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Effect of lysine and methionine supplementation on biological value of cottonseed-meal in broiler

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Cottonseed-meal can be used in broiler (Sharma *et al.* 1978) and layer rations (Reid *et al.* 1984), but the use is limited due to the presence of gossypol (Hermes *et al.* 1983) and deficiency of some essential amino acids like lysine (Kuck *et al.* 1975, Ryan *et al.* 1986) and methionine (Anderson and Warnick 1966). Furthermore, the availability of lysine is low (Reid *et al.* 1984) because the epsilon amino group of lysine is combined with gossypol, thus decreasing the nutritive value of cottonseed protein (Lodhi *et al.* 1976). This project was conducted to determine the protein quality of cottonseed-meal without or with supplemental lysine and/or methionine in broiler rations.

Isonitrogenous and isocaloric experimental rations (5) of 23% protein and 3 000 Kcal ME/kg diets were prepared. Ration A with casein as sole source of protein served as control. Rations B, C, D and E contained cottonseed-meal as sole source of protein. Ration C was supplemented with 0.21% methionine. In ration E both lysine and methionine were mixed. To measure the metabolic faecal nitrogen, a protein-free ration F (containing corn starch, 79.29%; wheat straw, 12.14%; DCP 2.5%; molasses 4%) was also prepared. The composition of experimental rations is shown in Table 1.

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The biological evaluation of the rations was carried out taking 30 broiler chicks. These were kept on a standard broiler starter ration for 7 days. On day 8 the chicks were randomly distributed to separate wire-net cage. The experimental rations were randomly assigned to these chicks such that each ration was fed to 5 chicks for 2 weeks.

The body weight of each chick was recorded daily. Feed intake and weight gain data of each chick were recorded and protein intake was computed from it for calculating protein efficiency ratio (PER). Faecal material of each chick was collected on filter-paper placed under wire cage, and dried daily. After 2 weeks the chicks were killed without bleeding, their abdomen opened and dried to constant weight at 70°C in an oven. Dried carcasses, respective diets and faecal material were ground, and nitrogen content of each was determined by Kjeldahl's method (AOAC 1984). Net protein utilization (NPU), apparent protein digestibility (APD), biological value (BV) and nitrogen incorporation efficiency were determined (Pellet and Young 1980).

The data collected and computed regarding all the above parameters were subjected to statistical analysis (Steel and Torrie 1981). Significant differences were compared by Duncan's multiple range test (Duncan 1955).

Statistical analysis of the data on feed consumed and average weight gain

revealed significant differences among treatment means (Table 2). Comparison of means indicated that weight gain of birds fed on rations supplemented wih lysine alone or lysine plus methionine excelled all other rations ($P<0.05$). Apparently the weight gain of birds fed on ration supplemented with methionine alone was lesser than control without any supplementation. However, the differences were nonsignificant statistically. Improvement in weight gain on lysine supplementation and depression in gain on methionine have been reported by Gerry *et al.* (1948), and improvement in weight gain on lysine plus methionine supplementation by Armas and Chicco (1972) and Gerry *et al.* (1948). Anderson and Warnick (1966) also reported lysine as first limiting and methionine as second limiting amino acid in cottonseed-meal. The high gain of weight on rations containing supplemental lysine or lysine and methionine may be attributed to significantly high intake of these rations due to lysine supplementation (Blaha *et al.* 1985). Consequently the total quantity of protein intake increased and the birds gained higher weights.

Apparent protein digestibility value of standard casein diet was significantly higher than of ration supplemented with both lysine and methionine but was similar to control and those supplemented with either lysine or methionine. When the efficiency of protein was calculated it was noticed that supplemental lysine and lysine plus methionine resulted in significant improvement in PER compared with other rations. These findings are in close agreement with those of Packhem *et al.* (1973).

Net protein utilization was highest on standard casein diet and remained nonsignificant with rations supplemented with lysine alone or in combination with methionine. Whereas methionine-supplemented ration had significantly ($P<0.01$) lower NPU and it was comparable with the value obtained on control ration. Similar trend was noticed in respect of biological value. Sharif (1989) reported similar improvement on lysine supplementation to corn-gluten-meal based rations. NIE values on all rations were

Table 1. Composition of experimental rations (%)

Ingredients	Rations				
	A	B	C	D	E
Casein	28.50	-	-	-	-
Cottonseed-meal	-	54.49	54.49	54.49	54.49
Corn starch	48.20	32.76	32.33	32.55	32.12
Wheat straw	14.75	-	-	-	-
Corn oil	-	4.75	4.75	4.75	4.75
Molasses	4.25	4.00	4.00	4.00	4.00
DCP	3.60	2.50	2.50	2.50	2.50
Limestone	0.20	1.00	1.00	1.00	1.00
Lysine	-	-	0.43	-	0.43
Methionine	-	-	-	0.21	0.21
Vit. mineral premix	0.50	0.50	0.50	0.50	0.54
Total	100.00	100.00	100.00	100.00	100.00

Table 2. Weight gain, feed intake and other protein quality parameters for standard and test diets

Description	Rations				
	A	B	C	D	E
Average weight gain per chick (g)	198.20^{b}	156.80^{b}	315.40^{a}	118.00^{b}	345.40^{a}
Average feed consumption (g)	517.60^{b}	427.00^{bc}	646.40^{a}	357.00^{c}	662.00^{a}
Average protein consumption per chick (g)	108.70^{b}	98.00^{b}	152.59^{a}	82.54^{b}	151.99^{a}
Apparent protein digestibility (%)	74.51^{a}	69.58^{ab}	73.76^{a}	74.40^{a}	67.76^{b}
Protein efficiency ratio (gain/intake)	1.82^{b}	1.61^{c}	2.07^{a}	1.45^{c}	2.27^{a}
Net protein utilization (%)	40.85^{a}	30.04^{c}	35.18^{abc}	32.90^{bc}	39.15^{ab}
Biological value (%)	55.21^{a}	43.05^{b}	47.90^{ab}	44.63^{b}	57.92^{a}
Nitrogen incorporation efficiency (%)	73.32	68.18	72.88	72.75	66.85

Same superscripts in a row represent nonsignificant ($P<0.05$) differences among treatment means.

comparable to each other. Zombade *et al.* (1980) also observed similar results and inferred that PER, weight gain and gross protein values of different protein sources correlated significantly with nitrogen incorporation efficiency.

The overall results of the study indicated that cottonseed was critically deficient in lysine. Its meal may be used in poultry rations after supplementing with lysine or lysine plus methionine.

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