4.34	4.39	4.39	4.30
Calcium (%)	0.89	0.96	0.95	0.97	0.86	0.83	0.83	0.84
Avail. Phosphorus (%)	0.49	0.44	0.44	0.44	0.44	0.43	0.40	0.43
Potassium (%)	0.93	0.92	0.91	0.86	0.77	0.78	0.79	0.75
Sodium (%)	0.12	0.12	0.11	0.12	0.13	0.11	0.11	0.13
Amino acids analyzed								
ARG (%)	1.462	1.430	1.350	1.272	1.377	1.285	1.257	1.194
ILE (%)	1.010	0.966	0.953	0.905	0.832	0.800	0.781	0.767
LYS (%)	1.330	1.220	1.100	1.010	1.250	1.135	1.030	0.930
MET (%)	0.612	0.561	0.508	0.458	0.461	0.421	0.382	0.344
CYS (%)	0.387	0.377	0.371	0.360	0.354	0.339	0.328	0.315
THR (%)	1.010	0.980	0.920	0.862	0.768	0.758	0.740	0.699
TRP (%)	0.262	0.258	0.250	0.237	0.259	0.252	0.246	0.240
VAL (%)	1.190	1.126	1.083	0.996	0.915	0.911	0.898	0.867

Provides per kg of diet: vitamin A (7,000 IU), vitamin D3 (1,400 IU), vitamin E (16.65 mg), vitamin K (1.5 mg), vitamin B1 (0.6 mg), vitamin B2 (2.36 mg), vitamin B6 (0.6 mg), vitamin B12 (0.013 mg), biotin (0.15 mg), choline (1.54 g), pantothenic acid (9.32 mg), niacin (30.12 mg), folic acid (1.42 mg), selenium (0.65 mg), iodine (0.35 mg), iron (57.72 mg), copper (12.30 mg), zinc (141.48 mg), manganese (173 mg)

amino acids (S) requirement level, 4-Diet with Low amino acids (L) requirement level. Diets were formulated isoenergetic and isonitrogenous and starter diet formulated according to NRC (1994) recommendations to contain 22.5% CP and 3.040 kcal of ME/kg and 18.97% CP and 3.170 kcal ME/kg in grower diets. The average analyzed differences between HAA, MAA and LAA vs. SAA for the amino acids density in the starter and grower periods were 10, 5 and -5%, respectively. This differences for lysine and methionine were 20, 10 and -10%, respectively (Table 1). Parameters were tested for normal distributions before analyses. Data were analyzed by factorial (GLM procedure, An ANOVA of SAS Institute, 2001) and where significance occurred, means were compared with the Duncan multiple range tests. Output data were expressed as means with SEM.

RESULTS

The results of body weight in weeks and growth weight in three periods of trail 0-21, 22-42 and 0-42 day of age are given in Table 2 and 3. Increasing level of amino acids density significantly increased body weight gain from 22 to 42 and 0 to 42 day of age ($p<0.05$). Increasing AA density improves body weight at 42 day of age. This result is similar to Kidd *et al.* (2004) and Corzo *et al.* (2005). There was a significantly highest in body weight in broiler fed H diet in weeks 4, 5 and 6 (Table 2). Maximum weight gain occurred at H dietary amino acids from 0 to 42 day of age (2293 g).

Body weight gain in starter period unaffected by amino acids density levels. Body weight gain in grower periods was significantly higher in H diet than compared to S diet by 194 g (Table 3).

DISCUSSION

The higher Lys requirement probably relates to increased growth rate and feed intake. Maximum weight gain occurred at H dietary amino acids from 0 to 42 day of age (2293 g). These results indicated that the lysine and methionine requirements of Arian male broilers for maximum body weight gain (grower period) were higher than those of values reported in NRC 1994 recommendation. The results of previous experiments

Table 2: Effects of amino acid density on body weight

Amino Acids levels	Body weight week 1 (g)	Body weight week 2 (g)	Body weight week 3 (g)	Body weight week 4 (g)	Body weight week 5 (g)	Body weight week 6 (g)
Low	98[b]	310[b]	531	910[b]	1447[c]	1925[c]
Standard	111[a]	350[a]	600	1026[ab]	1607[b]	2091[b]
Medium	112[a]	354[a]	618	1045[ab]	1606[b]	2125[b]
High	104[ab]	352[a]	608	1122[a]	1786[a]	2293[a]
p-value	0.016	0.034	0.238	0.041	0.025	0.04
SEM	2.67	7.26	16.54	22.96	27.37	36.25

[a-c]Means followed by different superscript are significantly different ($p<0.05$)

Table 3: Effects of amino acid density on body weight gain

Amino acids levels	Weight gain 0-21 d (g/day)	Weight gain 22-42 d (g/day)	Weight gain 0-42 d (g/day)	Growth weight 0-21 d (g)	Growth weight 22-42 d (g)	Growth weight 0-42 d (g)
Low	23.2	66.4[c]	44.8[c]	486	1393[c]	1880[c]
Standard	26.4	71.1[b]	48.7[b]	555	1491[b]	2046[b]
Medium	27.3	71.8[b]	49.5[b]	573	1507[b]	2080[b]
High	26.8	80.2[a]	53.5[a]	563	1685[a]	2248[a]
P-value	0.237	0.046	0.041	0.238	0.045	0.04
SEM	1.26	2.06	1.05	16.21	26.15	36.25

[a-c]Means followed by different superscript are significantly different ($p<0.05$)

by Zaghari *et al.* (2002; 2007) indicated that the digestible lysine requirements of Arian male broilers to achieve maximum body weight gain in the starter period were 1.075% but in this study showed that the lysine requirements of Arian male broilers to achieve maximum body weight gain in the starter and grower period were 1.33% and 1.25%, respectively.

This study diets formulated in the same amino acids (Isonitrogenous) and energy requirements (Isoenergetic) but were different in AA requirement levels. Postnatal protein accretion results from an increase in protein synthesis or a decrease in protein degradation. Diets containing low amino acids can limit meat formation early in development by reducing protein accretion from protein synthesis and RNA content (Tesseraud *et al.*, 1996). The results confirmed the previous studies which demonstrated that Lys requirement for growing chicks is higher than that of which NRC (1994) recommendation which is supplemented on the diet for maximal growth. It is also confirmed that increasing dietary Lys and Met level increases growth weight.

This study showed the higher efficiency of these diets as they allow a better transformation of AA intake into tissue synthesis and accretion. This is possibly related to a higher AA availability to synthesize muscle. Diets formulated with H level (specially: Lys and Met) promoted a better conversion of AA into body gain. This suggests that the excess of AA intake caused by the diet with H amino acids especially Lys and Met, it was also verified that the H diet promoted better conversion of AA into growth weight (Table 3). genetic differences have been observed for breast meat yield and other parts yields (Acar *et al.*, 1991; Holsheimer and Veerkamp, 1992; Smith and Pesti, 1998). Leclercq (1998) stated that the required level of lysine is highest for maximizing breast meat yield and body weight gain. Feeding H amino acids density diet to broilers increases body weight gain (Dozier *et al.*, 2007; Eits *et al.*, 2003). Dietary AA responses influencing breast meat yield may be additive among Lys and Met (De Leon, 2006; Kerr *et al.*, 1999) but other research found no interactions between Lys and Met (Si *et al.*, 2004). However in this study H density treatment was significantly highest in body weight and growth weight from 22 to 42 d ($p<0.05$).

Amino acids have largely demonstrated effects beyond their roles of building blocks of the protein accretion: from a better gut functioning to an enhanced immune system. More research is necessary to determine the optimal requirements of AA to improve not only muscle development but also meat quality. It has been identified that the optimal levels of AA were not the same for the maximization of weight gain or breast muscle development (Pesti *et al.*, 1994) but in this study H amino acids level was significantly highest in body weight at 42 day of age. Results of this study confirm to Kidd *et al.* (2004) find that high amino acids density throughout life optimized body weight gain and breast meat yield, whereas reductions in amino acids density reduced growth and breast meat yield.

Conclusion:

- Feeding broilers high amino acids density diet significantly increased body weight gain from 22 to 42 day of age.
- Feeding broilers high amino acids density diet increased body weight at 42 d by 10.52% more than broilers fed standard lysine density diets.
- Feeding broilers concentrations of dietary Lys and Met above NRC recommendations (20%) in starter and grower diets improves body weight gain from 22 to 42 d and 0 to 42 d.
- Feeding broilers high amino acids density diet significantly increased body weigh in weeks 4, 5 and 6.

ACKNOWLEDGMENT

The authors would like to thank Islamic Azad University, Saveh Branch for support of this study.

REFERENCES

Acar, N., E.T. Moran Jr. and S.F. Bilgili, 1991. Live performance and carcass yield of male broilers from two commercial strain crosses receiving rations containing lysine below and above the established requirement between six and eight weeks of age. Poult. Sci., 70: 2315-2321.

AOAC (Association of Official Analytical Chemist), 1990. Official Methods of Analysis, Association of Official Analytical Chemists. 15th Edn., AOAC Press, Gaithersburg, USA.

Corzo, A., M.T. Kidd, W.A. Dozier, T.J. Walsh and S.D. Peak, 2005. Impact of dietary amino acid density on broilers grown for the small bird market. Japan Poult. Sci., 42: 329-336.

De Leon, A.C., 2006. Limiting dietary amino acids and metabolizable energy response surface estimates for growing broilers. MS Thesis. Mississippi State Univ., Mississippi State.

Dozier, W.A., A. Corzo, M.T. Kidd and S.L. Branton, 2007. Dietary apparent metabolizable energy and amino acid density effects on growth and carcass traits of heavy broilers. J. Applied Poult. Res., 16: 192-205.

Eits, R.M., R.P. Kwakkel, M.W.A. Verstegen and G.C. Emmans, 2003. Responses of broiler chickens to dietary protein: Effects of early life protein nutrition on later responses. Br. Poult. Sci., 44: 398-409.

Garcia, A.R., A.B. Batal and D.H. Baker, 2006. Variations in the digestible lysine requirement of broiler chickens due to sex, performance parameters, rearing environment and processing yield characteristics. Poult. Sci., 85: 498-504.

Gorman, I. and D. Balnave, 1995. The effect of dietary lysine and Methionine on the growth characteristics and breast meat yield of Australian broiler chickens. Aust. J. Agric. Res., 46: 1569-1577.

Holsheimer, J.P. and C.H. Veerkamp, 1992. Effect of dietary energy, protein and lysine content on performance and yields of two strains of male broiler chicks. Poult. Sci., 71: 872-879.

Kerr, B.J., M.T. Kidd, K.M. Halpin, G.W. McWard and C.L. Quarles, 1999. Lysine level increases live performance and breast yield in male broilers and breast yield in male broilers. J. Applied Poult. Res., 8: 381-390.

Kidd, M.T., C.D. McDaniel, S.L. Branton, E.R. Miller, B.B. Boren and B.I. Fancher, 2004. Increasing amino acid density improves live performance and carcass yields of commercial broilers. J. Applied Poult. Res., 13: 593-604.

Leclercq, B., 1998. Specific effects of lysine on broiler production: Comparison with threonine and valine. Poult. Sci., 77: 118-123.

NRC, 1994. Nutrient Requirements of Poultry. 9th Rev. Edn., National Academy Press, Washington, DC.

Pesti, G.M., B.A. Leclercq, M. Chagneau and T. Cochard, 1994. Comparative responses of genetically lean and fat chickens to lysine, arginine and non-essential amino acid supply. II. Plasma amino acid responses. Br. Poult. Sci., 35: 697-707.

SAS Institute Inc., 2001. SAS/STAT User's Guide. Version 6, 4 Edn. Vol. 2 SAS Inst., Cary, NC.

Si, J., J.H. Kersey, C.A. Fritts and P.W. Waldroup, 2004. An evaluation of the interaction of lysine and methionine in diets for growing broilers. Int. J. Poult. Sci., 3: 51-60.

Smith, E.R. and G.M. Pesti, 1998. Influence of broiler strain cross and dietary protein on performance of broilers. Poult. Sci., 77: 276-281.

Sterling, K.G., G.M. Pesti and R.I. Bakalli, 2006. Performance of different broiler genotypes fed diets with varying levels of dietary crude protein and lysine. Poult. Sci., 85: 1045-1054.

Tesseraud, S., R. Peresson and A.M. Chagneau, 1996. Dietary lysine deficiency greatly affects muscle and liver protein turnover in growing chickens. Br. J. Nutr., 75: 853-865.

Vazquez, M. and G.M. Pesti, 1997. Estimation of lysine requirement of broiler chicks for maximum body gain and feed efficiency. J. Applied Poult. Res., 6: 241-246.

Zaghari, M., M. Shivazad, A. Kamyab and A. Nikkhah, 2002. Digestible lysine requirement of arian male and female broiler chicks during the 6-21 days of age. J. Agric. Sci. Technol., 4: 111-117.

Zaghari, M., M. Shivazad, A. Kamyab and A. Nikkhah, 2007. Reevaluation of the digestible lysine requirement of arian male broiler chicks by different diets with cottonseed meal. J. Agric. Sci. Technol., 9: 211-218.