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EFFECT OF SODIUM CARBONATE TREATMENT AND AUTOCLAVING ON THE NUTRITIVE VALUE OF RAPESEED MEAL IN BROILER FEEDS

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Rapeseed meal was treated with sodium carbonate or autoclaved to detoxify glucosinolates. Treated meals were used at 5 or 10% level along with similar levels of untreated control in broiler starter and finisher rations. The birds fed on rations containing sodium carbonate-treated meal showed the highest weight gains, followed by those fed on rations containing autoclaved meal and untreated control. Feed consumption and feed: weight gain ratio followed the same trend. The effect of treatment was non-significant on internal organs (heart, gizzard, liver). However, the weight of thyroid gland was significantly higher in birds fed untreated meal.

Key words: autoclaving, broiler feeds, nutritive value of rapeseed meal

INTRODUCTION

Rapeseed is one of the major oilseed crops of Pakistan and many other tropical countries. After the extraction of oil, the residual meal is mostly used in poultry feeds. However, its use is limited due to 'Goitrin', a sulfur containing glucoside which has goitrogenic effect on poultry (Faiman et al., 1967). Attempts have been made to detoxify the meal through expelling, solvent extraction and pre-pressed cum solvent extraction (Khan, 1990), ferrous sulfate treatment (Bell et al., 1971; Malik and Chughtai, 1979) or sodium carbonate treatment (Mustakas et al., 1968). Detoxification of meal with 3.8% sodium carbonate destroy thioglucosides, improve the acceptability and reduce the sinapine content from 0.5% in seed to below 0.05% in treated meal (Mustakas et al., 1968). Successful detoxification of rape seed meal seems promising for its commercial exploitation in terms of larger proportions of its use in poultry rations. The study under report was conducted to determine the effect of sodium carbonate treatment or autoclaving on the glucosinolate content of meal and inclusion of this meal in broiler rations.

MATERIALS AND METHODS

Rapeseed meal was subjected to sodium carbonate treatment or autoclaved before use in broiler ration. Sodium carbonate treatment was done by the method of Mustakas et al. (1968). Thirty-eight grams Na2COa were dissolved in 271 ml distilled water and sprinkled on one kg rapeseed meal. After thorough mixing, the meal was spread in trays in about 2 cm thick layer, to facilitate steaming. The meal was then cooked for 40 minutes under 6 PSI pressure at 110°C. It was then dried in an oven at 70 °C till its original weight was attained.

Autoclaving of meai was done by the method of Malik et al. (1967). The meal was mixed with water in the ratio of 4:1 i.e. one kg of meal in 250 ml water. It was then autoclaved for 30 minutes at 15 PSI pressure at 120°C , and dried in an oven at 70 °C till its original weight was attained. Allyl-thiocyanate (AOAC, 1984), thioglucosides (McGhee et al., 1965) and glucosinolate (Van Etten et al., 1974) contents of autoclaved and sodium carbonate-treated and untreated meal were determined.

Six experimental rations (A, B, C, D, E and F) were formulated using 5 or 10 % untreated, autoclaved or sodium carbonate-treated rapeseed meal along with other feed ingredients of known composition. Proximate composition of the rations was determined by the method of AOAC (1984). One hundred and eighty day-old broiler chicks of mixed sexes were randomly divided into 18 experimental units of 10 chicks each. Each of the ration was randomly allotted to 3 units of 10 chicks each. The starter rations, containing 23% protein with about 3000 Kcal/kg ME (Table 1) were fed during the first 4 weeks, while the finisher rations, containing 20% protein and nearly 3000 Kcal/kg ME (Table 2) were fed during the subsequent 2 weeks.

Feed and water were provided *ad libitum* and the birds were raised under standard managemental conditions. During the experiment, weekly weight gains of individual birds were recorded and feed consumption was recorded on unit basis. Feed: gain ratio was worked out. At the end of the experiment two birds from each replicate unit ware picked up randomly and slaughtered to get the weights of

Table 1. Composition of broiler starter rations

Ingredients (%)	Rations					
	A	B	C	D	E	F
Corn	27	27	27	27	27	27
Rice broken	13	10.9	13	10.9	13	10.9
Rice polish	10	10	10	10	10	10
Cottonseed meal	8	8.5	8	8.5	8	8.5
RSM untreated	5	10	-	-	-	-
RSM autoclaved	-	-	5	10	-	-
RSM Na_2CO_3 treated	-	-	-	-	5	10
Soybean meal	10	5	10	5	10	5
Guar meal	4	3.5	4	3.5	4	3.5
Corn gluten 30%	1.4	3	1.4	3	1.4	3
Corn gluten 60%	6.5	7.25	6.5	7.25	6.5	7.25
Fish meal	8	8	8	8	8	8
DCP	1	1	1	1	1	1
Limestone (ground)	1	0.75	1	0.75	1	0.75
Soybean oil	2.5	2.5	2.5	2.5	2.5	2.5
Molasses	2	2	2	2	2	2
Lysine	0.1	0.1	0.1	0.1	0.1	0.1
Vit. Min. premix	0.5	0.5	0.5	0.5	0.5	0.5
Nutrients						
Crude protein (%)	23.06	23.02	23.06	23.03	23.06	23.03
[illegible]	[illegible]	2994	2996	2994	2996	2994
Calcium (%)	1.08	1.03	1.08	1.03	1.00	[illegible]
Phosphorus (%)	0.45	0.45	0.45	0.45	0.45	0.45
Lysine (%)	1.09	1.05	1.09	1.05	1.09	1.05
Methionine (%)	0.64	0.65	0.64	0.65	0.64	0.65

Table 2. Composition of broiler finisher rations

Ingredients (%)	Rations					
	A	B	C	D	E	F
Corn	25	25	25	25	25	25
Rice broken	24.7	23.15	24.7	23.5	24.7	23.15
Rice polish	8	8	8	8	8	8
Cottonseed meal	4	4	4	4	4	4
RSM untreated	5	10	-	-	-	-
RSM autoclaved	-	-	5	10	-	-
RSM Na_2CO_3 treated	-	-	-	-	5	10
Soybean meal	10	5	10	5	10	5
Guar meal	3	4	3	4	3	4
Corn gluten 30%	2	2	2	2	2	2
Corn gluten 60%	3.2	4	3.2	4	3.2	4
Fish meal	8	8	8	8	8	8
DCP	1	1	1	1	1	1
Limestone (ground)	1	0.75	1	0.75	1	0.75
Soybean oil	2.5	2.5	2.5	2.5	2.5	2.5
Molasses	2	2	2	2	2	2
Lysine	0.1	0.1	0.1	0.1	0.1	0.1
Vit. Min. premix	0.5	0.5	0.5	0.5	0.5	0.5
Nutrients						
Crude protein (%)	20.01	20.01	20.01	20.01	20.01	20.01
Metab. energy (Kcal/kg)	2996.19	2995.49	2996.19	2995.49	2996.19	2995.49
Calcium (%)	1.08	1.03	1.08	1.03	1.08	1.03
Phosphorus (%)	0.44	0.44	0.44	0.44	0.44	0.44
Lysine (%)	0.99	0.96	0.99	0.96	0.99	0.96
Methionine (%)	0.56	0.57	0.56	0.57	0.56	0.57

heart, gizzard , liver and thyroid gland. The data thus collected were subjected to analysis of variance technique in completely randomized design with 3x2 factorial arrangement of treatments. The comparison of means was done by Duncan's multiple range test (Steel and Torrie, 1981).

RESULTS AND DISCUSSION

Both sodium carbonate treatment and autoclaving of rapeseed meal had a considerable effect on toxic principles of rapeseed meal. Particularly the Na_2CO_3 was more effective than autoclaving in decreasing allyl-thiocyanate and glucosinolate content of the meal (Table 3).

Table 3, Effect of treatment on toxic principles In rapeseed meal

Toxic principle	Treatment		
	Un-treated	Na2C03 treated	Auto-claved
Allyl-thiocyanate (mg/g)	1.29	0.51	0.76
Thiog'lucosides(%)	9.17	8.23	8.91
Glucosinolates (~mole/g)	23.17	9.61	14.80

Liu et al. (1994) reported that allyl-thiocyanate content of rapeseed cake was reduced by 60% after heating 'at 100-HO°C for 60-80 min and reduced by 95% on addition of 2-3% Na_2CO_3. Rapeseed cake contained more allyl-isothiocyanate than rapeseed meal (Liu et al., 1993) because during solvent extraction of rapeseed, considerable quantities of toxic substances are degraded (Schone, 1995) while expeller extracted rape seed cake has more of the toxic substances (McGhee et al. , 1965; Khan, 1990). The effect of feeding rations containing untreated, Na_2CO_3 treated or autoclaved rapeseed meal on growth rate, feed consumption and feed: gain ratio of broilers, during 6 weeks experimental period, have been summarized in Table 4.

Table 4, Effect of treated meal on weight gain, feed consumption and feed : gain ratio of birds

Parameters	Treatment means		
	Un-treated	Na2COa treated	Auto-claved
Weight gain/bird (kg')	1.496 c	1.692"	1.580b
Feeli consumption/bird (kg)	3.219 c	3.469"	3.300 b
Feed: Gain ratio	2.153"	2.050c	2.090b

Mean values with different superscripts in a row represent significant (p<O.Ol) difference.

Average total weight gain per bird fed on rations A, B, C, D, E and F was found to be 1497, 1494, 1582, 1578, 1693 and 1692 g, respe'ctively. The differences between 5 or 10% level of untreated or treated rapeseed meal were non-significant. However, those fed on ration containing Na_2CO_3 treated meal gained the highest weight (P<O.Ol) followed by those fed on ration containing autoclaved meal or untreated control. Average total feed consumption per bird fed on respective rations was 3232, 3206, 3326, 3274, 3463 and 3474 g. Again the differences between the levels of "rapeseed meal used were not significant and the pattern of results was similar to weight gain, the highest being on rations that led to the highest weight gains. Feed: gain ratio in respect of birds fed on different rations also followed the same trend.

Less feed intake by the birds fed on rations containing untreated rapeseed meal may be attributed to high concentration of allyl-isothiocyanate and glucosinolates which reduce feed intake and weight gain (Richter et al., 1996) due to impaired iodine metabolism and thyroid function (Schone, 1995). When rapeseed meal was treated with Na_2CO_3 or autoclaved and then added at the same level, toxic effects of these antinutritional factors were minimized and the performance of the birds was improved: A number of physical and chemical treatments, including heating (Grala et al., 1994) without or with chemical additives and aqueous extraction (Liu et al., 1994) have been recommended to minimize the toxic effects of antinutritional factors. In this study both the treatments of rapeseed meal, with Na_2CO_3 or autoclaving proved satisfactory but the former was comparatively better in minimizing the antinutritional factors and ultimately improving the performance of the birds. It could be that during this treatment some moisture was induced and during cooking under pressure, steam was produced which further improved nutritive value of the meal as claimed by Rotkiewicz (1991).

It may be seen from Table 5 that mean weights of the internal organs viz. heart, gizzard and liver, expressed as g % of dressed carcass, did not vary due to treatment of rapeseed meal. However, the weight of thyroid gland, expressed as mg % of dressed carcass was considerably high (P<O.Ol) in birds fed untreated meal, while the lowest weight (P<O.Ol) was in Na_2CO_3 treated meal group. The use of rapeseed meal, beyond certain limits, results in

Table 5. Effect of treated meal on organ weraiht ofb"rrds

Organ wt, g 1100 g carcass	Treatment means		
	Untreated	Na2C03 treated	Autoclaved
Heart	0.805	0.780	0.800
Gizzard	2.75	2.75	2.77
Liver	4.27	4.34	4.51
Thyroid (mg-/100 g)	28.22[a]	22.09[c]	24.18[b]

Mean values with different superscripts in a row represent significant (p<O.Ol)differences.

enlargement of thyroid gland with depressed function and decreased growth (Khan, 1990). Even the inclusion of Swedish low glucosinolate rapeseed meal at 12 to 20% level increased the weight of thyroid gland (Elwinger and Saterby, 1986). However, Na2COa treatment largely removed the toxic factor responsible for enlargement of thyroid gland (Mustakas et al., 1968) and ultimately the performance of the birds was improved. It may be stated that inclusion of rapeseed meal in broiler ration at higher levels is possible, provided it is treated with Na2C03 or autoclaved before adding to the rations.

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