RESPONSE OF GROWING GUINEA FOWLS (NUMIDA MELEAGRIS) TO DIETARY L-LYSINE SUPPLEMENTATION

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ABSTRACT

In two experiments, the performance of growing (day 1-6 weeks) guinea fowls, given 20 and 22.5% dietary protein supplemented with graded levels of lysine, was compared with control (25% protein) birds. Weight gain, feed conversion and nitrogen retention were significantly (P.05) better in the control than other treatments at both 4 and 6 weeks of age. There was no growth response to 0.05% lysine supplementation in any of the diets.

Supplementation of the 20% protein diets with 0.5% lysine produced significant (P.05) weight gains at both 4 and 6 weeks of age. However, supplementation of 22.5% protein diet with 0.5% lysine produced significant (P.05) weight gains, only, at 6 weeks. Best performances were obtained when total dietary lysine level was between 1.6% and 1.8% of the diet.

Key Words: Guinea fowls, performance, L-Lysine, Dietary Supplement

INTRODUCTION

The question of the protein requirement of the growing guinea fowl has not been completely resolved. This is particularly so for the starter period (hatch to 4 weeks). Recommendations for this period ranged from 22% (Auxillia, 1966) to 24% (Kari *et al.*, 1978) and 26% (Blum *et al.*, 1975). Satisfactory growth has also been reported in this bird, when given chicken broiler starters (Soldevila, 1977 Oguntona, 1982).

Since sources of protein are often the most expensive in poultry diets, a high dietary protein requirement could translate into high product costs. The recent interest in guinea fowl consumption world wide (World Poultry, 1986), requires that more efficient production methods be continually investigated. In this respect, Leclercq and Blum (1977) investigated the possibilities of reducing the protein requirements of guinea fowls by supplementation with synthetic amino acids during 4-8 and 8-12 weeks of age. They observed that while lysine supplementation could not partly replace protein requirement during the 4-8 weeks grower period, it would, during 8-12 weeks finisher period.

Although protein requirement of guinea fowls is believed to be higher between hatch and 4 weeks (Blum *et al.*, 1975), their response during this period to low dietary protein supplemented with lysine is not known. In the work presented here, guinea fowls from day 1 to 6 weeks are given low dietary levels of protein supplemented with graded levels of lysine and their performance compared with those given a high dietary protein.

MATERIALS AND METHODS

This study consisted of two experiments and the experimental schemes for the two are presented in Table 1.

Experiment 1

In the first experiment, three dietary protein levels (20, 22.5 and 25%) were used. The composition of the diets is shown in Table 2. The 25% protein diet served as the control, while the 20 and 22.5% protein diets, were respectively supplemented with two levels (0.05 and 0.5%) each of synthetic lysine to obtain a total of 7 dietary treatments (Table 1).

One hundred and twelve day-old male guineas (weight 21.7 ± 1.1g), from the University of Maiduguri flock, were divided into seven groups of sixteen. Each group was constituted into 4 replicates (4 birds/replicate) and allocated randomly to one of the dietary treatments (Table 1). The birds received standard broiler management procedures in chicken broiler house that was electrically heated during the first 4 weeks (temperature 29°C to 24°C). From 4 to 6 weeks mean temperature of the room was 24.2 ± 2.1°C. The poultry house received 24 hours continuous light with food and water provided *ad libitum*. Body weight and feed intake were determined weekly.

Table 1
Experimental Scheme: Protein, lysine levels and cost of experimental diets

Experiment 1				Experiment 2			
No.	Treatment	Total lysine (%)	Cost (₦) per kg	No.	Treatment	Total lysine (%)	Cost (₦) per kg
1.	20% protein	0.91	0.76	1.	22.5% protein	1.26	0.88
2.	20% protein + 0.05% lysine	0.96	0.77	2.	22.5% protein + 0.15% lysine	1.41	0.91
3.	20% protein + 0.5% lysine	1.41	0.86	3.	22.5% protein + 0.30% lysine	1.56	0.94
4.	22.5% protein	1.26	0.88	4.	22.5% protein + 0.45% lysine	1.71	0.97
5.	22.5% protein + 0.05% lysine	1.31	0.89	5.	22.5% protein + 0.60% lysine	1.86	0.99
6.	22.5% protein + 0.5% lysine	1.76	0.98				
7.	25% protein	1.58	1.12				

Table 2
Composition (%) of the basal and control diets

	Experiment 1			Experiment 2	
Ingredient	*Diet 1*	*Diet 4*	*Diet 7* (Control)	*Diet 1*	*Diet 6* (Control)
Corn	61.75	57.25	52.55	57.25	52.55
Soyabean Meal	29.00	31.00	34.20	31.00	34.20
Fish Meal	0.50	3.00	5.20	3.00	5.20
Vegetable Oil	5.00	5.00	4.80	5.00	4.80
Limestone	0.65	0.65	0.65	0.65	0.65
Defl. Phosphate	1.75	1.75	1.75	1.75	1.75
Common Salt	0.40	0.40	0.40	0.40	0.40
Trace Mineral Mix[1]	0.05	0.05	0.05	0.05	0.05
Vitamin Mix[2]	0.25	0.25	0.25	0.25	0.25
Dl-Methionine	0.15	0.15	0.15	0.15	0.25
Sand[3]	0.50	0.50	–	0.50	0.15
	100.00	100.00	100.00	100.00	100.00
Chemical analysis (calculated)	3.2	3.2	3.2	3.2	3.2
Protein, %	20.0	22.5	25.0	22.5	25.0
Lysine %	0.91	1.26	1.58	1.26	1.58
Methionine, %	0.46	0.55	0.57	0.55	0.57
Metyhionine, + Cystine, %	0.80	0.91	0.96	0.91	0.96
Arginine, %	1.14	1.54	1.60	1.54	1.60

1 See Oguntona (1982) for content.
2 See Oguntona and Zubair (1988) for content.
3 Supplementary lysine (L-lysine, 98%) was at the expense of the sand in the diet.

Experiment 2

The second experiment was conducted 4 weeks after the conclusion of the first one. Two dietary protein levels (22.5 and 25%) were used. This time the 22.5% protein diet was additionally supplemented with four graded levels (0.15, 0.30, 0.45 and 0.60%) of lysine, respectively, to give a total of six dietary treatments (Table 1). ninety-six day old guinea fowls (mean weight 24.1 ± 0.9g.) were divided into 6 groups of sixteen. Four replicates (4 guineas/replicate) constituted one group and one treatment was randomly allocated to each group. Management and feeding procedures were the same as described for experiment 1. Body weights and feed intake were also measured weekly. mortality was recorded whenever it arose.

Nitrogen retention determinations

In experiment 2, nitrogen balance studies were conducted during 42 to 45 days as described (D'Mello and Lewis, (1970). After final weighing on 42nd day, ten birds from each treatment were transferred into separate grower cages, which allowed individual feed intake measurements and total faecal collection. Below each cage was placed a plastic tray covered with weighed aluminium foil and 500 ml. of 0.1N H_2SO_4. Every 24 hours, during the 3 subsequent days, the contents of each tray were transferred quantitatively into a homogeniser, diluted to 1 liter and blended to an even consistency. 15ml. subsample of the homogenate was placed in kjeldahl flasks and the nitrogen determined. The results were expressed as g. nitrogen retained/g. of nitrogen ingested.

Statistical Analysis

The data in both experiments were subjected to statistical analysis using the general linear model procedure of the Statistical Analysis System (SAS) in conjunction with Duncan's multiple range test (SAS, 1979).

RESULTS

Experiment 1

Summaries of liveweight, feed intake and feed conversion ratio in experiment 1, are shown in Table 3. At 2 weeks of age, there was no significant difference in the liveweight of birds given any of the 22.55 CP diet (with or without lysine supplementation), and those given the highest dietary protein (25%) level. At this age, the liveweight of birds given any of the 22.5% CP diets (treatments 1, 2 and 3) however, were significantly ($P<0.05$) lower than birds on treatments 4-7. At 4 weeks, control birds already had mean liveweight that was significantly ($P<0.05$) higher than other dietary treatments. Guineas on 22.5% protein diet showed increased weight gain with increased lysine supplementation, but this was not enough to equal that obtained for birds on control diet. Birds on the lowest (20%) dietary protein also showed increased live-weight response to lysine supplementation and the increase, in the case of treatment 3 (1.41%) lysine), was enough to equal (P0.05) that of treatment 4(i.e., unsupplemented 22.5% protein). The pattern of liveweight at 6 weeks was different from that observed at 4 weeks only with the highest level of lysine supplementation of 22.5 protein diet (treatment 6). Unlike the performance at 4 weeks, the birds on treatment 6 had mean liveweight, which was significantly ($P<0.05$) higher than that for birds on treatment 6(1.76%) was higher than that in treatment 5. It was important to note that, although dietary lysine in treatment 6(1.76%) was higher than that in treatment 7(1.6%), weight of birds on treatment 7 (control) was significantly higher at both 4 and 6 weeks of age. In this experiment, feed intake and feed conversion followed the same pattern as that of liveweight gain. Treatment effects on mortality were not significant.

Experiment 2

Liveweight of control guineas (treatment 6) was significantly ($P<0.05$) higher than other treatments from 4 weeks (Table 4). Supplementation of the 22.5% protein diet with lysine produced growth response at every level of supplementation. This growth response was significant ($P<0.05$) at every level of supplementation at both 4 and 6 weeks. Cumulative feed intake data showed no significant ($P>0.05$) differences in feed consumption by guinea fowls on treatments 1 to 5. The birds on these treatments consumed significantly ($P<0.05$) less feed than control guineas.

Nitrogen retention data also showed increased response to lysine supplementation of the 22.5% protein diet. There were gradual increases in nitrogen retention with every increase in dietary lysine. it was a 0.60% (treatment 5) supplementary lysine

Table 3
Summary of liveweight, feed intake and feed conversion of guineas in Experiment 1

	Dietary Treatment	Liveweight (g)			Feed Intake (g)			g. Feed/g. gain		
		2 wks	4 wks	6 wks	2 wks	4 wks	6 wks	2 wks	4 wks	6 wks
1.	20% protein	80.2^{c}	181.3^{c}	302.6^{c}	200.1^{a}	441.1^{b}	941.5^{b}	3.33^{c}	2.74^{c}	3.21^{c}
2.	20% protein + 0.05% lysine	85.6^{c}	182.0^{c}	318.3^{c}	191.7^{a}	409.9^{c}	930.6^{bc}	2.94^{c}	2.53^{c}	3.10^{c}
3.	20% protein + 0.5% lysine	83.6^{c}	201.1^{b}	385.5^{c}	189.0^{a}	448.1^{b}	917.6^{c}	3.01^{c}	2.47^{c}	2.72^{c}
4.	22.5% protein	96.2^{a}	207.7^{b}	368.9^{c}	191.5^{a}	483.3^{a}	961.6^{a}	2.91^{c}	2.59^{c}	2.78^{c}
5.	22.5% protein + 0.05 lysine	96.4^{a}	209.8^{b}	380.7^{c}	212.3^{a}	472.0^{a}	975.8^{a}	2.85^{bc}	2.58^{c}	2.70^{c}
6.	22.5% protein + 0.5 lysine	97.5^{a}	220.4^{b}	419.8^{b}	203.5^{a}	450.8^{b}	981.5^{a}	2.66^{b}	2.25^{b}	2.46^{b}
7.	25% protein	101.2^{a}	239.8^{a}	437.9^{a}	190.90^{a}	451.6^{b}	941.1^{b}	2.39^{a}	2.08^{a}	2.26^{a}
	SEM	2.00	3.25	5.17	18.66	4.06	9.34	0.06	0.07	0.05

ab Means down a column having different superscripts are statistically different ($P < 0.05$)
bc Means down a column having different superscripts are statistically different ($P < 0.05$)
ac Means down a column having different superscripts are statistically different ($P < 0.01$)
SEM = Standard error of estimate

Table 4
Summary depicting liveweight, feed intake, feed conversion and nitrogen retention of guineas in Experiment 2

	Dietary Treatment	Liveweight (g)			Feed Intake (g)			g. Feed/g. gain		
		2 wks	4 wks	6 wks	2 wks	4 wks	6 wks	2 wks	4 wks	6 wks
1.	22.5% protein	83.3^{c}	186.0^{c}	332.2^{c}	155.8^{a}	414.8^{a}	902.1^{b}	2.50^{b}	2.50^{c}	2.89^{c}
2.	22.5% + 0.15% lysine	86.8^{bc}	188.0^{c}	338.4^{c}	153.0^{a}	410.0^{a}	891.0^{b}	2.33^{b}	2.44^{c}	2.80^{c}
3.	22.5% + 0.30% lysine	$94.6\%^{ab}$	199.3^{c}	380.5^{c}	177.3^{a}	406.2^{a}	901.2^{b}	2.41^{b}	2.30^{bc}	2.50^{c}
4.	22.5% + 0.45% lysine	100.2^{a}	206.4^{bc}	391.1^{bc}	179.3^{a}	414.7^{a}	897.8^{b}	2.01^{a}	2.23^{b}	2.42^{bc}
5.	22.5% + 0.60% lysine	100.6^{a}	210.8^{b}	412.0^{b}	151.2^{a}	416.3^{a}	900.0^{b}	1.90^{a}	2.19^{b}	2.36^{b}
6.	25% protein	110.3^{a}	248.7^{a}	451.8^{a}	180.0^{a}	428.9^{a}	930.0^{a}	1.94^{a}	1.88^{a}	2.15^{a}
	SEM	1.83	6.23	9.27	14.00	11.85	6.74	0.06	0.02	0.04

ab Means down a column having different superscripts are statistically different ($P < 0.05$)
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level, however, that nitrogen retention was significantly ($P<0.05$) higher than in treatment 1 (i.e., unsupplemented 22.5% protein). This was still significantly ($P<0.05$) lower than the nitrogen retention birds on the control diet. The guineas on the control diet also had the best feed conversion, followed by guineas on treatment 5 (higher lysine supplementation). Except at the lowest level of lysine supplementation (treatment 2), there was increased feed conversion response to lysine supplementation of 22.5% dietary protein by guineas.

DISCUSSION

Studies on the response of guineas to dietary protein are few (Blum *et la.,*1975; Leclercq *et. al.,* 1975; Leclercq and Blum, 1977; Kari *et al.,* 1978; Hughes and Jones, 1980) and so far there is no general agreement on the optimum dietary protein for guinea during the first few weeks of life. There are divergent views, not only on the level of starter dietary protein, but also on the duration (0-4, 0-6 or 0-12 weeks) that this diet should be given (Blum *et. al,* 1975; Hughes and Jones, 1980; Oguntona, 1982). The results of the present study show that both 20% and 22.5% dietary protein will not support guinea liveweight to the same extent as a 25% protein diet. This is in agreement with the results of Blum *et al.* (1975), who recommended a protein level of 25 to 26% up to 4 weeks of age.

Growth response of guineas on the lower protein diet supplemented with lysine, suggest that at 4 weeks, lysine in the 20% protein diet (0.91%) was inadequate for optimum growth. Lysine supplementation to 1.41% at this stage produced liveweight that was similar to that obtained for birds on treatments 4, 5 and 6 (22.5% protein) in experiment 1. This suggests that at this age, a high level of lysine is very important for the guineas and that increased growth could possibly result by further increasing the supplementary lysine, of the 22.5% protein diet. Also, between 4 and 6 weeks, in experiment 1, a more rapid growth (14.3g/d) was observed in guineas on treatment 6 as compared to guineas on treatment 5 (12.1g/d) and treatment 4(11.5g/d). This also suggests supplementary lysine that is high enough could be achieved, which will produce weight gain similar to that of the control.

Results from experiment 2 show that this cannot be achieved within the levels examined. Growth of Guinea on dietary lysine level of 1.8% (10% more than in control diet) was significantly ($P<.05$) less than growth on the control. It is possible to conclude, therefore, that for optimum growth during the first 6 weeks, the guinea fowl requires between 1.6 and 1.8% dietary lysine. This conclusion can be justified by the high protein level found to be necessary for rapid growth in this and other studies (Blum*et. al.,* 1975). High dietary protein by necessity contains high amino acids (and lysine) content and this study has shown that guineas respond to high supplementary lysine. Also, the inability of diet 5 (in experiment 2) to support guinea growth to the same extent as the control, suggests that dietary levels of other amino acids are equally important. In their studies, Leclercq and Blum (1977), identified methionine as the limiting amino acid for growth during 4 to 12 weeks of age. They also observed that lysine supplementation could not partly replace protein, for maximum guinea growth, during 4 to 12 weeks. Data on the cost of the diets per kilogram have been included (Table 1) to provide information on the economics of supplementation with synthetic lysine. it is evident from this, that, it is still cheaper to make a diet of 22.5% crude protein supplemented with 0.5% L-lysine than one of 25% crude protein.

While the present study does not aim to establish the exact lysine requirement of growing guinea fowl, the results have demonstrated the nature of the response of these birds to dietary supplementation of lysine. It has shown that the range of dietary lysine needed for optimum growth up to 6 weeks of age is between 1.6 and 1.8%, and that, even at this level, a dietary protein of 22.5% is inadequate.

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