

# Assessment of Dietary Requirement of Broiler Chicks for Available Lysine During Summer

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## ABSTRACT

A six weeks growth performance trial involving 450 birds was conducted to determine the dietary requirement of broiler chicks for available lysine (AL). Body weight gain of birds differed significantly ( $P<0.05$ ) among dietary AL levels and the values for high AL, normal AL and low AL diets were  $1500\pm 4.19$ ,  $1475\pm 4.20$  and  $1397\pm 4.20$  g/bird, respectively. The feed intake by birds ranged from  $3260\pm 29.61$  in low AL diet to  $3317\pm 29.61$  g/bird in high AL diet. The results of this study showed that the birds fed low AL diet consumed more feed per unit body weight gain ( $P<0.01$ ) than birds on normal and high AL diets ( $2.34\pm 0.014$ ,  $2.21\pm 0.014$  and  $2.23\pm 0.014$ , respectively). It was concluded that dietary standards as suggested by Alimentation Equilibre Commentry (AEC) are satisfactory during summer.

**Key Words:** Broiler Chicks; Available Lysine; Dietary Requirement

## INTRODUCTION

Most parts of Pakistan have tropical and subtropical environment, under which the ambient temperature during summer usually exceeds above comfortable zone for poultry. Poultry experience heat stress at high ambient temperature. High temperatures markedly affect broiler performance by causing a reduction in feed intake and body weight gain (Teeter *et al.*, 1985). High ambient temperature caused complicated metabolic reactions, such as panting, respiratory alkalosis, and reduced thyroid activity (Dale & Fuller, 1980; Leeson, 1986). These physiological and metabolic changes resulted in substantially reduced growth performance and altered carcass composition (Kubena *et al.*, 1972; Howliger & Rose, 1987).

Information on nutrients requirement for 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. It seems possible that as a consequence of nutrient partitioning, nutrients need of heat stressed chicks could change significantly. High nutrient (energy, amino acids) density is often recommended for broiler production system, where high ambient temperature occurs. Manipulating protein and amino acid level may be a lot more critical than manipulating fat and carbohydrate energy because the heat increment of protein is about 100% higher than either fat or carbohydrate (Blaxter, 1989). Lysine 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 to July 12 based on the meteorological data of Islamabad. In house meteorological data recorded during the experiment are presented in Table I.

**Housing.** The broiler chicks were reared in pens measuring  $10\times 5$  m 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" to 3" deep layer. In case of need during first two weeks metallic 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 h 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

**Table I. Meteorological data of shed recorded during experiment**

Weeks	Temperature, °C		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	—

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 Hydropericardium syndrome 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 II. Basal diets fulfilled all the nutrients requirement of birds as recommended by AEC (1987), except for 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, 0.66% AL and 0.36 and 0.33% available methionine (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 AL for broiler chicks was assessed using three levels of AL in the experimental diets. Standard diet (normal AL diet) contained level of AL recommended by AEC (1987); whereas, other two diets contained 10% below (low AL diet) or 10% above (high AL diet) than standard, for starter and finisher phases of growth. Low, normal and high AL diets were prepared by supplementing the basal diet with L-Lys and DL-Met to have the levels of AL as 0.89, 0.99 and 1.09% for starter diets and 0.77, 0.85 and 0.94% for finisher diets, respectively, while the level of AM in all the three dietary treatments was kept according to standard as 0.47 and 0.38% for starter and finisher diets, respectively. Broiler starter and finisher diets were fed to birds during 0 to 4 week and 5 to 6 week, respectively. Weekly records of weights of individual bird and of feed consumption for replicate were kept. Mortality was checked and recorded daily.

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 SAS Institute (1985). In case of significant differences, means were separated by Student Newman Keul multiple range test 5 and 1% level of probability (Sokal & Rohlf, 1969).

## RESULTS AND DISCUSSION

The average gain in body weight, feed intake of broiler chicks and feed efficiency of diets containing different levels of AL are presented in Table III.

**Table II. Composition of basal broiler starter and finisher diets**

Description	Starter	Finisher
<b>Ingredients (%)</b>		
Corn	55.00	60.00
Rice polishings	12.50	11.50
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 <sup>a</sup>	0.50	0.50
Vegetable oil	0.50	1.50
<b>Chemical composition (%)</b>		
Crude protein	21.00	19.09
Crude fibre	6.63	6.35
Ether extract	5.88	6.80
Calcium <sup>b</sup>	0.90	0.80
Phosphorus <sup>b</sup>	0.74	0.71
Lysine	0.94	0.85
Methionine	0.40	0.37
Available lysine	0.72	0.66
Available methionine	0.36	0.33
AME (Kcal/Kg <sup>c</sup> )	3000.00	3100.00
TME (Kcal/Kg <sup>c</sup> )	3390.00	3510.00

<sup>a</sup> 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  $\alpha$ -tocopherol (500 mg/Kg); Vit. K3 1.7 mg as menadione; Thaimine, 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, Cyanacoblamine, 0.015 mg; Maganases, 80 mg as maganese sulphate; Zinc, 80 mg as zinc sulphate; Iron, 40 mg as ferrous sulphae; Copper, 9 mg as copper sulphate and Iodine, 1.1 mg as potassium iodide.

<sup>b</sup>Calculated values

<sup>c</sup>Calculated from analysed ME and TME values of indigenous feedstuffs.

**Table III. Growth performance of broilers fed on diets with different levels of available lysine**

Description	Low AL diet	Normal diet	AL High AL diet
<b>Starter phase (0-4 week)</b>			
Av. initial body weight, g/bird	41.93±0.14	42.06±0.14	42.26±0.14
Av. total body weight gain, g/bird	768.00±4.04 <sup>c</sup>	821.00±4.04 <sup>b</sup>	833.00±4.02 <sup>a</sup>
Av. total feed intake, g/bird	1407.00±12.48	1420.00±12.48	1434.00±12.48
Feed efficiency	1.83±0.010 <sup>b</sup>	1.73±0.010 <sup>a</sup>	1.72±0.010 <sup>a</sup>
<b>Finisher phase (5-6 week)</b>			
Av. total body weight gain, g/bird	629.00±3.84 <sup>c</sup>	654.00±3.84 <sup>b</sup>	667.00±3.82 <sup>a</sup>
Av. total feed intake, g/bird	1853.00±23.72	1868.00±23.72	1883.00±23.72
Feed efficiency	2.95±0.046	2.86±0.046	2.82±0.046
<b>Overall (0-6 week)</b>			
Av. total body weight gain, g/bird	1397.00±4.20 <sup>c</sup>	1475.00±4.20 <sup>b</sup>	1500.00±4.19 <sup>a</sup>
Av. total feed intake, g/bird	3260.00±29.61	3288.00±29.61	3317.00±29.61
Feed efficiency	2.34±0.014 <sup>b</sup>	2.23±0.014 <sup>a</sup>	2.21±0.014 <sup>a</sup>

Different superscript on means in a row show significant difference at P<0.01; Mean±SE

**Body weight gain.** The results showed significant (P<0.01) differences among mean body weight gains of birds fed on different levels of AL in diets during starter and finisher

phases as well as during overall growth period. An increasing trend was observed in weight gain of birds with the increase in the level of AL throughout growth period. During 0-6 week growth period, there was 6% decrease in weight gain of birds when AL level in diet was low by 10% of AEC, however, when AL level was 10% above AEC recommendations, the weight gain of birds increased by only 1.5%. The results indicated that low AL diet decreased and high AL diet increased the body weight gains of birds.

**Feed intake.** The results showed non significant differences among mean feed intakes of birds on different levels of AL in starter and finisher phases as well as in overall growth period. However, an increasing trend was observed in feed intake by birds with the increase in the level of AL throughout growth period. The results indicated that 10% increase or decrease in AL level from AEC standard did not significantly influence the feed intake of broiler chicks during the growth period.

**Feed efficiency.** The results showed that feed efficiency for low AL diet was significantly ( $P < 0.01$ ) poorer than normal and high AL diets during starter and 0-6 week growth periods. However, differences in feed efficiency values were non-significant among low, normal and high AL diets during finisher phase of growth. The results indicated that birds fed low AL diet consumed significantly more feed per unit body weight gain as compared to normal and high AL diets during the early growth period and the overall growth.

The results indicated that addition of 10% AL over the standard levels (0.99 & 0.85% in starter and finisher diets) recommended by AEC (1987) improved the weight gain, but feed efficiency had not responded significantly to higher levels of AL under high temperature. Similar findings were reported by Han and Baker (1993) who observed that body weight gain of broilers reared at constant high temperature (37°C) from 8 to 22 days post-hatching on diets having 0.92, 1.02 and 1.12% digestible Lys were 290, 308 and 299 g; and 643, 652 and 676 g/kg. Han and Baker (1991) reported that digestible Lys concentration needed for maximum weight gain occurred at a digestible Lys level not exceeding 1.01% of the diet, while feed efficiency maxima occurred at a digestible Lys level not exceeding 1.21% of the diet.

It was observed that body weight gain and feed efficiency were depressed when dietary AL level was 10% lower from the standard. Han and Baker (1994) reported similar findings, regarding dietary digestible Lys requirement of broiler chicks during 22 to 43 d post-hatching period with basal diet containing 0.51% true digestible Lys. Weight gain and gain to feed ratios were significantly lower upto 0.3% Lys supplementation. But as the desired level of digestible Lys (0.91%) through supplementing with 0.4% Lys approached and then exceeded, the birds significantly gained body weight. Poor growth performance of broiler chicks at low level of AL diet could be due to imbalance between critical amino acids. The Lys is the reference amino acid to which all other indispensable amino acids are adjusted in the ideal protein

pattern for feed formulation. The Lys to sulphur containing amino acids ratios in low AL diet for starter and finisher diets were 100:87 and 100:84; whereas, in normal and high AL diets the ratios for starter diets were 100:78 and 100:71 and for finisher diets 100:75 and 100:69, respectively. The Lys to sulphur containing amino acids ratios in normal and high AL diets were much closer to that reported by Baker and Han (1994). While in case of low AL diet the difference was much wider reflecting imbalance between Lys and Met resulting into poor utilization of the diet. March and Biely (1972) indicated that the growth depressing effect seen with an amino acid imbalance is aggravated with an increased energy supply originating from either the diet or a heat stress situation. Pastro *et al.* (1969) also indicated that Lys deficiency increased body temperature. This situation would be of particular concern under warm environment conditions in which the experiment was conducted.

In general, it could be concluded that dietary inclusion level of AL (0.99 and 0.85% starter and finisher diets) as recommended by AEC (1987) for normal range of environmental temperature could also be successfully applied under the summer conditions of Islamabad. One important factor, which might had helped the birds to adjust their daily feed intake and perform normal on standard AL diet could be the daily cyclic temperature during the experiment. Average weekly maximum temperature range was 33.2-37.6°C 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°C rather constant high temperature.

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

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(Received 12 August 2005; Accepted 24 October 2005)