Pakistan Veterinary Journal

ISSN: 0253-8318 (PRINT), 2074-7764 (ONLINE)
Accessible at: www.pvj.com.pk

Effect of Lysine Supplementation in Low Protein Diets on the Performance of Growing Broilers

Saima, M. Z. U. Khan*, M. A. Jabbar, A. Mehmud[1], M. M. Abbas and A. Mahmood[1]

Department of Food and Nutrition; [1]Department of Poultry Production, University of Veterinary & Animal Sciences, Lahore, Pakistan
*Corresponding author: zafaronly@gmail.com

ARTICLE HISTORY

Received: March 04, 2009
Revised: June 29, 2009
Accepted: July 07, 2009

Key words:
Lysine
Broilers
Low protein
Weight gain
Feed efficiency

ABSTRACT

An experiment was conducted to evaluate the effect of lysine supplementation in low protein diets on the performance of growing broilers. Six broiler starter diets designated as A, B, C, D, E and F were formulated in such a way that diets A & B had CP 23%, diets C & D had CP level 21%, while diets E & F had CP 19%. Each pair of diets was supplemented with two levels of lysine i.e. 1.1 and 1.2%. These experimental diets were fed to the birds from day 0 to 28. Results indicated that both CP and lysine levels had significant effect on mean body weight gains. Maximum average weight gain (1244 gms) was observed in birds fed diets with 19% CP and 1.2% lysine. It was observed that there were significant differences in feed intake among diets. Minimum feed consumption (1900.24 gms) was observed in birds fed on diet containing 23% CP and 1.1% lysine. Protein and lysine levels had non-significant effect on the mean FCR of the diets. It was concluded that CP levels in the diets of the broilers could be reduced from 23 to 19%, when considering in terms of FCR, provided that their lysine levels are higher than NRC recommended levels.

To cite this article: Saima, MZU Khan, MA Jabbar, A Mehmud, MM Abbas and A Mahmood, 2010. Effect of lysine supplementation in low protein diets on the performance of growing broilers. Pakistan Vet J, 30(1): 17-20.

INTRODUCTION

Commercial poultry farming in Pakistan is expanding day by day. However, this sector is still confronted with many problems, like diseases (Alkhalaf, 2009), mal nutrition, which are hindering its progress. Cost of the feed covers about 60% of the total cost of production in most poultry production enterprises (Qureshi, 1987). Hence, a slight fluctuation in the feed cost can affect the total cost of operation. The composition of major animal protein ingredients is too variable to be dependable. So, use of vegetable proteins in diet formulation is inevitable. However, formulating diets using sole vegetable protein ingredients is not probably possible because most of the vegetable proteins are deficient in essential amino acids (EAA), particularly lysine (Han *et al.,* 1992).

The protein and EAA requirements for broilers proposed by NRC (1994) are unable to accommodate the terms of production for modern strains of birds. In order to catch up the additional growth, levels of commercially available amino acids are generally increased (Corzo *et a!.,* 2002). Most of these amino acids, particularly lysine, are now being supplemented in free form, enabling dietary crude protein to decrease below NRC (1994) levels (Corzo *et al.,* 2002). The development of amino acid supplementation allows meeting the EAA needs at low protein levels (Dirain and Waldroup, 2002). The use of synthetic amino acids to meet the amino acid needs of broilers leads to production of cost effective diets.

Lysine is one of the limiting amino acids in common broiler diets. The proportion of lysine to all other EAA is of great concern for optimal performance of broilers (Corzo *et a!*., 2002). Increasing dietary lysine levels has been reported to increase carcass protein retention (Sibbald and Wolynetz, 1986). Lysine requirements of broilers are higher in low protein diets for maximum weight gain and feed efficiency (Labadan *et al.,* 2001). Even at normal crude protein (CP) level, high lysine content has been reported to increase the growth rate in broilers (Holsheimer and Veerkamp, 1992). Lysine has been shown to exhibit specific effects on carcass composition and breast meat yield (Schutte and Pack, 1995). Increasing lysine over and above NRC (1994) recommendations has been reported to improve weight gain, feed efficiency and breast meat yield (Si *et aI.,* 2004) and reduce the deposition of extra fat in the carcass (Moran and Bilgili, 1990).

Broilers fed diets marginal in proteins but fortified with lysine performed as well as those fed a diet higher in proteins (Jensen and Colnago, 1991). Formulation with commercially available purified EAA to attain broiler requirements not only improves their overall balance but

allows reduction in CP while improving the overall performance of broiler birds (Zarate *et al.,* 2003). Reduction in the CP levels in broiler diets leads to the most pronounced effects in terms of live performance. The 1% decrease in CP resulted in a decrease in body weight gain but feed conversion improved (Zarate *et aI.,* 2003). However, the loss in weight gain was compensated by increasing levels of lysine. These statements support the concept that dietary CP in diets supplemented with lysine could be reduced without affecting the performance of birds.

The objective of the present study was to investigate the effect of different levels of supplemented lysine in low protein diets on weight gain, feed consumption and feed conversion ratio in growing broilers.

MATERIALS AND MERTHODS

One hundred and eighty day-old Hubbard broiler chicks of mixed sex were randomly divided into 18 experimental units of 10 chicks each. Three replicates were allotted to each treatment randomly. The chicks in each replicate were kept in separate pens measuring 4 x 3 x 2.5 inches. A two inch deep layer of saw dust was used as litter in each pen. It was stirred regularly during the experiment to keep it dry. The room temperature varied from 100°F to 90°F during the experiment.

Six broiler starter diets (A, B, C, D, E and F) were formulated. Amino acid requirements were based on NRC (1994). Calculated ingredients and nutrient composition of these diets are shown in Tables 1 and 2, respectively. Each broiler diet was fed to three experimental units randomly from day 1 to 28. Records of amount of feed offered and consumed by each experimental unit were maintained on weekly basis. Data on initial body weight, weekly body weight gain and feed consumption were recorded and feed conversion ratio was calculated. Data thus obtained were statistically analyzed through analysis of variance (ANOVA) by using Completely Randomized Design. Duncan's multiple range test was applied for multiple means comparisons, where necessary.

RESULTS AND DISCUSSION

The average gain in body weight of chicks fed different experimental rations has been shown in Table 3. Birds showed different trends for mean body weight gain during experimental period for the treatments A, B, C, D, E and F. Statistical analysis of the overall weight gain data indicated a significantly higher weight gain of chicks fed rations C, D and F in comparison to those fed rations A, B and E. Non significant differences in weight gain were noted among rations A, B & E, and among rations C, D, E and F (Table 3).

These results indicate that reduction of protein level from 23 to 19% had no detrimental effects on body weight gain in hot climatic conditions during whole experimental period when supplemented with lysine. The improvement in weight gain with the use of low CP diet supplemented with lysine might be due to reduction in heat increment produced by the metabolism of excess proteins. Results of the present study indicated that protein levels had no significant effect on the weight gain up till 4 week of age, while levels of the lysine showed a significant difference in live weight gain.

These results coincide with the findings of Surisdiarto and Farrell (1991), who found that increasing lysine levels at any given CP level improved the weight gain and feed conversion ratio (FCR), the response was much clear at the lower CP levels. Similarly, Holsheimer and Veerkamp (1992) and Si *et al.* (2001) reported that increasing the lysine levels in diet had significant effect on weight gain.

Contrary to the results of the present study, Bregendahl *et al.* (2002) reported that chicks fed low CP diet (20%) supplemented with essential amino acids (EAA) gained less weight than the chicks fed the control diet (23% CP). This might be due to the reason that those experiments had not been conducted in severe hot summer and the main difference was the high temperature in present study as the study was conducted in the months of May-June. The requirements of proteins are decreased in heat stress as compared to normal temperature.

Table 1: Percentage composition of experimental diets

Ingredients (%)	Experimental diets					
	A	B	C	D	E	F
Maize	42.99	40.46	45.97	45.76	50.00	50.00
Rice tips	01.45	02.41	03.00	03.00	05.14	04.94
Rice polishing	04.48	06.00	06.00	06.00	06.00	06.00
Soybean meal	34.08	33.96	29.54	29.58	24.43	24.48
Cottonseed meal	02.00	02.00	02.00	02.00	02.00	02.00
Com gluten (60%)	05.00	05.00	04.00	04.00	03.50	03.50
Vegetable oil	03.92	04.06	03.28	03.35	02.51	02.56
Molasses	02.50	02.50	02.50	02.50	02.50	02.50
Limestone	01.29	01.29	01.29	01.29	01.28	01.28
D.C.P.	01.68	01.68	01.73	01.73	01.79	01.79
Premix	00.50	00.50	00.50	00.50	00.50	00.50
L-Lysine HCI	-	00.03	00.05	00.15	00.18	00.28
DL-Methionine	00.11	00.11	00.14	00.14	00.17	00.17
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 2: Nutrient composition of experimental diets

Nutrients	Experimental diets					
	A	B	C	D	E	F
M.E. (KCaI/Kg)	3000	3000	3000	3000	3000	3000
C.P.(%)	23.00	23.00	21.00	21.00	19.00	19.00
C.F. (%)	3.80	3.80	3.61	3.61	3.34	3.34
Calcium (%)	1.00	1.00	1.00	1.00	1.00	1.00
Available phosphorus (%)	0.45	0.45	0.45	0.45	0.45	0.45
Lysine (%)	1.10	1.20	1.10	1.20	1.10	1.20
Methionine (%)	0.50	0.50	0.50	0.50	0.50	0.50
Met + Cys (%)	0.90	0.90	0.90	0.90	0.90	0.90
Threonine (%)	0.87	0.87	0.80	0.80	0.80	0.80
Arginine (%)	1.46	1.46	1.33	1.33	1.19	1.19
Linoleic acid (%)	3.20	3.20	2.98	3.01	2.66	2.69
Glycine (%)	0.94	0.94	0.87	0.87	0.78	0.78
Serine (%)	1.10	1.12	1.09	1.09	0.98	0.98
Histidine (%)	0.60	0.59	0.54	0.54	0.49	0.49
Isolucine (%)	0.96	0.96	0.86	0.86	0.77	0.77
Leucine (%)	2.18	2.17	1.98	1.98	1.81	1.81
Phenylalanine (%)	1.17	1.17	1.05	1.05	0.95	0.95
Valine (%)	1.09	1.10	1.00	1.00	0.91	0.91
Cost (RslKg)	11.79	11.85	11.28	11.42	10.75	10.89

M. E = Metabolisable energy; C. P. = Crude protein; C. F. = Crude fibre

Table 3: Average weight gain, feed consumed and feed conversion ratios (FCR) for different experimental diets

Diets	Average weight gain/chick (gms)	Average feed consumed/chick (gms)	FCR
A	1128.88a	1900.24 a	1.68a
B	1152.28a	1920.65a	1.67a
C	1177.73b	2023.64ab	1.71a
D	1187.81b	2032.09ab	1.70a
E	1133.58ab	I991.92a	1.75a
F	1244.14b	2020.77b	1.62a

Means within the same column with different letters differ significantly (P<0.05).

Birds showed different trends in average feed consumption during 4 weeks of experimental period for different treatments (Table 3). Feed consumption for ration F was higher when compared to the feed consumptions for rations A, B and E (P≤0.05). However, there were non significant differences between the feed intakes of chicks fed on rations A, B, C, D and E (Table 3).

These results indicate that there was an increase in the feed intake as the CP levels were decreased form 23 to 19%. The increase in the feed intake of the birds fed on ration F might be due to its requirement for proteins. Lysine level also had significant effect on feed consumption and this trend was clear in low CP diets. Birds consumed more of low protein, high lysine diets as compared to high protein, low lysine diets. Bregendahl *et al.* (2002) found significant increase in feed intake of broiler chicks fed 20% amino acid supplemented diet compared to those fed control diet with 23% amino acids. Sterling *et al.* (2003) also reported that the reduction in dietary CP level and supplementation of lysine resulted in more feed consumption as compared to the high CP diet with normal lysine levels.

The average values of weekly FCR of chicks fed different rations revealed non-significant differences among the rations (Table 3). These results indicated that a reduction up to 19% in the protein level of the broiler diets had no effect on the overall FCR during the experimental period of 4 weeks, provided the diets were supplemented with high level of lysine. It is obvious from these results that the quantity of the feed consumed by the birds to produce one kilogram live weight was not affected on high protein diets than on low protein diets in case when the lysine levels of the diets were kept higher than the NRC (1994) recommended standards.

Bregendahl *et al.* (2002) also recorded non significant differences in feed utilization among chicks fed at any of three low-CP diets. Zarate *et al.* (2003) observed an improvement in the FCR of birds fed diets with CP contents reduced from 23 to 19% and supplemented with essential amino acids in hot summer months.

An inference could, thus, be drawn from these findings that dietary protein level could be reduced from 23 to 19% in broiler rations along with the supplementation of lysine which had desirable effects on feed consumption and weight gain, without affecting FCR.

REFERENCES

Al-Khalaf, A. N., 2009. Serological evidence of avian paramyxovirus-2 infection in backyard and commercial poultry birds in Saudi Arabia. Pakistan Vet. J., 29(3): 107-109.

Bregendahl, K., J. L. Sell and D. R. Zimmerman, 2002. Effects of low protein diets on growth performance and body composition of broiler chicken. Poult. Sci., 81: 1156-1167.

Corzo, A., E. T. Jr. Moran and D. Hoohler, 2002. Lysine need of heavy broiler males applying the ideal protein concept. Poult. Sci., 81: 1863-1868.

Dirain, C. P. and P. W. Waldroup, 2002. Protein and amino acid needs of broilers in warm weather: a review. Int. J. Poult. Sci., 1: 40-46.

Han, Y., H. Suzuki, C. M. Parsons and D. H. Baker, 1992. Amino acid fortification of a low protein corn and soybean meal diet for chicks. Poult. Sci., 71: 1168-1178.

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

Jensen, L. S. and G. L. Colnago, 1991. Amino acids and proteins for broilers and laying hens. Proc. Maryland Nutr. Conf. for Feed Manufacturers. Baltimore, USA, pp:. 29-36.

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

Moran, E. T. Jr. and S. F. Bilgili, 1990. Processing losses, carcass quality and meat yield of broiler chickens receiving diets marginally deficient to adequate in lysine prior to marketing. Poult. Sci., 69: 702-710.

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

Qureshi, M. S., 1987. Quality control in poultry feed production in Pakistan. Feed International, 8: 94-95.

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

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

Si, J., C. A. Fritts, D. J. Burnham and P. W. Waldroup, 2004. Extent to which crude proteins may be reduced in corn-soybean meal broiler diets through amino acid supplementation. Int. J. Poult. Sci., 3: 46-50.

Sibbald, I. R. and M. S. Wolynetz, 1986. Effect of dietary lysine and feed intake on energy utilization and tissue synthesis by broiler chicks. Poult. Sci., 65: 98-105.

Sterling, K. G., G. M. Pesti and R. I. Bakalli, 2003. Performance of broilers fed various levels of dietary lysine and crude protein. Poult Sci., 82: 1939-1947.

Surisdiarto and D. J. Farrell, 1991. The relationship between dietary crude protein and dietary lysine requirements by broiler chickens on diets with or without ideal amino acid balance. Poult. Sci., 70: 830-836.

Zarate, A. J., E. T. Jr. Moran and D. J. Burnham, 2003. Reducing crude protein and increasing limiting essential amino acid levels in summer reared, slow and fast feathering broilers. J. Appl. Poult. Res., 12: 160-168.