PERFORMANCE CHARACTERISTICS OF BROILERS FED DIETS SUPPLEMENTED WITH TWO LEVELS OF LYSINE AND METHIONINE

[*1]Ekanem, N.J., [1]Frank, I.E., [2]Udedibie, A.B.I. and [1]Ifut, O.J.

[1]Department of Animal Science, University of Uyo, Uyo, Akwa Ibom State, Nigeria.
[2]Department of Animal Production, Federal University of Technology, Owerri, Nigeria..

**Corresponding authors' E-mail:* ekanem_n@yahoo.co.uk

ABSTRACT

A feeding trial was conducted to determine the comparative effects of 0.25 and 0.50% dietary lysine and methionine supplementation on feed intake, growth rate, weight gain, internal organs weight and cost of production of broilers in Uyo, Southern Nigeria. Sixty day-old unsexed Anak broiler chicks were divided into two groups of 30 broiler chicks. Each group was randomly assigned to one of two dietary treatments with 3 replicates of 10 birds each. Diet 1 was supplemented with synthetic lysine and methionine at 0.25% level each. Diet 2 had 0.50% level of synthetic lysine and methionine supplementation. The birds were fed conventional broiler starter mash for 2 weeks, followed by the experimental starter diet for 3 weeks and the finisher diet for 4 weeks. Data were collected on body weights, feed intake, and body weight gain. At the end of the feeding trial, 3 birds were randomly selected from each replicate (9 birds per treatment), slaughtered and their internal organs weighed. At the starter phase, there were no significant differences ($p > 0.05$) between the two groups for all the parameters determined. At the finisher phase, diet 2 appeared to have been more efficiently utilized with a feed conversion ratio of 3.13 as against 3.41 for diet 1. The cost of production of broilers on diet 2 was ₦293.81 per kg broiler and ₦305.88/kg broiler for those on diet 1. This tended to show that supplementation with 0.50% lysine and methionine level reduces the cost of production and is therefore recommended as more appropriate level for optimal performance of finisher broilers. .

Keywords: Lysine, Methionine, Broiler, Supplementation, Performance.

J. Agric. Prod. & Tech.2013; 2(2):44-50

INTRODUCTION

Lysine and methionine are the two most crucial or limiting amino acids in broiler diets based on corn and soybean meals. Deficiencies of these two amino acids lead to a significant loss in productive efficiency. May and Vardaman (1972) also stated that the essential amino acids that were likely to be deficient in poultry diets were lysine, methionine and cysteine. The supplementation of broiler feed with these amino acids in their crystalline forms is very common in the poultry industry. This makes possible the reduction of protein level of the diet, reducing nitrogen excretion and feed cost per unit body weight gain in broilers. It is more economically efficient to use L-lysine and DL-methionine as pure supplement in producing mixed feed for broilers production rather than as components of intact protein. Anderson and Dopson (1959) observed that addition of L-lysine to diets limited in this amino acid not only improved growth, but also appeared to

participate in meeting the chicks' requirement for arginine. Some studies have suggested that increased levels of lysine may result in enhanced performance, especially in regard to breast meat yield (Labadan *et al*., 2001; Barboza *et al*., 2000a, 2000b; Kerr *et al*., 1999; Kidd *et al*., 1998; Moran and Bilgili, 1990). Other studies have reported that methionine levels should be above the NRC (1994) recommendations for improved performance (Adeyemo, 2012; Café and Waldroup, 2006; Ojano-Dirain and Waldroup, 2002; Nadeem *et al*., 1999; Wallis, 1999; Gorman and Balnave, 1995; Schutte and Pack, 1995).

The relationship and interaction between methionine and lysine has not been extensively investigated. Lee *et al*. (1991), Chen et al. (1997) and Si *et al.* (2001, 2004) studied the relationship between methionine and lysine and showed no interactions between these amino acids. Si *et al*. (2004) concluded that there were no significant interactions between methionine and lysine levels in broiler diets for any parameter studied when both were fed equal to or in excess of NRC recommendations. Café and Waldroup (2006) indicated that when fed at time intervals more consistent with current industry practice that methionine and lysine levels are more critical than when fed at intervals on which NRC recommendations are based. Bouyeh (2012) showed that increasing methionine and lysine to diets of today's broiler in excess of NRC recommendations can improve immune system functions, FCR, abdominal fat deposition, breast meat yield and carcass efficiency.

Many poultry nutritionists use the levels recommended by the National Research council (NRC, 1994) as a guideline in establishing their own amino acid requirements regardless of location and environmental conditions. A limitation of using the NRC recommendations in warm weather feeding is that these levels are derived primarily from studies conducted in thermo-neutral environments and do not indicate possible differences in amino acid needs due to environmental temperatures. Since very little information is available on the amino acid needs of broilers raised in warm environments, nutritionists confronted with warm weather feeding generally add margins of safety to the NRC (1994) levels (Ojano-Dirain and Waldroup, 2002). The NRC has also suggested increasing the amino acid levels in warm environments to compensate for the expected reduction in feed intake. The NRC (1994) however noted that this adjustment should be exercised with caution. Previous studies on protein/amino acid nutrition of heat stressed broilers have shown conflicting results. Waldroup *et al*. (1976) showed that minimizing dietary amino acid excesses improved growth of broilers housed in hot temperatures. Chen *et al*. (1997) showed no advantage of increasing dietary amino acid levels of 3 to 7 week-old broilers when raised above 26.7 ^{o}C, thus they recommended feeding 90 – 100 % of NRC suggested amino acid levels. On the other hand, Ahmed and Abbas (2011**)** observed that dietary levels of methionine, expressed as percentage of NRC recommendations affected feed intake, feed conversion ratio and Protein Efficiency Ratio (PER) of broilers in Sudan.

Close examination of the formulae of poultry feeds in Nigeria shows that lysine and methionine are routinely added to them at 0.25% level. Previous studies in the University of Uyo Teaching and Research Farm, Uyo, Akwa Ibom State, have also shown that 0.25% lysine and methionine supplementation of broiler diets is necessary for improved performance of broilers at both starter and finisher levels (Orji-Uzor, 2007; Ukpong, 2007). This study was designed to compare the performance of broilers on diets supplemented with 0.25 % and 0.50 % lysine and methionine respectively, and to

evaluate the cost effectiveness of their production.

MATERIALS AND METHODS

The study was conducted at the Poultry unit of the Teaching and Research Farms, University of Uyo, Uyo, Akwa Ibom State, Nigeria. Uyo is situated on latitude 5° 02' 32' N and longitude 7° 54' 06' E and lies at an altitude of 120 meters above sea level, with average rainfall of 1500 mm. Two broiler experimental diets were formulated for both the starter and finisher levels such that Diet 1 contained 0.25 % lysine and methionine while diet 2 was supplemented with 0.50 % lysine and methionine. The ingredient composition of the diets is as shown in table 1. The diets were balanced to meet the protein and energy requirements of each broiler production phase. Sixty day-old broiler chicks of Anak breed were bought and fed commercial starter mash for 2 weeks. Thereafter, they were divided into 2 groups of 30 birds each. Each group was randomly allocated to one of the experimental starter diets. Each group was further sub-divided into three replicates of 10 birds each, with each replicates housed in a pen and fed the starter diet for 3 weeks. At the end of the starter phase, the birds were weighed and then reshuffled to obtain the initial body weight for the finisher phase. They were then fed the finisher diets for the next 4 weeks. .

Table 1: Ingredient Composition of the Experimental Diets

Growth phase	**Broiler Starter**		**Broiler Finisher**	
Diets (%)	**1**	**2**	**1**	**2**
Ingredients:				
Maize	50.00	50.00	60.00	60.00
Soyabean	30.00	30.00	18.00	18.00
Fish meal	2.50	2.50	2.00	2.00
Blood meal	3.50	3.50	3.00	3.00
Palm kernel cake	5.00	5.00	4.00	4.00
Wheat offal	5.50	5.00	9.00	8.50
Bone meal	2.50	2.50	3.00	3.00
Table Salt	0.25	0.50	0.25	0.25
*Premix (Vit./minerals)	0.25	0.50	0.25	0.50
L-Lysine	0.25	0.50	0.25	0.50
DL-Methionine	0.25	0.50	0.25	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition (% of 100gDM):				
Crude protein	23.74	23.66	18.99	18.92
Lysine	1.36	1.36	1.13	1.13
Methionine	0.73	0.73	0.55	0.55
Crude fibre	4.48	4.43	3.94	3.90
Ether Extract	3.72	3.72	4.43	4.38
Calcium	1.14	1.14	1.27	1.27
Phosphorus	0.92	0.91	0.98	0.98
ME (kcal/g)	2.82	2.81	3.03	3.02

*Premix supplied/kg diet: Vit. A, 10,000 iu; Vit. D3, 1500 iu; Vit. K, 2 mg; Riboflavin, 3 mg; Pantothenic acid, 6 mg; Niacin, 15 mg; Vit. B12, 0.08 mg; Folic acid, 4 mg; Manganese, 8 mg; Zinc, 0.5mg; Iodine, 1.0mg; Cobalt 1.2 mg; Copper, 10 mg; Iron, 20 mg.
DM = Dry matter, ME = Metabolizable energy.

At the end of the feeding trial, 2 birds per replicate were randomly selected from each treatment and slaughtered. Data were collected on feed intake, weight gain, growth rate, feed conversion ratio, carcass weights, and weight of the internal organs and cost of production. Relative weights of internal organs were expressed as percentage of live weight. The economics of production was calculated thus:

.

$$\text{Cost/kg feed} = \frac{\text{Summation of price/ kg of feed ingredients x their proportions in the feed formula}}{100}$$

$$\text{Average Cost/kg feed} = \frac{\text{Cost/kg feed (Starter phase)} + \text{Cost/kg feed (Finisher phase)}}{2}$$

Cost of Production (Feed cost per weight gain) = Cost/kg feed x feed: gain ratio.

Data obtained were analyzed using analysis of variance (ANOVA) as outlined by Snedecor and Cochran (1978) and the means were separated using Studentized t-test.

RESULTS AND DISCUSSION

Data on the performance characteristics of broilers at the starter and finisher phases is as shown in table 2. There were no significant differences ($p > 0.05$) in feed intake, body weight gain and growth rate between the two groups. However, at the starter phase, the birds on diet 1 (0.25% lysine and methionine) recorded numerically higher values (94.44, 976.07 and 45.51 g) than those on diet 2 (0.50%) that had 89.78, 922.08 and 44.12 g for feed intake, body weight gain and growth rate respectively.

At the finisher phase, those on 0.50% supplementation recorded numerically higher values (166.33, 1500.01 and 53.57 g) than those on 0.25% that recorded 158.75, 1313.33 and 46.90 g for feed intake, body weight gain and growth rate respectively. The increased weight gain of birds on the 0.50% supplementation is in agreement with Moran and Bilgili (1990), Schutte and Pack (1995), Café and Waldroup (2006) and Adeyemo (2012). The increased feed intake recorded also agreed with Ahmed and Abbas (2011).

There was no significant difference ($p>0.05$) in the feed conversion ratios of the groups. At the starter phase, diet 2 (0.50% lysine and methionine) was poorly utilized with a numerically high feed to gain ratio of 2.14 compared to diet 1 (0.25% lysine and methionine) that recorded a feed conversion ratio of 2.05. However, at the finisher phase, diet 2 with a feed to gain ratio of 3.13 appeared to have been more efficiently utilized than diet 1 (3.41).

The cost of production of the experimental birds as shown in table 3 indicated that it was more economical to use 0.25 % supplementation of the 2 essential amino acids at starter phase and 0.50% for the finisher level. The results tended to confirm NRC (1994) recommendation of about 0.50 % for mature birds.

There were no significant differences ($p>0.05$) in the weights of the internal organs (Table 4). The results tended to confirm the earlier observations of Orji-Uzor (2007) and Ukpong (2007) on the need for lysine and methionine supplementation in broiler diets. The result also agreed with Ojano-Dirain and Waldroup (2002) who suggested that under moderate heat stress, the recommended level of lysine and methionine by NRC (1994) may be inadequate for maximum performance characteristics of broilers. .

Table 2: Performance of broiler birds fed diets supplemented with 0.25 and 0.50% lysine and methionine

Growth phase	Starter			Finisher		
Lysine & Methionine levels (%)	**0.25**	**0.50**	**SEM**	**0.25**	**0.50**	**SEM**
Initial body weight (g/bird)	270.60	276.67	6.24	1223.33	1233.34	31.00
Final body weight (g/bird)	1246.67	1243.65	36.21	2536.67	2733.35	83.62
Body weight gain (g.bird/8wks)	976.07	922.08	32.62	1313.33	1500.01	89.01
Growth rate (g/bird/day)	45.51	44.12	1.73	46.90	53.57	3.18
Feed Intake (g/bird/d)	94.44	89.78	4.75	158.75	166.33	2.69
Feed conversion ratio(feed: gain)	2.05	2.14	0.17	3.41	3.13	0.39
Average cost/kg feed (₦)	89.70	93.8	-	89.70	93.89	-
Cost of Production (₦)	183.89	200.73	-	305.88	293.86	-
Mortality (%)	0.00	0.00	-	1.67	0.00	-

Means along the same row are not significant ($p > 0.05$).

Table 3: Economics of production of broilers fed diet supplemented with 0.25 and 0.50% lysine and methionine

Treatments	**1**	**2**
Lysine & methionine levels (%)	**0.25**	**0.50**
Average cost/kg feed (₦)	89.70	93.89
Feed Conversion Ratio	3.41	3.13
Cost of Production (₦)	305.88	293.81

Table 4: Internal organs (% live weight) of finisher broilers fed diets supplemented with two levels of lysine and methionine

Lysine & Methionine levels (%)	**0.25**	**0.50**	**SEM**
Liver	1.81	1.77	0.06
Heart	0.32	0.37	0.01
Gizzard	1.88	1.67	0.10
Abdominal Fat	0.98	0.99	0.16

SEM = Standard error of mean.

CONCLUSION

- Supplementation of lysine and methionine at 0.25% level is adequate for broilers at the starter phase but a higher value of 0.50% supplementation of the synthetic amino acids elicited optimal performance at the finisher phase. .

REFERENCES

Adeyemo, G.O. 2012. Performance of broiler starters fed varying levels of dietary methionine. *International Journal of AgriScience*. 2(2): 143–148.

Ahmed, M.E. and Abbas, T.E. 2011. Effects of dietary levels of methionine on broiler performance and carcass characteristics. *International Journal of Poultry Science*. 10 (2): 147-151.

Akpodiete, O.J. and Inoni, O.E. 2000. Economics of broiler chickens fed maggot meal as a replacement for fish

meal. *Nigeria Journal of Animal Production*. 23(1): 57-63.

Anderson, J.O. and Dobson, D.C. 1959. Amino acid requirement of the chick. *Poultry Sci*. 38: 1140 – 1150.

Barboza, W.A., Rostagno, H.S., Albino, L.F.T. and Rodrigues, P.B. 2000a. Lysine levels for broiler chickens from 1 to 21 and 15 to 40 days of age. *Rev. Bras. Zootec*. 29: 1082-1090.

Barboza, W.A., Rostagno, H.S., Albino, L.F.T. and Rodrigues, P.B. 2000b. Lysine levels for broiler chickens from 22 to 40 and 42 to 48 days of age. *Rev. Bras. Zootec.* 29: 1091-1097.

Bouyeh, M. 2012. Effect of excess lysine and methionine on immune system and performance of broilers. *Annals of Biological Research*. 3 (7): 3218-3224.

Café, M.B and Waldroup, P.W. 2006. Interactions between levels of methionine and lysine in broiler diets changed at typical industrial intervals. *International Journal of Poultry Science.* 5(11): 1008 - 1015.

Chen, J., Hou, S., Lu, L., Zhao, L., Yu, J., Fang, L. and Huang, J. 1997. Study on the dietary requirements of total sulphur containing amino acid and lysine of Shi-Qi Yellow broiler during the early growth period. *Acta Vet. Zootech. Sinica*. 28: 394-400.

Gorman, I. and Balnave, D. 1995. The effect of dietary lysine and methionine concentrations on the growth characteristics and breast meat yields of Australian broiler chickens. *Aust. J. Agri. Res.* 46: 1569-1577.

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

Kidd, M.T., Kerr, B.J., Halpin, K.M., McWard, G.W. and Quarles, C. L. 1998. Lysine levels in starter and grower finisher diets affect broiler performance and carcass traits. *J. Appl. Poult. Res*. 7: 351-358.

Labadan, M.C., Jr., Hsu, K.N. and Austic, R.E. 2001. Lysine and arginine requirements of broiler chickens at two- to three-week intervals to eight weeks of age. *Poult. Sci*. 80: 599 - 606.

Lee, S.J., Kim, S.S., Lee, K.H., Kwack, C.H and Lee, J. D. 1991. Effects of dietary lysine and methionine levels on broiler performance. *Res. Rep. Rural Dev. Admin. Livest*., 33: 33 - 39.

May, T.D. and Vardaman, J.H. 1972. The influence of temperature and sex on amino acid requirement of broilers. *Poultry Sci.* 51: 1391 – 1396.

Moran, E.T.J. and Bilgili, P. 1990. Processing losses, carcass quality and meat yields of broiler chickens receiving diets marginally deficient or adequate in lysine prior to marketing. *Poult Sci*. 69: 702-710.

Nadeem, M.A., Gilani, A.H. and Khan, A.G. 1999. Assessment of dietary requirement of broiler chick for available methionine during summer. *Asian Aust. J. Anim. Sci.*, 12: 772 - 775.

National Research Council. 1994. Nutrient requirements of poultry. 9th edition. Academy Press, Washington. DC.

Ojano-Dirain, C.P. and Waldroup, P.W .2002. Evaluation of lysine, methionine and threonine needs of broilers three to six weeks of age under moderate temperature stress. *International Journal of Poultry Science.* 1(1): 16 - 21.

Orji-Uzor, T.P. 2007. Growth performance and cost of production of finisher broilers fed diets with or without lysine and methionine supplementation. Bachelor of Agriculture project report, Department of Animal Science, Faculty of Agriculture, University of Uyo, Uyo, Akwa Ibom State, Nigeria.

Schutte, J.B and Pack, M. 1995. Effects of dietary sulphur-containing amino acids on performance and breast meat deposition of broiler chicks during the growing and finishing phases. *British Poultry Science* 36:747-762.

Si, J., Fritts, C.A., Burnham, D.J. and Waldroup, P.W. 2001. Relationship of dietary lysine level to the concentration of all essential amino acids in broiler diets. *Poult. Sci*. 80: 1472-1479.

Si, J., Kersey, J.H., Fritts, C.A. and Waldroup, P.W. 2004. An evaluation of the interaction of lysine and methionine in

diets for growing broilers. *International. Journal of Poultry Science* 3: 51 - 60.

Snedecor, G. W. and Cochran, W. G. 1978. Statistical Methods (6^{th} edn). The Iowa State Univ. Press, Iowa, USA.

Ukpong, I.E. 2007. Growth performance and cost of production of broiler starters fed diets with and without lysine and methionine supplementation. Bachelor of Agriculture Project Report, Department of Animal Science, Faculty of Agriculture, University of Uyo, Uyo, Akwa Ibom State, Nigeria.

Wallis, I.R. 1999. Dietary supplements of methionine increase breast meat yield and decrease abdominal fat in growing broiler chickens. *Aust. J. Exp. Agri.* 39: 131-141.