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Research Article

EFFECT OF FEEDING OF RAPESEED MEAL IN LAYER TYPE CHICKEN

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ABSTRACT
Biological trial was conducted on layer chicken to assess the feeding value of rapeseed meal (RSM) and the effect of different kinds of treatments of RSM or supplementations to RSM. In the trial involving layers, RSM inclusion at 10 or 15% was found to result in poor egg production and numerically poor feed efficiency values which got accentuated over time indicating a cumulative toxic effect of RSM on the above parameters. Egg weight, shell thickness and yolk index were affected adversely only upon 15% RSM inclusion while albumen quality started showing deterioration at 10% RSM inclusion itself. Supplementations with potassium iodide, enzymes or amino acids were helpful in arresting the depressing effect of RSM on egg production and feed efficiency. However, such supplementations varied in their influence towards maintaining egg quality characteristics.

Key Words: *Rape seed meal – Effect of feeding – Layers*

INTRODUCTION
Over the last decade, poultry population has shown spectacular growth throughout the world showing an increase of 23 per cent in developed countries and 76 per cent in developing countries. Feed constitutes nearly 70 per cent of total production costs in poultry. In the ever growing demand for feed ingredients, the cheaper and alternate source of feed and feed ingredients that do not compete with human food, enhancement of its feeding value and amelioration of feed toxicants in it need to be established.

Of the many plant protein sources, deoiled groundnut cake (GNC) is the one most commonly used poultry feed ingredient in India. Though high in protein, GNC is a poor source of essential amino acids particularly lysine and methionine. GNC is invariably infested with *Aspergillus* sp. under favourable conditions produce aflatoxins that are potent carcinogens and toxic to poultry.

A suitable alternate to GNC in poultry feeding, therefore needs to be identified and under the circumstances deoiled rapeseed meal (RSM) appears to be a potential source for replacing GNC in poultry rations. In common industrial processing, the oil is extracted using organic solvent (hexane) to effect maximum extraction. It is commonly employed as a protein supplement in the concentrate mixtures for the large farm livestock. The use of RSM in poultry feeding is limited by the presence of certain antinutritional substances. Efforts have been focused on reducing the two toxic components glucosinolates (GSLs) and erucic acid (EA) in the rapeseed by plant breeding methods. New double zero varieties of rapeseed with GSL level of less than 50 μmol and low EA contents are now available.

In perspective, therefore, it has been proposed to investigate the effect of feeding rapeseed meal at varying levels replacing deoiled groundnut cake on the performance of layers.

MATERIALS AND METHODS
Deoiled rapeseed meal samples collected from various commercial livestock and poultry feed manufactures at Namakkal, TamilNadu, India were analysed for their proximate composition, mineral profile, amino acid assay and some of the toxic principles like tannin and glucosinolates at various laboratory units of Tamil Nadu Veterinary and Animal Sciences University and Central Institute of Brackish water Aquaculture (CIBA), Chennai, India.

Amino acids lysine and methionine were supplemented in layer ration at the concentration of 0.325 and 0.125 g/kg of feed respectively for 10% RSM inclusion and 0.500 and 0.200 g/kg of feed respectively for 15% RSM inclusion. Per cent ingredient and chemical composition of layer ration provided in this research was presented in Table 1.

Table 1: Per cent ingredient and chemical composition of Layer ration

	Level of RSM (Per cent)		
Ingredient Composition	**0**	**10**	**15**
Maize	29	36	31
Cumbu (Pearl millet)	34	23	28
Rice polish	5	5	4
SBOC	3	11	7
GNC	15	---	---
RSM	**---**	**10**	**15**
Dry fish	5	6	6
Shell grit	6	6	6
Mineral and Vitamin mixture*	3	3	3
Chemical Composition Per cent (Calculated)			
Crude Protein	18.20	18.00	18.02
Lysine	0.79	0.96	0.94
Methionine	0.31	0.37	0.38
Calcium	3.35	3.52	3.56
Available Phosphorus	0.38	0.48	0.51
ME (Kcal/kg)	2551	2581	2526

** Supplied by M/S Sarabhai Chemicals, Vadodara 390 007 Each 250g contains 75g calcium, 2.75g manganese, 0.1g iodine, 0.75g iron, 1.5g zinc, 0.2g copper, 0.45g cobalt, 5 lacs I.U. vit. A, 1 lac I.U. vit. D_3, 0.2g vit. B_2, 75 I.U. vit. E, 0.1g vit. K, 0.25g calcium pantothenate, 1g nicotinamide, 0.6 mg vit. B12, and 15g choline chloride.*

Common salt was not added to the diet as the salted dry fish was incorporated in the ration.

The experimental birds were housed in individual cages and offered *ad libitum* wholesome drinking water and respective experimental diets from 45 to 56 weeks of age. They were conditioned with the experimental diets for 10 days before the start of the experiment. The birds were provided with uniform photoperiod of 16 hours including daylight. Other managemental practices followed were uniform for all the treatments.

Individual body weight of all experimental birds at 45 weeks of age and 56 weeks of age were recorded. Feed consumed and the number of eggs laid by each replicate during each 28-day period was recorded. From these data, hen day egg production percentages and feed intake, feed efficiency as kilogram feed / dozen of eggs and kilogram feed / kilogram eggs were worked out.

At the end of each 28 days laying period, all the eggs laid for three consecutive days were collected, weighed individually to 0.5 g accuracy and analysed for egg quality studies, shape index, shell thickness, albumen index, haugh unit, yolk index and yolk colour. The performance of layers with the relative economical benefits after inclusion of RSM at different levels in poultry rations was estimated.

The data obtained in this research trial were subjected to statistical analysis for significance, according to the method of Snedecor and Cochran (1989).

RESULTS

Performance of Layers Fed RSM

Effect of inclusion of RSM as raw or supplemented with potassium iodide, enzymes or amino acids in layer diets was studied. Mean layer performance in terms of hen day egg production of layers fed raw or supplemented RSM at 10 or 15% levels in their feed as shown in table 2

Table 2: Hen day egg production (%) of layers fed RSM

Treatment	Hen day egg production (Mean ± SE)			
	Period I	Period II	Period III	Over all
T1 0% RSM	$80.16^{A} \pm 1.79$	$80.36^{A} \pm 2.52$	$81.76^{A} \pm 2.12$	$80.75^{A} \pm 1.24$
T2 10% RSM	$77.78^{ABC} \pm 1.94$	$73.24^{BC} \pm 2.18$	$64.51^{EF} \pm 2.21$	$71.84^{DE} \pm 1.41$
T3 10% RSM + POI	$80.95^{A} \pm 1.95$	$77.56^{AB} \pm 2.13$	$71.41^{CD} \pm 2.00$	$76.64^{BC} \pm 1.20$
T4 10% RSM + ENZ	$77.58^{ABC} \pm 2.22$	$77.36^{AB} \pm 1.73$	$78.77^{AB} \pm 1.15$	$77.77^{AB} \pm 1.15$
T5 10% RSM + AAS	$80.33^{A} \pm 2.02$	$80.36^{A} \pm 2.22$	$75.99^{BC} \pm 2.39$	$78.89^{AB} \pm 1.31$
T6 15% RSM	$75.00^{BC} \pm 1.53$	$68.06^{C} \pm 2.40$	$60.91^{F} \pm 1.53$	$67.99^{F} \pm 1.24$
T7 15% RSM + POI	$80.74^{A} \pm 2.15$	$76.17^{AB} \pm 2.10$	$73.04^{CD} \pm 2.13$	$76.65^{BC} \pm 1.36$
T8 15% RSM + ENZ	$74.21^{C} \pm 2.01$	$72.02^{BC} \pm 2.42$	$67.86^{DE} \pm 2.59$	$71.36^{EF} \pm 1.37$
T9 15% RSM + AAS	$79.34^{AB} \pm 1.76$	$74.01^{B} \pm 2.29$	$71.23^{D} \pm 1.94$	$74.86^{CD} \pm 1.26$

A-F Means within a column with no common superscripts differ significantly at P<0.01
(RSM: Rapeseed meal, POI: Potassium Iodide, ENZ: Enzymes, AAS: Amino acids)

Inclusion of raw RSM at both 10 and 15% levels in layer diets in place of GNC had resulted in significantly ($P < 0.01$) poor egg production for all the first, second and third 28 day periods, also in the overall values for the three periods of study as compared to the control diet. All the groups produced less than the control group. Supplementation of potassium iodide, enzyme or amino acids, all three were found to alleviate the depressing effect of RSM on egg production partially.

Feed Intake

Table 3 gives mean feed intake values of layers per day as influenced by different levels of inclusion of RSM with or without supplementation. There were no significant differences in mean feed intake per day of layers under different treatments. However, marginal reduction in per day feed consumption was noticed upon inclusion of raw RSM at 10 or 15% level in layer diets compared to control group.

Table 3: Feed intake (g) per day per bird of layers fed RSM

Treatment	Feed intake (Mean ± SE)			
	Period I	Period II	Period III	Over all
T1 0% RSM	96 ± 0.34	101 ± 0.87	103 ± 1.72	100 ± 0.97
T2 10% RSM	95 ± 2.25	100 ± 0.30	99 ± 0.79	98 ± 0.87
T3 10% RSM + POI	98 ± 2.80	101 ± 1.39	102 ± 1.76	100 ± 1.60
T4 10% RSM + ENZ	96 ± 1.98	101 ± 1.14	103 ± 0.65	100 ± 0.37
T5 10% RSM + AAS	102 ± 0.97	101 ± 0.99	103 ± 0.36	102 ± 0.43
T6 15% RSM	92 ± 2.50	100 ± 1.65	102 ± 0.69	98 ± 1.36
T7 15% RSM + POI	101 ± 2.83	102 ± 0.69	104 ± 1.20	102 ± 0.99
T8 15% RSM + ENZ	95 ± 1.69	103 ± 0.55	104 ± 1.04	101 ± 0.79
T9 15% RSM + AAS	97 ± 2.94	100 ± 2.39	101 ±1.47	99 ± 1.97

Feed Cost and Feed Efficiency

Feed cost (Rs) required to produce one dozen of eggs under different treatments indicated that it remained the lowest for the control group without RSM inclusion, highest in raw RSM 10 % and 15 % diets. Mean feed efficiency (per dozen eggs) of layers of different treatment groups in this trial clearly show that feed efficiency values for all three periods and pooled values did not evince any significant differences between treatment groups even upon inclusion of RSM at 15%. The efficiency of feed utilization for egg production was the best when RSM was not included in layer ration and inclusion of RSM at both 10 and 15% levels in place of GNC reduced feed efficiency of layers fed such diets. Supplementation of potassium iodide, enzymes or amino acids resulted in improving feed efficiency to a great extent at 10% RSM inclusion and moderately at 15% level of inclusion of RSM. Even though differences between treatment groups did not appear significant, very poor feed efficiency upon inclusion of raw RSM at 10 or 15% levels in place of GNC in layer diets. Enzyme supplementation helped in salvaging efficiency of feed utilization both at 10% and 15% RSM inclusion to a great extent.

Egg Weight

Significant differences were observed in mean egg weight values at all the three periods between treatment groups. Pooled mean for the three periods indicated that enzyme supplementation to 15% RSM inclusion resulted in significantly ($P < 0.01$) better egg weights than even the control group. Further, mean egg weights appeared to increase with increasing duration of usage of feed with RSM.

Livability (%) and Shape Index

Livability (%) was observed to be 100% in all the treatments during the period under study. Overall egg shape index values did not differ between treatments tried in this research trial. The values ranged between 73.70 for T3 (10% RSM with potassium iodide supplementation) and 75.21 for T6 (15% raw RSM inclusion).

Egg Taint and Shell Thickness

Tainting of eggs was observed only in T6 birds fed raw RSM at 15% inclusion level during period III to an extent of 16%. Mean shell thickness values did not differ significantly between treatment groups during the first two periods. However, the same differed significantly ($P < 0.05$) during the 3rd period. Egg shell thickness was found to go down significantly when RSM inclusion level in place of GNC was increased from 10 to 15%. During the third period, eggs in 15% RSM with enzyme supplementation had significantly higher shell thickness.

Albumen Index and Yolk Index

Overall mean albumen index values pooled over three periods indicated that albumen quality deteriorated significantly ($P <0.01$) upon RSM inclusion at 10 or 15% compared to the control group. Amino acids supplementation was helpful to sustain the same to some extent only at 10% RSM inclusion. At 15% RSM, none of the supplementations tried in the experiment could halt the deterioration of albumen quality significantly.

Yolk quality as evidenced by mean yolk index values showed significant differences between groups. Overall means for Yolk index varied between 0.429 for T8 (15% RSM with enzyme supplementation) and 0.408 for T6 (15% raw RSM). Hence, RSM inclusion was found to affect yolk quality at 15% level and enzyme and potassium iodide supplementation did help in sustaining the same at that level of RSM inclusion.

Haugh Unit and Yolk Colour

Assessment of albumen quality through mean Haugh Unit values for different treatments also revealed that the same deteriorated down significantly ($P < 0.01$) when raw RSM was included at 15% compared to control group.

Mean yolk colour values obtained for different treatments were influenced significantly ($p < 0.01$) and that yolk colour was the darkest upon 15% RSM inclusion with amino acids supplementation. All

treatment groups fed diets with RSM generally gave better yolk color values compared to the control group.

DISCUSSION

Egg Production

Enzyme and amino acids supplementations were more effective with 10% RSM inclusion and not so effective with 15% RSM inclusion. The findings in this study corroborate those of Campbell (1977) and Ibrahim (1978). Richiter *et al*. (1996) reported that egg production was adversely affected by inclusion of RSM in layer diets even though Thomas *et al.* (1978) could not observe any reduction in egg production consequent to RSM inclusion in layer rations. The variations observed could be because of varying levels of toxic principles like glucosinolates and tannin etc., present in the RSM samples employed in respective experiments. Banday *et al.* (2000) indicated that iodine supplementation was effective in ensuring normal thyroid function and offset the toxic effects of glucosinolates.

Feed Intake and Feed Efficiency

Eventhough significant differences in mean feed intake per day were not noticed among layers of different treatment groups, numerical differences showed a consistency in that compared to control and various groups. Groups fed raw RSM at 10 or 15% levels had shown comparatively lesser feed intake per day. The findings support those made by Das and Ali (1993) and Richiter *et al.* (1996).

Poor feed efficiency observed in layers upon inclusion of RSM might be because of poor protein/ amino acid availability (Sauer *et al..,* 1982 and Nerilo *et al.,* 1996), or toxic factors like glucosinolates and tannin in RSM (Bell, 1993 and Jamroz, 1995). Supplementation of potassium iodide might have helped to offset the toxic effects of glucosinolates while enzyme and amino acid supplementations would have ensured better digestibility/availability of protein and amino acids.

Egg Weight

Enzyme supplementation was found to improve egg weight even over and above control group. Amino acids supplementation was found useful in alleviating egg size loss partially at 15% RSM inclusion while potassium iodide supplementation was not found effective both at 10% and 15% RSM inclusion.

Shape Index and Shell Thickness

Toxic principles in RSM were not found to influence shape index of eggs. Mean shell thickness during first and second period egg production did not differ among themselves. But during the third period, eggs in 15% RSM with enzyme supplementation had significantly higher shell thickness. Further, RSM itself is considered to be a fairly good source of minerals (Clandinin *et al.,* 1976 and Bell, 1984) and these would have also contributed to better eggshell thickness. However, the same quality could not be maintained at 15% RSM inclusion. Angelovicora *et al.* (1995) also reported that egg shell thickness was not affected by the presence of rapeseed meal in layer diets up to 10%.

Albumen Index and Yolk Index

Only amino acids supplementation to 10% RSM included diet could bring about some improvement in albumen quality suffered by RSM inclusion. Potassium iodide and enzyme supplementation were not so effective.

Mean Yolk index values also differed significantly ($P < 0.01$) between treatments with the groups fed diets with 15% raw or amino acids supplemented groups showing the poorest yolk index values. Yolk quality was not found to be affected upto 10% RSM inclusion in layer diets while at 15% RSM inclusion, Potassium iodide and enzyme supplementation were effective in maintaining Yolk quality, amino acids supplementations was not helpful. Richiter *et al.* (1996) indicated the possibility of changes in fatty acid profile of egg yolk consequent to RSM inclusion in layer diets.

Haugh Unit and Yolk Colour

The differences in mean albumen index and Haugh unit values between treatments were found to be significantly high ($P < 0.01$). Richiter *et al.* (1996) reported that RSM indeed reduced Haugh Units of eggs.

Yolk colour of eggs produced by birds fed diets with 10% potassium iodide supplemented RSM and 15% amino acids supplemented RSM were found to be significantly ($P < 0.01$) better. Blair *et al.* (1975) also stated that yolk colour was improved by the inclusion of rapeseed meals. However, the same was not witnessed when RSM inclusion level in layer diets was increased to 15%.

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