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UTILIZATION OF RAPESEED MEAL/CAKE IN POULTRY FEED. *PART II.* EFFECT OF INCORPORATING HIGHER LEVELS OF RAPESEED CAKE IN POULTRY DIET ON LAYING PERFORMANCE OF BROWN-EGG LAYER (TETRA SL)

Amal Badshah*, Aurang Zeb, Nizakat Bibi, Sajjad Ali, M A Chaudry and A Sattar

Nuclear Institute of Food and Agriculture (NIFA), Tarnab, Peshawar, Pakistan

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An experiment was conducted to see the effect of higher levels of rapeseed cake (15, 20 and 25%) in poultry diet on the performance of laying hen (Tetra SL). All the diets were isocaloric (within the range of 319 to 321 kcal 100 g^{-1}), isoproteinacious (17.19 to 17.31%) and the fibre contents were within the recommended range (2.98 to 3.52%). The experiment was of 28 days duration. Egg size was maximum for the 20% repeseed cake group (62.25g) followed by the 25% group (61.24 g) and minimum for 15% rapeseed cake group (58.26 g). Egg size of standard group was 58.99 g. The egg laying percentage was 60% for standard group and 59.33% for 25% rapeseed group. No difference in birds live weight was observed due to feed variation throughout the experimental period. No mortality was recorded. Organoleptic evaluation by trained judges revealed no difference in overall acceptability of eggs by all the groups.

Key words: Rapeseed meal, Poultry diet, Egg laying.

Introduction

Controversial evidence about the nutritional value of rapessed cake in poultry ration and its availability at a comparatively cheaper rate was the basis for conducting this experiment. A number of studies have been reported which show that rapeseed meal can be used in laying bird diets to replace a substantial quantity of soybean meal protein without any change in production performance (Hulan and Proudfoot 1980; Clandinin and Roblee 1983, Clandinin *et al* 1983; Summers 1983). There are also some reports which suggests that it may play a role in precipitating a fatty liver and/or haemorrhagic condition in layers (Pearson and Butler 1978; Papas *et al* 1979; Ibrahim *et al* 1980; Hulan and Proudfoot 1981). However, there are equal number of reports that indicate no liver problems with canola feeding (March *et al* 1975, Thomas *et al* 1978; Proudfoot *et al* 1983). Reduced egg size has also been reported with feeding of canola to laying hens (March *et al* 1975; Leeson *et al* 1978, Proudfoot *et al* 1982). From the results of our previous experiment (Badshah *et al* 1998) using brown-egg-layer, it was observed that rapeseed cake (RSC) at a level of 10% can be used in poultry ration to replace other expensive protein source with the improved production performance. Encouraged from these results, the level of rapeseed cake in the diet was increased up to 25% in the present study and the production performance was monitored and compared with that of standard. Increased levels of rapeseed cake in the poultry ration can greatly slash the cost of feed and hence can have great economic impact on poultry production in Pakistan.

*Author for correspondence

Materials and Methods

Rapeseed of commercial high-glucosinolate (60.85 μ mol g^{-1}) variety, Pakcheen, was obtained from the Mutation Breeding Section of the Nuclear Agriculture Division of Nuclear Institute for Food and Agriculture (NIFA), Peshawar. After cleaning, the seeds were expeller extracted and the material left after the oil extraction was used in the test diet formulations. A standard diet (without RSC) was also included for comparison. The compositions of the diets are given in Table 1. The chemical composition of ingredients used during the formulation of diets was taken from Scot *et al* (1982) and Malik and Chughtai (1979). A computer spread-sheet (Microsoft Excel-5) was developed for the formulation of the diets as well as for determining the calculated analysis of the feed. As depicted in Table 1, each of the diets used was isocaloric (calories $100g^{-1}$ ranged between 320-321), isoproteinacious (17.19-17.31%) and their fibre content ranged between 2.98-4.35%. Assay for total glucosinolates was carried out according to the method of DeClercq and Daun (1989).

Thirty four-weeks-old hens from our previous experiment were given ten days washout period by feeding them on standard diet and then divided into four groups each replicated three times. Every group had five birds per group and were caged separately. As for the previous experiment, the size of the cage

was 0.6 x 1.2m. The birds were maintained on natural day light condition throughout the experiment. The data given in this experiment pertains to the month of January, when the duration of the natural day light was about 11 h. Three groups of hens were fed on test diets and one group was maintained on standard ration. The RSC groups were observed for live weight (gain/loss), egg size, production and egg quality and compared with the standard group for a period of 28 days. Physical properties of eggs were determined and analysis for protein and moisture content was performed.

For the determination of egg size, average weight of all the eggs produced per group in 28 days was taken. To determine the proportion of different physical contents of eggs and protein and moisture contents, three eggs per group of the last day of the experiment were taken.

Sensory and statistical evaluation. Egg samples from RSC and standard groups were boiled, deshelled and then presented under code numbers to a panel of 9 judges trained on the subject and to whom the phenomenon of off flavour production was explained. The samples were scored on 1-10 scale for flavour, with 1 extremely disliked and 10 extremely liked (Larmond *et al* 1980). The data were statistically evaluated by the analysis of variance using co-state package and means were compared using DNMRT.

Results and Discussion

The incorporation of rapeseed cake up to 25% in layer ration had no effect on live weight (gain/loss) and mortality as recorded for the subject- layer. The results (Table 2) showed maximum egg size in 20% RSC group (62.25 g) followed by 25% RSC group (61.24 g) and minimum size in 15% RSC group (58.26 g) while egg size for the standard group was 58.99 g. Egg production was recorded 60% for standard group and 59.33% RSC group. Laying performance of the other two groups were also comparable to that of the standard group. Interestingly, organoleptic quality checked through several experienced judges revealed no difference in overall acceptability of eggs from all the groups (data not given).

As for the physical properties of egges from hens receiving different levels of RSC, a significant ($p>0.05$) increase in the proportion of egg-white and decrease in that of egg yolk as a result of feeding on increased levels of RSC was observed. These changes seemed to be dose dependent and related to the inclusion of rapeseed cake in the diet. A decrease in moisture content (though very small) and protein content (a clear cut pattern) of egg white with the increased levels of RSC in diet (Table 3) was also noted. The moisture and protein contents of egg yolk were not influenced by RSC inclusion in ration.

Presently, the use of rapeseed meal or cake (with high glucosinolates) is subject to severe criticism in several published works. Vogt *et al* (1969 a & b) reported that with 10% rapeseed meal (glucosinolate content 0.92%) in the diet, there was a 15% reduction in the egg production, 8% lower feed conversion efficiency and 11% reduced feed intake, whereas with 20% rapeseed meal in the diet, there was 23% reduction in egg production and 26% lower feed efficiency. He also reported decreased egg quality with respect to smell and taste. The reduced performance of laying hens was attributed to the glucosinolates in the rapeseed meal. These results were quiet contradictory to our findings and to those of Summers *et al* (1971 a & b) who carried out work to see the comparative effect of feeding rapeseed meal and soybean meal on layer performance. These authors established that the poor performance of rapeseed meal-fed group was related to the amino acid imbalance in rapeseed protein rather than to some antinutrients. Although a glucosinolates threshold does not seem to have been established for layers, however in the case of broilers it was reported that depression in growth of broiler chicks fed on rapeseed meal was related to the total content of glucosinolates in the diet (Zeb *et al* 1999). It can be noted that the glucosinolate contents of all the test rations

Table 1
Composition of layer diets (%)*

Ingredients		Rapeseed cake diets		
(%)	Standard	15%	20%	25%
Wheat	38.00	38.00	38.00	15.00
Maize	19.00	15.00	14.00	37.00
Rice polishing	5.00	10.00	10.00	5.00
Wheat bran	5.00	-	-	-
Fish meal	4.00	3.00	1.00	2.00
Blood meal	3.00	2.00	1.00	-
Cotton seed cake	5.00	-	-	-
Corn glutin (60%)	4.00	-	-	-
Molasses	5.00	5.00	5.00	5.00
Meat meal	3.00	3.00	2.00	2.00
Rapeseed cake	-	15.00	20.00	25.00
Dicalciumphosphate	2.00	2.00	2.00	2.00
Limestone	7.00	7.00	7.00	7.00
Total	100.00	100.00	100.00	100.00
Crude protein %**	17.20	17.23	17.19	17.31
ME (Kcal/100g)	320.75	319.71	321.79	320.30
Fibre %	2.98	3.52	3.97	4.35
Glucosinolates(###g/g)	0.00	9.12	12.16	15.2

* To each 100 kg of diet 250g vitamineral mixture was added. The Vitamin-mixture provided per kg of the diet:- 11022 iu Vitamin A, 1100 iu vitamin D3, 11 iu vitamin E, 2.25 mg Vitamin K, 2.25 mg thiamine, 4.5 mg riboflavin, 14.25 mg pantothenic acid, 32.5 mg nicotinic acid, 4.5 mg pyridoxine, 1.25 mg folic acid, 0.25 mg biotine, 1322.5 mg choline, 55 mg Mn, 550 mg Mg, 87.5 mg Fe, 11 mg Cu, 44 mg Zn, 0.25 mg Se and 0.25 mg I.
** Calculated analysis.

Table 2
Effect of feeding different levels of rapeseed cake in the diet on production performance of brown egg layer (Tetra SL)

Groups	Live weight record		Production performance	
	Initial weight (kg)	Final weight (kg)	Egg size (g)	Production (%)
Standard	1.95a	1.98a	58.99bc	60.00a
15% RSC	1.98a	1.93a	58.26c	58.50a
20% RSC	1.98a	1.96a	62.25a	59.25a
25% RSC	1.99a	1.95a	61.24ab	59.33a

Values in the same column followed by different letters are statisticallydifferent ($p<0.05$) from each other.

Table 3
Physical properties of eggs of brown layer receiving different levels of rapeseed cake in their diet

Groups	Egg weight (g)	Egg white (%)	Egg yolk (%)	Egg shell (%)
Standard	60.13	56.99b	29.65a	13.09b
15% RSC	59.90	58.43a	28.55b	12.64c
20% RSC	67.00	57.81ab	28.10c	13.63a
25% RSC	63.55	58.49a	27.02d	12.02d

Average of three determinations.
Values in the same column followed by different letters are statisticallydifferent ($p<0.05$) from each other.

Table 4
Protein and moisture contents of egg white and yolk of brown layer receiving different levels of rapeseed cake in their diet

Groups	Egg white		Egg yolk	
	Moisture (%)	Protein* (%)	Moisture (%)	Protein* (%)
Standard	86.07a	78.41a	50.29b	48.67c
15% RSC	85.49b	77.42b	44.08d	59.73a
20% RSC	84.84c	76.89c	48.49c	51.45b
25% RSC	84.79c	71.44d	53.00a	48.21c

*Moisture free basis.
Values in the same column followed by different letters are statisticallydifferent ($p<0.05$) from each other.

ranged from 9 to 15 μg g^{-1}. These authors proved that the effect of glucosinolates on broiler's growth was not a linear rather a polynomeal phenomenon; where the threshold lies at 9-10 μg of glucosinolates per gram of feed. O'Neil (1957) reported that rapeseed meal could replace all of the soybean meal in a diet containing 3% animal protein without any detrimental effect on production and hatchability of eggs from laying breeders. McGregor and Blakely (1964) and Robblee and Clandinin (1967) observed no adverse effect on the performance of turkey breeder flock using 10% rapeseed meal in their ration.

It is concluded from the experiment that RSC, having glucosinolate content in the range of those used in the present study, can be used safely upto a level of 25% without any adverse affect on the production performance of the breed used. However, further experiments are needed to confirm the results.

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