Vol XVI (3-4), 1979

EFFECT OF DIFFERENT LEVELS OF LEAF PROTEIN CONCENTRATE (LPC) WITH AND WITHOUT ADDED LYSINE IN BROILER RATIONS

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The use of LPC at the cost of animal protein sources in the broiler ration was the main objective of the study. LPC was used at 6 & 8 per cent levels with and without 0.2 per cent lysine at the cost of animal protein sources. The rations were fed to chicks for a period of 8 weeks. The results showed a significant ($P<0.01$) difference in weight gain of birds given different levels of LPC. The chicks on 6 and 8 per cent LPC ration supplemented with lysine gained significantly more weight than those on the same level of LPC without supplementation. Lysine supplemented rations showed apparently better growth than control but statistically the differences were observed to be non-significant. The results also revealed significant ($P<0.01$) differences among feed consumption of chicks. The chicks on the control ration consumed the maximum feed followed by those on rations containing 8 and 6 per cent LPC supplemented with lysine. The efficiency of feed utilization and dressing percentage followed the same pattern as that of growth and feed intake; lysine supplementation lead to marked improvement in feed utilization as well as dressing percentage.

INTRODUCTION

The developing poultry industry particularly broiler enterprise, is playing a vital role in bridging the protein gap shown to exist in human dietary in Pakistan. Leaf protein concentrates are of increasing interest in the supply of high quality proteins. This concentrate contains higher proportions of essential amino acids with the exception of lysine, isoleucine and methionine than many animal food stuffs (Gerloff *et al.*, 1965). The biological value of leaf protein concentrate has been reported to be higher than the values of beaf, casein, soybean and yeast (Akeson and Stahmann, 1965). Keeping in view the importance of LPC, it was considered worth-while to study (i) the possibility of replacement of animal protein sources with different levels of LPC in the broiler rations and (ii) the effect of lysine supplementation to solo vegetable protein ration.

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MATERIALS AND METHODS

The experiment was conducted on 150 day old broiler chicks (Arbor Acre) in April, 1974 at the Poultry Experiment Station, University of Agriculture, Lyallpur. The chicks were weighed, wing banded individually for identification and were protected against Newcastle disease by intraocular vaccination at day old. The chicks were randomly divided into fifteen groups having ten chicks in each group. The chicks were raised upto 8 weeks of age in the battery brooders in separate compartments having an area of 8 square ft. (0.8 sq. ft. per chick) per compartment under continuous lighting programme. The room temperature was recorded throughout the experimental period and it ranged between 80° to 100° F.

Five experimental rations namely A, B, C, D and E were prepared (Table 1) and the experimental chicks were randomly allotted to various rations in such a way that each ration was fed to three groups. Ration A served as control whereas rations B, C, D and E had 6 per cent LPC, 6 per cent LPC plus 0.2 per cent lysine, 8 per cent LPC and 8 per cent LPC plus 0.2 per cent lysine, respectively. The substitution of LPC was done at the cost of animal protein sources. All the five experimental rations were computed on isonitrogenous and iso-carloric basis. The representative samples from each ration were drawn and analysed for crude protein by Kjeldahl method. Rations A, B, C, D and E had 21.7, 21.7, 21.9, 21.7 and 21.9 per cent crude protein, respectively.

The feed and water were provided *ad libitum* throughout the experimental period. Initial, weekly and final weight records of individual chicks were maintained and the feed consumption of each group was recorded at weekly intervals. Mortality was also recorded. At the end of the experiment, three chicks from each group were picked up at random and slaughtered to calculate the dressing percentage. The experiment was conducted according to completely randomized design. The data collected were subjected to statistical analysis using analysis of variance and Duncan's Multiple Range Test (Snedecor, 1959; Steel and Torrie, 1960 and Duncan, 1953).

RESULTS

The chicks fed on ration A (Control), B (6 per cent LPC), C (6 per cent LPC+0.2 per cent lysine), D (8 per cent LPC) and E (8 per cent LPC+0.2 per cent lysine) gained 888.4, 700.0, 973.7, 723.3 and 962.8 grammes live body weight, respectively (Table 2).

Table 1. *Percentage composition of experimental rations.*

Ingredients*	*Rations*				
	A	B	C	D	E
Maize (Yellow)	35.50	34.50	34.50	34.50	34.50
Wheat	22.00	21.00	21.00	22.00	22.00
Sesame cake	10.00	10.00	10.00	10.00	10.00
Corn gluten meal	12.00	12.00	12.00	11.00	11.00
Guar meal	5.00	5.00	5.00	5.00	5.00
Bone meal	1.75	2.50	2.50	2.50	2.50
Cottonseed cake	2.00	4.50	4.50	2.00	2.00
Leaf protein concentrate		6.00	6.00	8.00	8.00
Fish meal	5.00	—	—	—	—
Blood meal	2.00	—	—	—	—
Molasses	1.00	1.00	1.00	1.00	1.00
Rice husk	3.00	2.75	2.55	3.25	3.05
Common salt	0.25	0.25	0.25	0.25	0.25
Micromix**	0.50	0.50	0.50	0.50	0.50
Lysine			0.20		0.20
Total	100.00	100.00	100.00	100.00	100.00

*The ingredients were ground, thoroughly mixed and were fed to chicks in a mash form.

**Each pound of micromix contains: Vitamin A 536000 I.U./lb, Vitamin D_3 36000 I.U./lb, Vitamin B_2 260.0 mg/lb, Vitamin B_1 180.0 mg/lb, Vitamin B_6 180 mg/lb, Vitamin K 100 mg/lb, Vitamin E 720.0 mg/lb, Pantothenic acid 720 I.U./lb, Folic acid 62.00 mg/lb, Niacin 600 mg/lb, Vitamin B_{12} 0.89400 mg/lb, Choline chloride 44600 mg/lb, Zinc oxide 4460.0 mg/lb, Manganese oxide 6690.00 mg/lb.

Table 2. *Performance of broiler chicks fed different experimental rations.*

Rations	A	B	C	D	E
Average initial weight per chick (gm)	43.5	42.7	42.3	42.9	42.2
Average final weight per chick (gm)	951.9	742.7	1016.0	766.2	1005.0
Total weight gain per chick (gm)	888.4	700.0	973.7	723.3	962.8
Total feed consumption per chick (gm)	2232.7	1898.4	2173.7	1954.8	2212.0
Feed efficiency (feed/gain)	2.51	2.71	2.23	2.72	2.29
Dressing percentage	68.0	66.1	72.0	66.3	69.2
Mortality percentage	3.3	3.3	3.3	16.7	6.70
Net profit per broiler (Rs.)	1.52	0.64	2.20	0.91	2.14

The results showed significant difference ($P<0.01$) among the weight gains of chicks kept on different rations (Table 3). The chicks on 6 and 8 per cent LPC rations supplemented with lysine gained significantly more weight than those on the same levels of LPC without supplementation (Table 3). The difference in weight gain between chicks on rations having 6 and 8 per cent LPC levels was, however, found to be non-significant. Lysine supplemented rations showed apparently better growth than control, but statistically, the differences were observed to be non-significant.

Average total feed consumption per chick was 2232.7, 1898.4, 2173.7, 1954.8 and 2212.0 grammes with rations A, B, C, D and E respectively. The statistical analysis revealed significant ($P<0.01$) differences among feed consumption of chick fed different rations. The chicks on control ration consumed the maximum feed followed by those on rations containing 8 and 6 per cent LPC supplemented with lysine. The chicks fed on rations A, B, C, D and E utilized 2.51, 2.71, 2.23, 2.72 and 2.29 grammes of feed per gramme of gain in body weight. The efficiency of feed utilization in groups of chicks fed on different rations was found to be significant ($P<0.05$). Least amount of feed per unit gain was utilized by chicks on ration having 6 per cent LPC with lysine followed by 8 per cent LPC with lysine and control.

Table 3. *Analysis of Variance*

Source of variation	*Weight gain*		*Feed consumption*		*Feed efficiency*		*Dressing percentage*	
	Degree of freedom	Mean square	Degree of freedom	Mean square	Degree of freedom	Mean square	Degree of freedom	Mean square
Treatment	4	473879.69**	4	72857.92**	4	0.155*	4	17.74**
Replicates	2	34281.65NS	2	13296.44NS	2	0.045NS	3	0.89NS
Error	133	73126.53	8	10232.52	8	0.033	8	1.59

NS Non-significant

* Significant at five per cent level

** Significant at one per cent level

Duncan's Multiple Range Test	*G E A*	*D B*	*A.B.C.*	*D.B.*	*D.B.A.*	*E C*	*C*	*B A*	D B

Lines show non-significant differences

The average dressing percentages were 68.0, 66.1, 72.0, 66.3 and 69.2 in chicks fed on rations A, B, C, D and E respectively. Statistically significant ($P<0.01$) differences were observed among dressing percentage values. The dressing percentage of chicks on ration having 6 per cent LPC with lysine was significantly higher ($P<0.01$) than those fed other rations.

The economics of the rations having all vegetable sources was worked out to see the possibility of replacement of animal protein sources with vegetable proteins on a commercial scale. Profit came out to be rupees 1.52, 0.64, 2.20, 0.91 and 2.14 per bird in case of rations A, B, C, D and E respectively (Table 2). Profit per bird on ration C was rupees 0.68 more as compared to that on ration A (Control). The data revealed that ration C (6 per cent LPC+0.2 per cent Lysine) was comparatively better and economical than the other rations.

DISCUSSION

The control ration had about 15 per cent animal protein of the total protein which was completely replaced by protein from LPC (6 per cent). This replacement adversely affected the gain in body weight. The depression so caused was probably due to deficiency of lysine as calculated value of lysine in 6 per cent leaf protein concentrate ration was 0.8 per cent against a normal requirement of 1 per cent in control ration. A further evidence was produced in favour of the above view when the calculated deficiency was made good through the addition of 0.2 per cent synthetic L-lysine. This supplementation affected a marked stimulation in growth and the body weight became higher by 85.5 gms. than control. A similar situation was noticed when LPC was used at 8 per cent level. These findings lead to the conclusion that leaf protein concentrate has probably lysine as the most limiting amino acid. As the practical rations showed optimum levels of methionine, no attempt was made for methionine supplementation. The other basis for this assumption was lack of response in growth of broiler chicks on ration having leaf protein concentrate in place of animal protein sources with the supplementation of synthetic methionine (Malik, 1973).

Zaka-ur-Rehman and Habibullah (1969) observed better results in terms of weight gain in chicks when leaf protein concentrate (Berseem) was substituted for animal protein sources in broiler ration. However, studies have shown a successful use of 5 per cent level of alfalfa in chick ration (Cooney *et al.*, 1948) and a slight depression in growth has been reported at 5 per cent level of alfalfa leaf meal by Findrik and Cek (1955). The growth depressing effect may be attributed to saponin as well as limiting effect of lysine.

The substitution of leaf protein concentrate for animal protein sources also depressed feed intake of birds at both 6 and 8 per cent levels, and addition of synthetic lysine led to marked improvement in feed intake. This evidence further strengthens the view that the most limiting amino acid in leaf protein concentrate is lysine. Decreased feed intake in birds on more than 5 per cent alfalfa meal (Lepkovsky *et al.*, 1949) has been speculated to be due to some growth depressing effect which in turn is associated with decreased feed intake.

Better feed consumption with alfalfa, lucerne and berseem leaf meals has been demonstrated (Mangelson *et al.*, 1949 and Gill, 1966) contrary to the above findings. This may have been due to better palatability as well as sufficient lysine supply in the rations.

The efficiency of feed utilization and dressing percentage followed the same pattern as that of growth and feed in-take. Lysine supplementation led to marked improvement in feed utilization as well as dressing percentage. The growth depressing effect of leaf protein concentrate particularly at 8 per cent level might have favoured the mortality at this level. It may be noted that the birds on 8 per cent leaf protein concentrate had highest mortality and when lysine supplementation was done, there was a definite decrease in mortality percentage. It may, therefore, be postulated that leaf protein concentrate possesses some growth depressing factor when used at levels above 6 per cent.

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