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DETOXIFIED MUSTARD SEED MEAL IN BROILER RATIONS

A.H.K. Niazi and F.H. Shah

PCSIR Laboratories Complex, Lahore-54600

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Animal and vegetable protein in broiler rations was replaced with low phytate, detoxified mustard seed meal (DMSM). The standard ration containing blood, fish and sesame meals as source of animal and vegetable protein showed an average weight gain of 1675 g. Replacement of sesame meal with low phytate-DMSM showed significant increase in weight gain (2225 g). Average weight gain of broilers increased to 2050 and 1860 g when 33% fish, 33% blood and 100% sesame meals or 33% fish and 66% blood meals was replaced by low phytate–DMSM. Higher replacement of animal protein with low phytate-DMSM adversely affected the growth and average weight gain decreased to 1615 g.

Key words: Glucosinolates, Phytic acid, Nutritive value

INTRODUCTION

Poultry are efficient converters of low quality protein into protein of high biological value i.e. meat and eggs. The poultry industry in Pakistan has showed an annual growth of 15-20% in the last decade. A potential still exists for its further growth at the rate of 30 to 40% per year [1]. The rapid development of the industry has resulted in scarcities and high prices of feed ingredients which have created a difficult situation for the feed manufacturers and poultry farmers. This situation necessitates the exploration of the unconventional source of good quality protein.

Pakistan produces 250 thousand metric tonnes of mustard and rape seeds [2]. The cake left after oil extraction contains 35-40% protein which has a well balanced amino acid profile [3]. The cake has a limited use in animal and poultry rations due to the presence of toxic and antinutritive factors i.e. glucosinolates, phytic acid and crude fibre [4-6]. Removal of these toxic factors would render the cake fit for incorporation in poultry feeds. Many researchers have reported that mustard/rape seed cake content of the broilers and layers rations should not exceed 10-12% [7–10]. The present study was conducted to evaluate the low phytate, glucosinolate free mustard seed meal as a substitute of sesame cake, blood and fish meals in broiler rations.

MATERIALS AND METHODS

All the ingredients were purchased from the local market except low phytate, detoxified mustard seed meal (DMSM) which was prepared according to procedure reported elsewhere [11]. Individual ingredients and the prepared rations were analysed for crude protein, crude fibre, fat and ash by the methods described elsewhere [12]. The hydrolytic product of glucosinolate i.e. allyl isothiocyanate and phytic acid in the untreated and treated mustard seed meal were estimated according to standard methods [13–14].

One day old broiler chicks (120) were purchased from PIA Shaver Hatchery, Karachi, for the experiments. The chicks were weighed, wing banded and randomly divided into twelve groups of 10 birds each. Two replicates were set up for each ration and birds were raised in wire mesh cages. The temperature of the experimental room was maintained at 32± 1° in first week and in the subsequent weeks it was lowered by 3° week until it reached 26°. The six experimental rations, fed to the birds, were isonitrogenous and isocaloric (Table 1). The birds were provided *ad libitum* in mash form under continuous supply of light and water. Each group was considered a unit. Initial body weight, weight of each broiler per week, feed consumption/ weight gain and dressing percentage were recorded.

After 56 days, four chicks from each group were weighed, slaughtered, feather and skin removed, reweighed and the dressing percentage calculated. The data collected was statistically evaluated by using analysis of various based on completely randomized design and difference in mean values were tested by Duncan's multiple range test [15]. Mortality (%) of chicks during the experiment was calculated according to the following formula:

$$\text{Mortality (\%)} = \frac{\text{No. of chick died}}{\text{No. of chicks taken}} \times 100$$

RESULTS AND DISCUSSION

Enzymic treatment followed by leaching with 4% NaC1 solution at pH 5[11] reduced the glucosinolates to traces and eliminated 86.63% of the total phytic acid content of mustard seed meal. Low phytate detoxified (glucosinolate free) mustard seed meal containing 38.42% protein, 2.44% fat, 7.9% ash, 12.80% crude fibre and 0.45% phytic acid was incorporated in different broiler rations as a substitute of vegetable and animal protein. The effect of its incorporation is shown in Table 2.

The standard ration (R_1) containing blood, fish and sesame meals as sources of vegetable and animal protein showed a weight gain of 1675 g (Table 2). Total replacement of sesame meal with low phytate-DMSM (R_2) resulted in an increase in average weight gain (2225 g). The average weight gain was 2120, 2060, 2050 and 1860 g when 33% blood meal (R_3), or 33% fish and 33% blood meals (R_4) or 33% fish, 33% blood and 100% sesame meals (R_5) or 33% fish and 66% blood meals (R_6) were replaced by low phytate-DMSM. However, replacement of higher level of animal protein i.e. 66% fish and 66% blood meals (R_7) adversely affected the growth of chicks, decreasing the average weight to 1615 g. No abnormality in thyroid or liver of broilers was observed as reported by Griffiths [16]. Statistical analysis of the data showed significant difference ($P< 0.05$) in the weight gain of the seven experimental rations (Table 3). These findings indicated that 100% sesame meal or 33% fish and 66% blood meals could be replaced by low phytate-DMSM but it was not feasible to replace higher amount of animal protein with low phytate-DMSM.

Standard ration (R_1) showed feed efficiency of 2.72 (Table 2). Replacement of upto 33% fish and 66% blood meals (R_6) with low phytate-DMSM showed feed efficiency (2.64) comparable to standard ration R_1. However, replacement of higher level of animal protein i.e. 66% fish and 66% blood meals (R_7) adversely affected the feed efficiency (2.84). This decrease in the feed efficiency appeared to be due to amino acid imbalance in the ration. Replacement of 100% sesame meal with low phytate-DMSM showed improvement in the feed efficiency (2.17) of ration R_2. The results indicated that low phytate-DMSM has a better amino acid profile. The presence of antinutrive factors i.e. oxalic acid and phytic acid [17] in sesame meal might be an other cause for its lesser nutritive value than low phytate, glucosinolate free mustard meal. The differences in the feed efficiency values of the rations were significant (P 0.05).

The average dressing percentge of chicks fed on rations R_1-R_7 varied from 64.40 to 68.68%. Significantly (P 0.05) better dressing percentage was observed in chicks fed on ration R_2 and R_3 in which 33% blood or 33% blood and

Table 1. Replacement of fish, blood and sesame meals by low phytate detoxified mustard seed meal in broiler rations.

Ingredients (%)	Standard ration (R_1)	100% sesame meal replaced by low phytate DMSM (R_2)	33% blood meal replaced by low phytate DMSM (R_3)	33% fish and 33% blood meals replaced by low phytate-DMSM (R_4)	33% fish, 33% blood and 100% sesame meals replaced by low phytate-DMSM (R_5)	33% fish and 66% blood meals replaced by low phytate-DMSM (R_6)	66% fish and 66% blood meals replaced by low phytate-DMSM (R_7)
Maize (yellow)	45.0	46.0	45.0	45.0	46.0	45.0	44.4
Sorghum	14.0	15.0	14.0	13.0	15.0	13.0	13.2
Wheat bran	6.0	4.6	6.0	6.0	4.9	7.0	6.2
Rice polishings	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Rice husk	1.0	-	0.9	0.3	-	0.2	2.0
Corn gluten meal	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Sesame meal (40%)*	8.0	-	8.0	8.0	-	8.0	8.0
Low phytate-detoxified mustard seed meal	-	8.4	2.1	4.7	13.1	6.8	9.4
Guar meal	3.0	3.0	3.0	4.0	4.0	3.0	4.0
Blood meal (40%)*	6.0	6.0	4.0	4.0	4.0	2.0	2.0
Fish meal (48.92%)	6.0	6.0	6.0	4.0	4.0	4.0	2.0
Molasses (cane)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Bone meal	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Vitamin and mineral premix	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Limestone	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Crude protein* (%) analysed	21.50	21.37	21.49	21.28	21.38	21.45	21.55
M.E. Cal./kg (calculated)	2906	2904	2906	2905	2903	2905	2907

*Dry matter basis

Table 2. Low phytate-detoxified mustard seed meal as a vegetable and animal protein substitute in broilers ration.

Parameter	Standard ration (R_1)	100% sesame meal replaced by low phytate-DMSM (R_2)	33% blood meal replaced by low phytate-DMSM (R_3)	33% blood and 33% fish meal replaced by low phytate DMSM (R_4)	33% blood, 33% fish and 100% sesame meals replaced by low phytate DMSM (R_5)	33% fish and 66% blood meals replaced by low phytate-DMSM (R_6)	66% fish and 66% blood meals replaced by low phytate-DMSM (R_7)
Average weight gain (g)	1675.00	2225.00	2120.00	2060.00	2050.00	1860.00	1615.00
Dressing percentage	65.38	68.39	68.68	65.71	66.20	65.42	64.40
Feed cost per kg of ration (Rs)	2.75	2.54	2.66	2.59	2.52	2.63	2.45
Average feed consumed per chick (g)	4554.00	4828.00	4834.00	4759.00	4859.00	4984.00	4587.00
Feed efficiency	2.72	2.17	2.28	2.31	2.37	2.64	2.84
Feed cost Rs/kg of weight gain	7.40	5.51	6.06	5.98	5.97	7.05	7.21
Mortality	5.00	Nil	Nil	Nil	Nil	Nil	5.00

Table 3. Duncan's multiple range test of weight gain in broiler.

Ration	Mean χ	χ-1615	χ-1675	χ-1860	χ-2050	χ-2060	χ-2120	χ-2225
R_2	2225	810**	550**	365**	175**	165**	105**	–
R_3	2120	505**	445**	260**	$70^{N.S.}$	$60^{N.S.}$	–	–
R_4	2060	445**	385**	200**	$10^{N.S.}$	–	–	–
R_5	2050	435**	375**	190*	–	–	–	–
R_6	1860	245**	185**	–	–	–	–	–
R_1	1675	$60^{N.S.}$	–	–	–	–	–	–
R_7	1615	–	–	–	–	–	–	–

N.S. = Non-significant, ** = Significant at 1% level, * = Significant at 5% level.

33% fish meals were replaced by low phytate-DMSM (Table 2). The mortality (5%) observed in chicks fed on standard (R_1) and experimental rations (R_7) within the first week of feeding was not due to toxicity of the ration but due to hatchery defect.

The results confirmed that the nutritive value of low phytate-DMSM was comparable to blood and fish meals available in the market. On the basis of feeding trials on broilers, it is concluded that proper detoxification of mustard/rape seed cake, an agro-industrial waste, would provide 100,000 metric tonnes of additional protein annually which can help to substitute costly and scarcely available vegetable and animal protein sources for poultry ration.

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