

NUTRITIVE VALUE OF HORSE GRAM (*DOLICHOS BIFLORUS*) FOR EGG-TYPE CHICKS AND GROWERS

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ABSTRACT

Horse gram (Dolichos biflorus) is cultivated in several parts of South India, mainly as dry crop in moderate rainfall areas. It is relatively cheaper than cereals and reduces feed cost, if incorporated in poultry feeds. In this experiment, raw horse gram was incorporated at 0, 10, 20 and 30% levels either as mash or pellet; with or without multi-enzyme supplementation on isonitrogenous and isocaloric basis in diets of egg-type chicks and growers. In chicks, growth rate was in favor of control group followed by 10% horse gram. Pelleting and enzyme supplementation influenced the performance of chicks. Growers fed with 0% dietary level of horse gram had highest body weight gain followed by 10%. Better feed efficiency was observed at 0% followed by 10% horse gram. No mortality was observed. Results suggested that horse gram could be utilized in chick and grower ration without any deleterious effect at the levels tested.

Keywords: Dolichos biflorus, Egg-type chicks, Egg-type growers, mash, pellet, enzyme supplementation

INTRODUCTION

Poultry industry in our country is on the threshold of unparalleled advancement and is emerging as one of the most rapidly developing agro-industries. The rapid expansion of poultry industry without a parallel increase in the availability of conventional feedstuffs for preparation of compounded poultry feeds makes it mandatory to carryout research for identifying and evaluating alternative potential and economical feedstuffs for poultry. Future development of poultry industry will remain very much handicapped until and unless the production of conventional feed ingredients increases or alternate feed resources are identified. Even though several cereals like maize, sorghum,

wheat, rice, barley, bajra, ragi and other grains are available for incorporation in poultry feeds, the day-to-day increase in prices of these ingredients makes the compounded feed costlier.

This increase in price of the cereals and other grains necessitated to search intensively for a relatively cheaper ingredient for inclusion in poultry feeds. Among leguminous seeds, horse gram (*Dolichos biflorus*) appeared to be one of the potential un-conventional feedstuffs which is readily available for compounding low cost poultry feeds. However, the use of such un-conventional feedstuff would be possible only if their use is comparatively

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economical and found to be non-toxic. Hence, the present investigation was undertaken to study the effect of inclusion of horse gram in the diets of egg-type chicks and egg-type growers.

MATERIALS AND METHODS

Laboratory and biological experiments were conducted to determine the chemical composition and metabolizable energy value of horse gram and to study its utilization in chick and grower ration.

EXPERIMENT

Seven hundred and twenty commercial Bovans egg-type Single Comb White Leghorn (SCWL) chicks belonging to a single hatch were weighed and wing banded. Fifteen female day-old chicks were allotted to each of the 48 replicates and three replicates were randomly allotted to each of the 16 treatments. In the grower experiment, Two hundred and eighty eight commercial Bovans egg-type Single Comb White Leghorn (SCWL) growers belonging to a single hatch were weighed and wing banded. Six growers of the same hatch were allotted to each of 48 replicates. In order to make the number of birds more or less uniform in different replicates the birds within each treatment were allotted to the three replicates in uniform number. After uniform distribution of the birds in each replicate and treatment randomly, the surplus pullets were discarded.

Horse gram was incorporated at 0, 10, 20 and 30 per cent levels in chick and grower rations on iso-caloric and isonitrogenous basis. This feed was offered either as mash or pellet, with or without multienzyme supplementation. The ingredients and chemical composition of experimental chick and grower rations are shown in Table 1. Chemical composition of Horse gram is given in Table 2.

All chicks were housed in well ventilated litter floor pens using paddy husk as litter material

with about 900 cm² of floor space per bird. All pens were provided with uniform brooding facilities. Linear feeders and trough waterers were provided with sufficient feeder and waterer space per bird. Pellets were crumbled before feeding. Irrespective of treatments, all chicks were fed *ad libitum* wholesome drinking water throughout the experimental period. All growers were housed in litter proof pens using paddy husk as litter material. Only day light was provided during the entire experimental period. At 18 weeks, pullets were shifted to individual layer cages after leg banding, deworming and delicing. All birds were offered *ad libitum* wholesome drinking water and respective experimental diets from 9-20 weeks of age. Except for experimental feeds, other managemental practices followed were uniform for all the treatments in chicks and growers.

The individual body weight of the birds was recorded to one gram accuracy and the body weight gain was worked out from 0 to 8 weeks of age. Feed consumption by each replicate group at 4 weeks interval up to 8 weeks of age was maintained and feed efficiency was calculated. In growers, individual body weight and feed consumption in each group were recorded from 9-20 weeks of age. Feed efficiency was calculated for each replicate group. Mortality among the experimental birds during the study period was recorded and the causes thereof were ascertained by carrying out detailed autopsy. All experimental data collected were subjected to analysis of variance for significance, according to the methods of Snedecor and Cochran (1967)

RESULTS AND DISCUSSION

The influence of different forms of diet containing graded levels of horse gram on SCWL chicks and growers is reported in Tables 3 and 4. Highly significant differences in body weight gain between forms of feed and different levels of horse gram were observed. A significant difference

for enzyme supplementation was also observed. However, inclusion level of horse gram x forms of feed and inclusion level of horse gram x enzyme supplementation interaction effects were found to influence the body weight gain significantly ($P<0.01$) from 0 to 8 weeks of age.

The chicks fed with diets free of horse gram had the highest body weight gain followed by those fed 10 per cent. Chicks fed pelleted feed had significantly higher body weight gain than mash fed groups. Pelleting of diets with and without enzyme at 10 per cent dietary level of horse gram resulted in improved growth rate in chicks than the other groups.

Enzyme supplementation influenced the body weight gain in chicks. Chicks fed with enzyme supplemented feed without horse gram either as mash or pellet improved the growth rate significantly ($P<0.05$). Significantly ($P<0.01$) higher body weight gain was noticed in chicks, fed diet containing zero per cent horse gram, followed by 10 per cent level of horse gram. The reduced body weight gain in the graded levels horse gram fed groups may be attributed to the presence of known and unknown factors and complex indigestible carbohydrates present in the horse gram. Similar conclusions were drawn by Banerjee and Mandal (1975). On the other hand, pellet fed chicks had significantly ($P<0.01$) higher body weight gain than the mash fed groups. This may be attributed to some chemical change like gelatinization, inactivation of the growth inhibitor in the ration.

Further, it was also observed that enzyme supplemented groups had significantly ($P<0.01$) higher body weight gain than the non-enzyme supplemented groups. Similar results were reported by Willingham et.al. (1960), Rexen (1981), McCracken et.al. (1993) and Celophas et. al (1995). The better weight gain due to enzyme supplementation may be attributed to the ability of enzymes to improve the availability of nutrients

by removing antinutritional factors and better digestibility.

The effect of feeding graded levels of horse gram in chick diets under different forms on feed efficiency in commercial egg-type chicks is presented in Table 4. Feed efficiency from 0 to 8 week period did not show any significant difference between levels of horse gram or between dietary treatments.

The feed efficiency data did not reveal any trend among the experimental chicks. Banerjee and Mandal (1975) reported that as the level of inclusion of horse gram increased, feed efficiency decreased proportionately. Similarly, Stewart and Upp (1951) stated that the form of feed had no effect on the feed efficiency.

Different forms and dietary levels of horse gram had no adverse effect on the livability and health status of chicks. Mortality and their causes among the experimental chicks suggested that there was no association between the dietary treatments and dietary levels of horse gram. No earlier work was available for comparison.

The influence of different forms of diet containing graded levels of horse gram on SCWL growers are reported in Tables 3 and 4. The results revealed highly significant ($P<0.01$) differences in body weight gain between the dietary levels of horse gram fed groups (Table 3). The egg-type growers fed with zero per cent dietary level of horse gram had the highest body weight gain followed by the group fed with 10 per cent dietary level of horse gram. The forms of feed and the enzyme supplementation did not improve the body weight gain significantly in growers.

The weight gain during 9-20 weeks of age was significantly ($P<0.01$) higher in zero per cent dietary level of horse gram (626.9 g) fed growers, followed by 10 per cent dietary level (593.7 g) of

horse gram. The weight gain was lower in graded levels of dietary horse gram fed groups than the control. This may attributed to the presence of the known and unknown factors in the horse gram. Similar growth depression effect was also observed by Alumot and Nitsan (1961) and Kakade et al. (1970)

Feed efficiency in growers was highly significant ($P<0.01$) between the dietary levels of horse gram. However, the forms of feed and enzyme supplementation had no effect on the feed efficiency. Growers fed at zero per cent level of horse gram exhibited better feed efficiency followed by the group fed 10 per cent dietary level of horse gram.

Feed efficiency was significantly ($P<0.01$) better with zero per cent level (7.68) of horse gram followed with 10 per cent level of horse gram (7.95). Incorporation of higher levels of horse gram resulted in poor weight gain and feed efficiency.

There was no mortality among the experimental groups during the growing period from 9 to 20 weeks of age. Even though horse gram depressed growth rate and feed efficiency, it did not affect the livability of growers. No earlier work was available for comparison.

In the Single Comb White Leghorn chicks and growers experiments, raw horse gram was incorporated at 0, 10, 20 and 30 per cent levels either as mash or pellet; with or without multi-enzyme supplementation on isonitrogenous and isocaloric basis. In chicks, the growth rate was in favor of control group which was free of horse gram followed by 10 per cent level of horse gram group, whereas, feed efficiency was not significant among the experimental groups. Among the form of feed, pelleting of chick diet had better performance. Similarly, enzyme supplementation influenced the body weight gain. Mortality and causes thereof were found to be independent of the dietary treatments and levels of horse gram, suggesting that horse gram could be utilized in the chick ration without any deleterious effect at the levels tested. The egg-type growers fed with zero per

cent dietary level of horse gram had the highest body weight gain followed by the group fed with 10 per cent dietary level of horse gram. The forms of feed and the enzyme supplementation did not improve the body weight gain significantly in growers. Feed efficiency in growers was highly significant ($P<0.01$) between the dietary levels of horse gram. However, the forms of feed and enzyme supplementation had no effect on the feed efficiency. There was no mortality among the experimental groups during the growing period from 9 to 20 weeks of age. Results suggested that horse gram could be utilized in the grower ration without any deleterious effect at the levels tested.

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Table 1

Per cent ingredient and chemical composition* of chick and grower diets

Ingredient composition	Level of horse gram (%)							
	0		10		20		30	
	C	G	C	G	C	G	C	G
Yellow maize	48.0	43.0	43.0	37.50	38.0	32.00	33.0	26.50
Horse gram	-	-	10.0	10.0	20.0	20.0	30.0	30.0
De-oiled rice bran	8.0	30.00	7.0	30.00	6.0	30.00	5.0	30.00
De-oiled ground-nut cake	22.0	9.00	19.0	6.25	16.0	3.50	13.0	0.75
Sunflower oil cake	10.0	10.00	9.0	8.25	8.0	6.50	7.0	4.75
Fish meal	9.5	5.50	9.5	5.50	9.5	5.50	9.5	5.50
Mineral and Vitamin mixture ¹	2.5	2.50	2.5	2.50	2.5	2.50	2.5	2.50
Coccidiostat ²	+	+	+	+	+	+	+	+
Chemical composition								
Crude protein	22.03	17.13	22.02	17.13	22.01	17.12	22.02	17.12
Lysine	1.02	0.76	1.08	0.83	1.15	0.89	1.21	0.91
Methionine	0.41	0.36	0.41	0.35	0.40	0.34	0.40	0.33
Calcium	1.46	1.16	1.48	1.19	1.50	1.21	1.53	1.23
Total Phosphorus	0.50	0.42	0.51	0.43	0.54	0.45	0.55	0.47
ME (Kcal /kg)	2656	2545	2666	2549	2676	2554	2686	2559

C - Chick diets, G - Grower diets

* Calculated value

- At the level added supplied: 6.4 g calcium, 1.2 g available phosphorus, 54 mg manganese, 54 mg zinc, 40 mg iron, 4 mg copper, 1 mg iodine, 0.45 mg cobalt, 8250 IU Vitamin A, 1200 IU cholecalciferol, 5 mg riboflavin, 1 mg vitamin K, 10 mg nicotinamide, 25 mg calcium pantothenate and 0.01 mg cyanocobalamin per kg diet.

Table 2
Chemical composition of horse gram

Criterion	Composition on dry matter basis (%)
Total dry matter	92.00
Crude protein	22.05
Ether extract	0.59
Crude fibre	5.63
Total ash	5.16
Nitrogen free extract	66.57
Acid insoluble ash	0.81
Calcium	0.34
Total Phosphorus	0.27
Magnesium	0.18
Manganese	37.00
Zinc	0.28
Copper	19.00
Iron	72.00
Sugars	5.81
Starch	31.86
Available Carbohydrate	37.15
Calculated ME ¹ (Kcal/kg)	2802
Tannin (%)	0.2
Trypsin inhibitor activity (mg g ⁻¹)	8.63
Estimated ME (Kcal/kg)	2804
Estimated TME (Kcal/kg)	2885

¹ Calculated as per the formula of Bolton (1967)

Table 3
Mean body weight gain as influenced by different forms of chick and grower diet containing horse gram

Treatments	Level of horse gram (%)								Mean for forms of feed		Mean for enzyme supplementation	
	0		10		20		30		C	G	C	G
	C	G	C	G	C	G	C	G				
Mash without enzyme	436.7	620.2	422.7	602.3	414.0	576.0	390.3	561.6	Mash 420.9 ^a ± 3.42	Mash 589.7± 10.13	Without enzyme 428.8 ^x ± 3.94	Without enzyme 584.3 ± 9.44
Mash with enzyme	446.3	636.7	420.0	594.4	427.7	568.5	409.7	558.1				
Pellet without enzyme	436.7	615.2	453.0	587.3	445.0	566.5	431.7	545.4	Pellet 442.4 ^b ± 2.93	Pellet 583.5 ± 10.98	With enzyme 434.5 ^y ± 3.73	With enzyme 588.9 ± 11.35
Pellet with enzyme	461.3	635.3	455.7	590.6	418.7	572.0	437.0	555.8				
Mean for levels	445.3 ^a ±3.12	625.9 ^a ±5.39	437.8 ^b ±5.26	593.7 ^b ±3.22	426.3 ^c ±3.68	570.8 ^c ±2.09	417.2 ^d ±5.81	555.2 ^d ±3.49				

C - Chick diets, G - Grower diets
Means within a row and column bearing different superscript differ significantly

Table 4
Mean feed efficiency as influenced by different forms of chick and grower diet containing horse gram

Treatments	Level of horse gram (%)								Mean for forms of feed		Mean for enzyme supplementation	
	0		10		20		30		C	G	C	G
	C	G	C	G	C	G	C	G				
Mash without enzyme	3.62	7.77	3.55	7.86	3.64	8.19	3.89	8.22	Mash 3.63 ± 0.03	Mash 8.11 ± 0.08	Without enzyme 3.57 ± 0.03	Without enzyme 7.99 ± 0.08
Mash with enzyme	3.48	7.87	3.55	8.22	3.52	8.37	3.77	8.41				
Pellet without enzyme	3.53	7.63	3.47	7.79	3.36	8.11	3.53	8.37	Pellet 3.44 ± 0.02	Pellet 7.95 ± 0.07	With enzyme 3.49 ± 0.03	With enzyme 8.07 ± 0.07
Pellet with enzyme	3.34	7.45	3.26	7.92	3.47	8.13	3.57	8.21				
Mean for levels	3.49 ± 0.03	7.68 ^b ± 0.11	3.46 ± 0.04	7.95 ^{ab} ± 0.07	3.50 ± 0.03	8.20 ^a ± 0.07	3.69 ± 0.05	8.30 ^a ± 0.07				

C - Chick diets, G - Grower diets
Means within a row and column bearing different superscript differ significantly