Assessment of Dietary Requirement of Broiler Chicks for Available Methionine during Summer

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ABSTRACT : A six week growth performance trial involving 450 birds was conducted to determine the dietary requirement of broiler chicks for available methionine (AM). Body weight gain was significantly (p<0.01) lower on high AM diet (1411 g/bird) than low AM (1470 g/bird) and normal AM (1466 g/bird) diets. The feed intake by birds ranged from 3241±25.69 in high AM diet to 3321±25.69 g/bird in low AM diet. The feed efficiency for the three diets having low, normal and high level of AM were 2.26±0.02, 2.24±0.02 and 2.30±0.02, respectively. The results indicated that the birds fed high AM diet consumed significantly (p<0.01) more feed per unit body weight gain as compared to birds on low and normal AM diets. *(Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 5 : 772-775)*

Key Words : Broiler Chicks, Available Methionine, Dietary Requirement

INTRODUCTION

Research with various protein sources in the 1970's and 80's revealed that substantial losses of amino acids occurred following indigestion of feed. This was either because they were not digested and absorbed or because they were not utilized following absorption. This led to the concept of available amino acid i.e., the amount of an amino acid which is available to the bird for use in protein synthesis. Formulating feeds based on available amino acids have advantages over formulating on a total amino acid basis by describing more accurately their potential nutritional value (Fernandez et al., 1995). Feeds formulated on the basis of available amino acids more closely reflect the actual amino acid requirement, allowing for more efficient use of protein supplements from both an economic and environmental view point.

Variability in requirements of birds expressed as dietary concentrations has been noticed due to environmental conditions particularly high temperature. Growth and feed consumption of poultry have been observed to be affected by environmental temperature (Prince et al., 1961; Milligan and Winn, 1964; de Albuquerque et al., 1978). Due to changes in feed intake, it has been suggested that an adjustment in dietary protein or amino acid concentration should be made (Comb, 1970; Wilgus, 1973; Waibel et al., 1976).

Several reports have shown a relationship between environmental temperature and protein requirements. Waibel et al. (1975) observed that growth of turkeys reared at 10.6℃ from 4 to 20 week was maximized on a lower protein level than in the 22.2℃ environment. Similar results were reported by Waibel et al. (1976), who showed that lower dietary protein was needed by Large White male turkeys reared at environmental temperatures of 9.4℃ or 14.4℃ than at 20℃ or 27℃ from 6 to 20 week of age.

Information on the requirement for available amino acids in broilers is available from temperate countries. However, these requirement values for broiler chicks may not be entirely satisfactory in the tropics and subtropics because of the different climatic conditions. Methionine being the limiting amino acid in broiler chicks has been selected in this study for assessing its dietary requirement on available basis for broiler chicks during summer.

MATERIALS AND METHODS

This experiment was conducted during 0-6 week of age. The trial was conducted in hot-dry season from June 1~July 12 based on the meteorological data of Islamabad. In house meteorological date recorded during the experiment are presented in table 1.

Table 1. Meteorological data of shed recorded during experiment

Weeks	Temperature, ℃		Relative Humidity (%)	Rain Fall (Frequency)
	Maximum	Minimum		
1	34.69	31.79	34.68	One Light
2	33.44	31.61	44.04	One Light
3	33.24	27.33	52.55	One Light, One Heavy
4	37.58	28.13	35.86	One Light
5	36.27	27.27	31.43	One Light
6	37.63	27.10	36.06	-

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Received July 15, 1998; Accepted September 12, 1998

Housing

The broiler chicks were reared in pens measuring 10×5 meters each on deep litter in a shed. The pens were cleaned, washed and disinfected before spreading the litter. Fresh and dry saw dust was used to provide litter in 2"-3" deep layer. In case of need during first two weeks metalic floor brooders fitted with electric bulbs were used. Each pen was provided with feeders and automatic waterers. There was cross ventilation and chicks were protected from direct sunlight exposure by providing side wall curtains. Thermometer and humidity meter were fixed at different places in the shed to measure the temperature and humidity. A 24 hr constant light schedule was maintained throughout the experiment.

Birds and management

Four hundred and fifty commercial broiler chicks (Hubbard, one-day old) were used in the experiment. Chicks were weighed and tagged individually at the start. Chicks weighing 40 to 45 g were randomly assigned to nine groups (pens) of 50 chicks each following completely randomized design. Three pens were randomly assigned to each of the three dietary treatments. They were vaccinated against Newcastle disease, Infectious bronchitis, Infectious bursal disease and Hydro pericardium syndrom as per recommended schedule. The feed was offered three times a day at equal intervals for *ad libitum* feeding and fresh water was made available round the clock.

Basal diets

Broiler starter and finisher basal diets were prepared from the feedstuffs procured in bulk for the preparation of experimental diets. The composition of starter and finisher basal diets is presented in table 2. Basal diets fulfilled all the nutrients requirement of birds as recommended by AEC (1987), except lys and met. In starter and finisher basal diets, lys was 0.94 and 0.85% and met 0.40 and 0.37%, respectively, while availability of lys was 76.6 and 77.7% and met was 90.0 and 89.19%, respectively as determined by quick bioassay technique (Sibbald, 1986). Thus, the starter and finisher basal diets provided 0.72 and 0.66% available lysine (AL) and 0.36 and 0.33% AM, respectively. After assessing the actual contribution of AL and AM from basal diets, the quantity of L-lys HCl and DL-met was calculated for supplementation to obtain the desired levels.

Dietary treatments

The dietary requirement of AM for broiler chicks were assessed using three levels of AM in the experimental diets. Standard diet (normal AM diet contained level of AM recommended by AEC (1987), Whereas, other two diets contained 10% below (low AM diet) or 10% above (high AM diet) than standard, for starter and finisher phases of growth. Low, normal and high AM diets were prepared by supplementing the basal diets with DL-met and L-lys to have the levels of AM as 0.42, 0.47 and 0.52% for starter diets and 0.34, 0.38 and 0.42% for finisher diets, respectively. While, the level of AL in all the three dietary treatments was kept according to standard as 0.99 and 0.85% for starter and finisher diets, respectively.

Table 2. Composition of basal broiler starter and finisher diets

Description	Starter	Finisher
Ingredients (%)		
Corn	55.00	60.00
Rice polishings	12.05	11.20
Cottonseed meal	5.00	4.00
Rapeseed meal	5.00	3.00
Corn gluten meal (60%)	5.00	4.00
Soybean meal	9.00	9.00
Fish meal	6.00	5.00
Dical. phosphate	1.50	1.50
Vit. min. premix[a]	0.50	0.50
Vegetable oil	0.50	1.50
Chemical composition (%)		
Crude protein	21.00	19.09
Crude fibre	6.63	6.35
Ether extract	5.88	6.80
Calcium[b]	0.90	0.80
Phosphorus[b]	0.74	0.71
Lysine	0.94	0.85
Methionine	0.40	0.37
Total sulphur containing amino acids	0.75	0.69
Available lysine	0.72	0.66
Available methionine	0.36	0.33
AME (kcal/kg[c])	3000.00	3100.00
TME (kcal/kg[c])	3390.00	3510.00

[a] vit. min. premix provide per kg of feed : Vit. A 10,000 IU as Retinol (500,000 IU/g); Vit. D3, 3,300 ICU as chole-calciferol (500,000 IU/g); Vit. E, 30 IU as α-tocopherol (500 mg/kg); Vit. K3, 1.7 mg as menadione; Thiamine, 1.7 mg; Riboflavin, 7.5 mg, Pantothenic acid, 11.0 mg as Di-cal. pantothenate (99%); Niacin, 40 mg; Pyridoxine, 3.3 mg; Choline, 700 mg as choline chloride 50%; Folic acid, 1.0 mg; Biotin, 0.11 mg; Cyano-coblamine, 0.015 mg; Manganese, 80 mg as manganese sulphate; Zinc, 80 mg as zinc sulphate; Iron, 40 mg as ferrous sulphate; Copper, 9 mg as copper sulphate and Iodine, 1.1 mg as potassium iodide.

[b] Calculated values.

[c] Calculated from analysed ME and TME values of indigenous feedstuffs.

Broiler starter and finisher diets were fed to birds during 0 to 4 week and 5 to 6 week, respectively.

Table 3. Growth performance of broilers fed on diets with different levels of available methionine (AM)

Description	Low AM diet	Normal AM diet	High AM diet
Starter phase (0-4 week)			
Av. initial body weight, g/bird	42.35± 0.15	41.99± 0.15	42.03± 0.15
Av. total body weight gain, g/bird	812.00± 3.85[a]	805.00± 3.89[a]	781.00± 3.83[b]
Av. total feed intake, g/bird	1426.00±12.99	1420.00±12.99	1392.00±12.99
Feed efficiency	1.76± 0.024	1.76± 0.024	1.78± 0.024
Finisher phase (5-6 week)			
Av. total body weight gain, g/bird	658.00± 1.71[a]	661.00± 1.73[a]	630.00± 1.71[b]
Av. total feed intake, g/bird	1896.00±16.74	1869.00±16.74	1850.00±16.74
Feed efficiency	2.87± 0.020[a]	2.83± 0.020[a]	2.93± 0.020[b]
Overall (0-6 week)			
Av. total body weight gain, g/bird	1470.00± 3.74[a]	1466.00± 3.77[a]	1411.00± 3.72[b]
Av. total feed intake, g/bird	3321.00±25.69	3288.00±25.69	3241.00±25.69
Feed efficiency	2.26± 0.020[a]	2.24± 0.020[a]	2.30± 0.020[b]

Different superscript on means in a row show significant difference at $p<0.01$. Mean±SE.

Weekly records of weights of individual bird and of feed consumption for replicate were kept. Mortality was checked and recorded daily.

RESULTS AND DISCUSSION

The data on weight gain, feed intake and feed efficiency were subjected to analysis of variance technique suitable for completely randomized design using the General Linear Model procedure of the SAS Institute (1985). In case of significant differences, means were separated by Student Newman Keul multiple range test at 5 and 1% level of probability (Sokal and Rohlf, 1969). The average gain in body weight, feed intake of broiler chicks and feed efficiency of diets containing different levels of AM are presented in table 3.

Body weight gain

The average initial body weight per bird on low, normal and high AM diet were 42.35±0.15, 41.99±0.15 and 42.03±0.15 g/bird, respectively. The results showed that body weight gain of birds was significantly lower ($p<0.01$) on high AM diet as compared to low and normal AM diets. However, there was nonsiginficant difference in weight gains of birds on low and normal AM diets during starter, finisher and overall growth periods. A decreasing trend in weight gain of birds was observed with the increase in the level of AM throughout growth period. There was 3% decrease in weight gain of birds when AM level in diet was increased by 10% above that recommended by AEC.

Feed intake

The results showed nonsignificant differences among means of feed intakes of birds on different levels of AM in various phases of broiler growth. A decreasing trend was observed in feed intake of birds with the increase in the level of AM throughout the growth period. The results indicated that 10% increase or decrease in AM level from AEC standard in the broiler diets did not significantly influence the feed intake of birds.

Feed efficiency

The results showed that feed efficiency in birds on high AM diet was significantly ($p<0.01$) poorer than that of those on normal and low AM diets during finisher phase and the overall growth period. However, feed efficiency values had nonsignificant differences among low, normal and high AM diets during starter phase of growth.

Broiler chicks on standard level of AM (0.47 and 0.38% in starter and finisher diets, respectively) and 10% below the standard level of AM alongwith standard level of AL in the diet as recommended by AEC (1987) performed better during summer in Islamabad, while 10% addition in standard AM depressed the growth performance of birds. The birds on standard diet might have adjusted well to cope with the cyclic high temperature during summer in Islamabad. The maximum temperature range was 33.2~37.6℃ during the experiment, which is much above the comfortable temperature zone for broiler chicks. The signs of heat stress were quite visible, particularly in last three weeks of the experiment. There was hyperthermic panting by the birds with stretched wings. Birds reduced their feed intake and increased water uptake during noon hours. But the peak of temperature remained only for few hours. The birds were comfortable in the morning, in the evening and during night. Deaton et al. (1984) indicated that broilers were better able to withstand a cyclic temperature of 35~21℃ rather than constant high temperature.

Poor performance of birds on high AM in diet could be due to imbalance between sulphur containing amino acids and Lys being the reference amino acid. The Lys to sulphur containing amino acids ratios in high AM diet for starter and finisher were 100:83 and 100:81, whereas in low and normal AM diets the ratios were 100:73 and 100:78 for starter diets and 100:71 and 100:76 for finisher diets, respectively. The Lys to sulphur containing amino acids ratios in low and normal AM diets were much closer to that reported by Baker and Han (1994). In case of high AM diet, the difference was much wider reflecting imbalance between Lys and Met resulting into poor utilization of the diet.

In contrary to the findings of the present study, Waldroup et al. (1976) found similar growth performance of 1 to 56 day-old heat stressed broiler chicks on increasing level of sulphur containing amino acids in the diet (from 0.87 to 0.95). But Lys level was also elevated from 1.13 to 1.24% resulting into similar Lys to sulphur amino acids ratio (100:77). Edmonds and Baker (1987) and Han and Baker (1993) reported that excess of Met at 1% inclusion level in broiler diet is more growth depressant than other amino acids.

ACKNOWLEDGEMENTS

The authors would like to thank S. B. Chicks & Feeds, Islamabad for donating the broiler chicks used in this study.

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