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# UTILIZATION OF RAPESEED MEAL/CAKE IN POULTRY FEED. *III*. EFFECT OF INCORPORATING INCREASED LEVELS OF RAPESEED CAKE ((POST-AUTOCLAVING EXTRACTION) ON PERFORMANCE OF BROWN-EGG-LAYER (TETRA SL).

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The effect of increased levels of rapeseed cake obtained from autoclaved rapeseed on laying performance of brown-egg-layer was studied. The rapeseed cake (RSC) remaining after extraction of oil from the seed, was incorporated in layer ration at levels of 15, 20 and 25%. The birds fed on RSC diet were observed for production performance, feed intake and feed conversion ratio, liveability and egg quality parameters and then compared with birds maintained on standard ration (RSC free diet). The results indicated higher egg production in standard and 15% RSC group (61 and 60% respectively), though statistically nonsignificant, compared to the other two group (55% each). Egg size slightly decreased from 63.26g (standard group) to 59.17g (25% RSC group). Increase in the level of RSC resulted in increase in the proportion of egg white and decrease in yolk of hens fed on it. Similarly, the protein content of egg white of hen receiving 25% RSC was maximum and its yolk protein content was minimum, indicating some influence of RSC on protein biosynthesis. Organoleptic tests judge by 7 experienced persons revealed no difference in overall acceptability among different groups.

***Key words***: Rapeseed cake, Layers, Production performance, Autoclaving.

## Introduction

A series of experiments have been conducted (Badshah *et al* 1998, 1999; Zeb *et al* 1998a & b) at this Institute in an attempt to determine the production performance of poultry birds, associated with inclusion of rapeseed (solvent extracted) meal or (expeller extracted) cake in their ration. It was concluded from these experiments that rapeseed cake (RSC) could be used in the layers as well as in the broiler rations up to a level of 25% with no deterimental effect on performance. The growth and production performance at a level of 10% RSC inclusion in ration of brown-egg-layer (tetra SL) was found to be superior to that of the standard group. However, data with respect to the use of rapeseed meal/cake as source of supplementary protein for growing chickens have not been sufficiently consistent to allow definite recommendations for the use of this product. There are reports that suggest glucosinolates (Leslie and Summers 1972; Leslie *et al* 1973; Summers and Leeson 1977) and amino acid imbalance (Leslie and Summers 1975; Leslie *et al* 1976; Leeson *et al* 1976) as contributing factors in poor performance usually associated with birds fed on rapeseed, as compared to soybean meal diets. Lo and Hill (1971) found that a protein concentrate extracted from heat treated RSM (rapeseed meal) had a protein efficiency ratio and net protein utilization similar to casein when tested on mice. On the other hand, Oliver *et al* (1971) working with rats, found that only low glucosinolate RSM resulted in nitrogen retention equivalent to that of casein. Lodhi *et al* (1970) observed that nitrogen absorption was less of RSM than soybean meal for both chicks and hens. A reduction in egg weight has also been observed when laying hens were fed diets containing RSM (Summers *et al* 1971 a, b). Moran *et al* (1969) had suggested that a reduction in egg weight could be caused by an amino acid imbalance or deficiency. March and Biely (1971) showed that lysine supplementation of a wheat RSM diet significantly increased growth rate of chicks. Olomu *et al* (1974) reported an improvement in performance of chicks fed on autoclaved RSM diets supplemented with methionine and arginine but no responce to lysine supplementation. Dow and Allen (1954) substituted 17% of RSM for soybean meal in a broiler diet and obtained equally good growth with RSM and soybean meal. Collins and March (1967) similarly obtained favourable results from inclusion of upto 15% of RSC in broiler ration. Klain *et al* (1956) reported that lysine supplementation of a practically chick ration in which all the soybean meal (28% of the diet) was replaced with RSM considerably improved growth. Summers *et al* (1969) fed pullets of 8 to 22 weeks of age, diets with RSM replacement levels of 5, 10, and 15% reported that these birds gained less weight than did control birds fed a similar diet in which soybean meal supplied all the supplementary protein. March and Biely (1971) suggested that contradictory results reported in literature regarding performance of growing birds fed RSMs are due to differences in the nutritional characteristics of diets in which the meals have been tested. Thus, when RSM has been used as a supplement in high protein broiler diets, it has given favourable results. On the other hand, the growth rate on low protein diets based on wheat was very sensitive to the level of available lysine supplied by the protein supplement and additional lysine was necessary if RSC was to be satisfactorily substituted for soybean in such

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diets. Yapar and Clindinin (1972) found no significant difference in absorbability of nitrogen from the tannin containing and tannin free rations regardless of whether RSM provided a part or all of the protein in the ration. Robblee *et al* (1981) reported wide acceptance of canola meal as a feedstuff for poultry. Salmon (1979, 1982) found that as much as 450g canola meal per kg may replace soybean meal in turkey starter diets without loss of performance. March *et al* (1975) reported that in the absence of dietary antibiotic, dietary RSM like wise interacted with the intestinal microflora to affect nutrient availability to the host. The same authors, in their earlier experiments (March *et al* 1973) while working on the estimation of metabolizable energy value of RSM using chicken of different ages, found that the M E (metabolizable energy) values for RSM may differ considerably depending upon the age of the birds used in the bioassay. The values obtained with mature birds were appreciably higher then those obtained with growing chicks. In order to obtain additional information on the fate of RSM/RSC in poultry rations, the following study was undertaken which was an attempt to ascertain the most acceptable level of RSC in the diet with least detrimental effect on performance of laying hens.

## Materials and Methods

*i) Diet formulation.* Seed of Pak-Cheen variety of rapeseed *(Brassica napus)*, obtained from the Breeding Section of Nuclear Institute for food and Agriculture, was autoclaved at 121 °C and 15 PSI for 30 min. A cake obtained after the extraction of oil, was incorporated in the layer ration at a level of 15,20 and 25% of the diet. For comparison, a standard diet (without rapeseed cake ) was also included. The composition of diet with calculated analysis is given in Table 1. The chemical composition of ingredients used for formulation of diets was taken from Scott *et al* (1982) and Malik and Chughtai (1979). Calculated analysis of amino acids, also taken from Scott *et al* (1982) are given in Table 2. The amount of vitamins and minerals supplied in the rations are summarized in Table 3. All the diets used were isocaloric (calories $100g^{-1}$ ranged between 320-321), isoproteinacious (17.19-17.31%) and their fibre contents were within the recommended range (between 2.98 in standard group and 4.35 in 25% RSC groups). A computer spread-sheet (microsoft Excel-5) was developed for feed formulation as well as for determining calculated analysis.

*ii) Experimental hens.* Three replicate groups of 40 weeks old Brown-egg-layer (Tetra SL) hens were used in this experiment. Each group had five birds caged separately. The size of the cage and other experimental conditions were the same as for our previous experiments (Badshah *et al* 1998). The hens were reared on natural day light conditions throughout 28 days of the experiment. the study was conducted during the month of January and February, when the duration of the natural day light was 11-11 ½ h. All the test diet groups were studied for live weight, egg size and production; and egg quality and compared with the standard group. Some physical properties as well as protein and moisture contents of eggs were also determined.

*iii) Sensoric and statistical evaluations*: Boiled and deshelled eggs from RSC group and the standard groups were presented to 7 persons trained on the subject and to whom the phenomena of off flavour production was explained. The samples were judged on 1-10 scale for flavour and taste, with 1 extremely disliked and 10 extremely liked (Larmond *et al* 1980). The data were statistically analyzed by the analysis of varians using Co-stat package and means were compared using DNMRT.

**Table 1**
Percent composition of layer diets

| Ingredients | Standard | Rapeseed cake (%) Diets | | |
|---|---|---|---|---|
| | | 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 | 0.00 | 0.00 | 0.00 |
| Fish meal | 4.00 | 3.00 | 1.00 | 2.00 |
| Blood meal | 3.00 | 2.00 | 1.00 | 0.00 |
| Cotton seed cake | 5.00 | 0.00 | 0.00 | 0.00 |
| Corn glutin (60%) | 4.00 | 0.00 | 0.00 | 0.00 |
| Molassis | 5.00 | 5.00 | 5.00 | 5.00 |
| Meat meal | 3.00 | 3.00 | 2.00 | 2.00 |
| Rapeseed cake | 0.00 | 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 $100g^{-1}$) | 320.75 | 319.71 | 321.79 | 320.30 |
| Fibre % | 2.98 | 3.52 | 3.97 | 4.35 |
| Glucosinolates (μg/g) | 0.00 | 9.12 | 12.16 | 15.20 |

* To each 100 kg of diet 250g vitamineral mixture was added.
**Calculated analysis.

**Table 2**
Calculated amino acid composition (%) of layer diets

| Amino acids | Requirement | Standard | Rapeseed cake (%) diets | | |
|---|---|---|---|---|---|
| | | | 15 | 20 | 25 |
| Arginine | 0.85 | 1.21 | 1.16 | 1.13 | 1.08 |
| Cystine | 0.27 | 0.35 | 0.28 | 0.26 | 0.23 |
| Histidine | 0.34 | 0.99 | 1.22 | 1.28 | 1.7 |
| Isoleucine | 0.68 | 1.48 | 1.25 | 1.18 | 2.03 |
| Leucine | 1.33 | 1.80 | 1.48 | 1.37 | 1.41 |
| Lysine | 0.37 | 0.86 | 0.96 | 0.87 | 0.89 |
| Methionine | 0.34 | 0.37 | 0.34 | 0.33 | 0.34 |
| Phenylalanine | 0.78 | 1.04 | 0.94 | 0.91 | 0.90 |
| Threonine | 0.54 | 0.72 | 0.67 | 0.62 | 0.64 |
| Tryptophane | 0.15 | 0.22 | 0.21 | 0.21 | 0.20 |
| Tyrosine | 0.54 | 0.54 | 0.65 | 0.68 | 0.77 |
| Valine | 0.68 | 1.04 | 0.88 | 0.79 | 0.74 |
| Calcium | 3.7 | 3.46 | 3.54 | 3.42 | 3.50 |
| Available P | 0.45 | 0.47 | 0.73 | 0.65 | 0.68 |

## Results and Discussion

Live weight, egg size and egg production data are summarized in Table 4. No gain/loss in live weight was noted due to rapeseed inclusion in the diets. A slight decrease in egg size and egg production, though statistically nonsignificant, was noted due to feeding on increased levels of rapeseed cake. In our previous experiments (Badshah *et al* 1998, 1999), in which untreated rapeseed cake was used at the same levels as in the present experiment, no decrease or increase in egg size and production was noted. O' Neil (1957) reported that rapeseed meal can replace all of the soybean meal in a diet containing 3% of animal protein without any deterimental effect on production and hatchability of eggs from laying breeders. No adverse effect on the performance of Turkey Breeder Flock using 10% rapeseed meal in their ration was observed by McGregor and Blakely (1964) and Robblee and Clandinin (1967). Badshah *et al* (1998) while using rations containing 10% rapeseed cake, reported significantly improved performance by Brown-egg-layer (Tetra SL).

As for our previous experiment (Badshah *et al* 1999) the proportion of egg white increased and egg yolk decreased with the inclusion of RSC in ration (Table 5). On the other hand, protein content of egg white of the hens recieving 20 and 25% RSC in the ration was maximum while that of the yolk was minimum. While, in the earlier work, the protein content of egg white decreased with the increased levels of RSC in ration, thus showing negative correlation between protein values and RSC levels. This clearly shows some influence of treated and untreated RSC in the diet on physical as well as chemical properties of egg from the hens fed on it. Egg shell ratio and moisture content of the egg were unaffected due to rapeseed cake inclusion in the ration (Table 6). At the end of experiment, eggs from all the groups were boiled and deshelled and then presented to a pannel of seven judges for organoleptic testing. It was interesting to note that the judges ranked those eggs superior in taste which were layed by hens fed on RSC containing diets. In contrast to that, when the eggs were deshelled by the judges themselves, they noted off flavour in all the eggs from all the groups and the off flavour increased with the increased levels of RSC in ration. This controversy may be explained by the fact that in the deshelled eggs all the volatile (off flavour) have been evaporated before evaluation by the judges. The eggs may taste better after the emission of off flavour as compared to the eggs with lesser or no off flavour compounds.

**Table 3**
Composition of the vitamin-mineral premix

| Vitamins | Units $g^{-1}$ of premix | Inorganic elements | Units $g^{-1}$ of premix |
|---|---|---|---|
| A (IU) | 4409 | Calcium (%) | 0.9 |
| D3 (IU) | 440 | Phosphorus | |
| E (IU) | 4.4 | available (%) | 0.4 |
| K (mg) | 0.9 | Sodium (%) | 0.1 |
| Thiamine (mg) | 0.9 | Potassium (%) | 0.4 |
| Riboflavin (mg) | 1.8 | Chloride (%) | 0.1 |
| Pantothenic | | Manganese (mg) | 22.0 |
| acid (mg) | 5.7 | Magnesium (mg) | 220 |
| Nicotinic acid (mg) | 13 | Iron (mg) | 35 |
| Pyridoxine (mg) | 1.8 | Copper (mg) | 4.4 |
| Folic acid (mg) | 0.5 | Zinc (mg) | 17.6 |
| Biotin (mg) | 0.1 | Selenium (mg) | 0.1 |
| Choline (mg) | 529 | Iodine (mg) | 0.1 |

**Table 4**
Effect of incorporating increased levels of rapeseed cake (post-autoclaving extraction) on performance of brown-egg-layer

| Group | Live weight record | | Production performance | |
|---|---|---|---|---|
| | Initial weight (kg) | final weight (kg) | Egg size (g) | Production (%) |
| Standard | 2.00a | 2.10a | 63.26a | 61.67a |
| RS-15% | 1.95a | 1.94a | 60.65a | 60.00a |
| RS-20% | 1.95a | 2.07a | 59.56a | 55.00a |
| RS-25% | 1.92a | 1.97a | 59.17a | 55.83a |
| Mean | 1.95 | 2.02 | 60.66 | 58.13 |
| CV | 1.70 | 3.18 | 3.04 | 5.54 |

**Table 5**
Effect of incorporating increased levels of rapeseed cake (post-autoclaving extraction) on egg quality of brown-egg-layer

| Group | Egg weight (g) | Egg white (%) | Egg yolk (%) | Egg shell (%) |
|---|---|---|---|---|
| Standard | 56.20 | 54.40 | 32.21 | 13.11 |
| RS-15% | 54.33 | 56.82 | 29.14 | 13.86 |
| RS-20% | 62.43 | 60.28 | 26.06 | 13.46 |
| RS-25% | 67.67 | 61.81 | 24.97 | 13.00 |
| Mean | 60.16 | 58.33 | 28.10 | 13.36 |
| CV | 10.12 | 5.74 | 11.61 | 2.91 |

**Table 6**
Effect of incorporating increased levels of rapeseed cake (post-autoclaving extraction) on protein and moisture content of egg

| Group | Egg white | | Egg yolk | |
|---|---|---|---|---|
| | Moisture (%) | Protein (%) | Moisture (%) | Protein (%) |
| Standard | 86.61 | 78.61 | 50.73 | 57.98 |
| RS-15% | 86.76 | 74.75 | 52.89 | 59.52 |
| RS-20% | 86.26 | 79.38 | 52.79 | 55.22 |
| RS-25% | 86.14 | 81.21 | 50.72 | 40.07 |
| Mean | 86.44 | 78.49 | 51.78 | 53.20 |
| CV | 0.33 | 3.46 | 2.36 | 16.79 |

It is concluded from the experiment that rapeseed cake can be used upto a level of 25% in a ration containing 4% animal protein with no/or minimal detrimental effect on performance of layers. Increased levels of rapeseed cake ( a comparatively cheaper feed ingredient) in the poultry ration can greatly reduce the cost of feed and hence can have an anormous impact on poultry production in Pakistan. The off flavour in the freshly deshelled eggs, if any, could be avoided by using the eggs after a few minute of deshelling.

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