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The Effects of Replacing Soybean Meal with Different Levels of Rapeseed Meal on Performance of Commercial Laying Hens

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Abstract: This study was conducted to determine the effect of replacing different levels of rapeseed meal with soybean meal on the performance of commercial laying hens. Four levels of rapeseed meal; 0, 5, 10 and 15% were used in diets of 144 Hi-Line (W-36, Strain) laying hens from the age of 44 to 56 weeks. Hens were distributed in a randomized complete block design with 4 treatment, 3 replicates and 12 hens in each replicate. The parameters measured were the feed intake, hen-day egg production, egg mass, feed conversion ratio and egg weight. With increasing of rapeseed meal level in diets, feed intake was showed elevation ($p<0.05$). Egg weight was significantly higher when birds fed 10% rapeseed meal ($p<0.05$). No specific trend was observed on the effect of rapeseed meal on egg mass and feed conversion ratio, however these parameters were higher in groups that fed 10% rapeseed meal. With increasing rapeseed meal in diets, production ratio was decreased. It was concluded that; the replacement of 10% rapeseed meal with soybean meal in the layer diets might be useful and had economical benefits for producers.

Key words: Rapeseed meal, laying hens, performance, egg

INTRODUCTION

Since the amino acid proportion of rapeseed meal almost similar to soybean meal, this ingredient can finely substitute with soybean meal. Moreover, low price of rapeseed meal can decrease total production costs (Zeb, 1998). Newkirk *et al*. (1997) have reported the protein content of 44.6% for *B. napus* and 43.1% for *B. rapa* varieties. In other study Thanaseelaan *et al*. (2007) have reported an average value of 34.92% for commercial rapeseed meal. Amino acid comparison of rapeseed meal with soybean meal showed that, rapeseed meal contains more sulphuric amino acids but lower lysine, tryptophan, leucine and isoleucine value than soybean meal (Bell, 1984). Nutritive value of rapeseed meal is limited by the presence of some antinutritive factors, including the indigestible nonstarch polysaccharides. The major nonstarch polysaccharides components found in rapeseed meal are pectic polysaccharides, cellulose and xylans, which are predominantly found in hull fraction (Meng and Slominski, 2005). Attempts have been made to improve the utilization of these nonstarch polysaccharides for poultry by using different carbohydrase supplementation. Crude fiber of rapeseed meal were higher than soybean meal, nowadays, scientists try to decrease crude fiber of rapeseed meal by dehulling rapeseed, genetic selection and produce varieties with thinner hulls, but they cannot make an economic solution for this problem. The vitamin content of rapeseed meal compared with soybean meal, showed higher values for all the B vitamins listed except for pantothenic acid and also mineral

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content of rapeseed meal like other cereal grain and oilseed meals (Bell, 1984). Campbell and Solminski (1999) studied on two different varieties of canola meal and they reported, feed consumption was lower for hens fed commercial canola meal than for hens fed 20% low-glucosinolate canola meal. They suggested, this may reflect the over formulation of added fat in canola diets to produce isocaloric diets. Kaminska (2003) used two form of rapeseed meal (regular and fractionated) and reported no effect on laying rate parameters of egg and egg shell quality. But as the content of rapeseed meal in the diet increased, the weight of eggs decreased significantly. Roth-Maier (1995) used up 25% of rapeseed meal in laying hens ration and reported, feed intake and egg weight decreased and egg size diminished with increasing proportions of rapeseed meal. Jeroch *et al*. (1999) evaluated untreated and hydrothermal treated rapeseed meal at dietary inclusion rates of 0, 7.5, 15, 22.5 and 30% in layer diets and observed high percentages of both diets cause significant reduction in laying intensity and feed conversion ratio. Egg weight remained unchanged for all dietary treatments. They suggested, rapeseed meal can be used at dietary doses up to 15% with out any negative effect on egg production. Roth-Maier (1999) in other study, using canola meal at up to 15% inclusion levels in layer diets, demonstrated excellent hen performance with regard to egg production and feed conversion efficiency. Shen *et al*. (1983) showed that if the seeds were finely ground or steam pelleted, good results with up to 20% whole canola seed could be expected.

The goal of this research is to investigate the effect of replacing soybean meal with rapeseed meal as a protein source on performance of laying hens, determine the proper level of rapeseed meal in ration and try to decrease total cost.

MATERIALS AND METHODS

Experiment was conducted with 144 Hi-Line (W-36 Strain) commercial laying hens over a 3 months period. This study carried out at Islamic Azad University, Shabestar branch, Shabestar-Iran in summer 2006. When the experiment starts, layers were on 44 week of age. Experiment was performed in completely randomized block design (RB) and laying hens distributed randomly to 4 treatments with 3 replication and 12 hens in each replicate.

The 4 experiment diets were: (A) Control group, (B) Control group+5% rapeseed meal, (C) Control group+10% rapeseed meal and (D) Control group+15% rapeseed meal as replacements of soybean meal.

The chemical analysis of the rapeseed meal used in this study is presented in Table 1. The composition of the diets was adjusted to the respective requirements of the NRC (1994). Water and feed were provided *ad libitum*. The ingredients of diets are showed in Table 2. This experiment was done in 6 periods, each 15 days sequential period. In order to evaluate the condition of flock, first data collecting supplied in 1 month before starting the experiment and it was found that there were no differences in performance of treatments before the experiment. Feed consumption, Hen-day egg production, egg mass, feed conversion efficiency and egg weight were parameters used to assess productive performance. Feed was given *ad libitum* daily and feed left was weighted at the end of each 2 week to determine feed consumption. Eggs were collected daily, then hen-day egg production and egg weight determine every 2 week.

Table 1: The chemical composition of rapeseed meal

Chemical composition	Values
ME (kcal kg^{-1})	2000.0
Crude protein (%)	35.0
Ether extract (%)	01.4
Ash (%)	04.7
Dry matter (%)	90.8
Moisture (%)	09.2
Av. phosphorus (%)	00.4
Calcium (%)	00.8

Table 2: The nutritional composition of dietary treatments

	Diets			
Ingredients	A	B	C	D
Corn	45.94	44.49	43.05	41.63
Soybean meal (44%)	21.27	17.39	13.49	9.59
Rapeseed meal (35%)	0.00	5.00	10.00	15.00
Wheat	10.00	10.00	10.00	10.00
Barley	10.00	10.00	10.00	10.00
Soybean oil	1.23	1.61	1.98	2.35
Oyster shell	8.82	8.78	8.75	8.71
Bone meal	1.91	1.84	1.78	1.71
Premix[1]	0.50	0.50	0.50	0.50
DL-methionine	0.06	0.05	0.04	0.03
L-Lysine	0.00	0.07	0.14	0.21
Salt	0.27	0.27	0.27	0.27
Calculated composition				
ME (kcal kg^{-1})	2700.00	2700.00	2700.00	2700.00
Crude protein (%)	15.55	15.55	15.55	15.55
Linoleic acid (%)	1.99	2.19	2.38	2.58
Calcium (%)	4.00	4.00	4.00	4.00
Av. phosphorus (%)	0.35	0.35	0.35	0.35
Lysine (%)	0.80	0.80	0.80	0.80
Meth+cyst (%)	0.58	0.58	0.58	0.58
Total price (rial)	2176.00	2144.00	2114.00	2083.00

[1]Supplied per kilogram of diet: vitamin A, 10000 IU; vitamin D3, 9790 IU; vitamin E, 121 IU; B12, 20 mg; riboflavin, 4.4 mg; calcium pantothenate, 40 mg; niacin, 22 mg; choline, 840 mg; biotin, 30 mg; thiamin, 4 mg; zinc sulfate, 60 mg; manganese oxide, 60 mg-(A) Control group, (B) Control group+5% rapeseed meal, (C) Control group+10% rapeseed meal and (D) Control group+15% rapeseed meal as replacements of soybean meal

Because of doing this research within 6 period of sampling we used, the period effect as an one a factor inside the model when the analysis of data done and because of no significant effects of period, all data of 6 period pooled together and into the designed model with General Linear Models (GLM) procedure of SAS (1993) software, was employed and significant differences between treatments were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Feed consumption data showed significant differences ($p<0.05$) between treatments. Comparison between means showed that, group fed 15% rapeseed meal had the highest feed consumption; while group fed 5% rapeseed meal had the lowest feed consumption (Table 3).

Because, higher feed intake did not improve feed conversion and egg production, this increase in feed intake was due to the higher amount of soybean oil in diet. The researchers have mentioned the decrease occurred in feed consumption with increase the level of canola meal in diets (Campbell and Solminski, 1999; Roth-Maier, 1999). Summers *et al.* (1988) suggested that the phytic acid in canola meal may reduce calcium availability and in turn decrease feed intake. Najib and Al-Khateeb (2004) and Talebali and Farzinpour (2005) reported an increase in feed consumption with increasing the proportion of canola seed in diets. There is no significant difference ($p>0.05$) in egg production between experimental diets, but numerically, best production ratio was found in birds fed control diet (Table 3). The results are in agreement with result of other researchers (Campbell and Solminski, 1999; Roth-Maier, 1999).

No significant difference ($p>0.05$) in egg mass observed among all experimental and control diets. Comparison between means showed that the diet had 10% rapeseed meal had best value, while the diet had 5% rapeseed meal had the poorest value. This result has similarity with Roth-Maier (1999) findings. From the result of Table 3 implied that adding different level of rapeseed meal in diets, had not any significant effect on feed conversion ratio, but numerically the diet had 10 and 15% rapeseed

Table 3: The effect of different levels of rapeseed meal on performance values of laying hens (44-56 weeks) at whole period

	Diets				
Parameters	A	B	C	D	SE[1]
Feed intake (g)	110.44[b]	110.00[c]	110.46[b]	111.41[a]	0.31
Hen-day egg production (%)	85.35	82.64	82.10	83.04	4.66
Egg mass	53.00	52.47	53.77	52.74	3.54
Feed conversion ratio (g g^{-1})	02.09	02.11	02.06	02.12	0.14
Egg weight (g)	62.14[c]	63.45[b]	65.53[a]	63.54[b]	1.94

[1]SE = standards error. [a,b,c] Means in rows with no common superscript differ significantly ($p<0.05$), (A) Control group, (B) Control group+5% rapeseed meal, (C) Control group+10% rapeseed meal and (D) Control group+15% rapeseed meal as replacements of soybean meal

meal gave the best and poorest value respectively. Different researchers reported that increasing the level of rapeseed meal had not any effect on feed conversion ratio (Campbell and Solminski, 1999; Roth-Maier, 1999). But Taraz *et al.* (2006) and Talebali and Farzinpour (2005) observed an increase in feed conversion ratio with increase of canola seed in diets. They suggested that negative effect of anti nutritional factors such as glucosinolate could be decrease hens performance and increase feed conversion ratio. The result of this study showed that there was a significant difference in egg weight between dietary treatments. Comparison between means showed that hens fed 10% rapeseed meal had higher egg weight than hens fed other dietary treatments and control group. Probably higher egg weight in dietary treatments than control group was influenced by amount of soybean oil in diets. Because oils have extra metabolic and extra caloric effect (Wiseman, 1984), then this higher egg weight could be due to the higher amount of soybean meal in the experimental diets. In contrary to this study other researchers had mentioned increasing canola seed in diets decrease egg weight (Roth-Maier, 1999; Kaminska, 2003; Najib and Al-Khateeb, 2004).

CONCLUSION

On the basis of present study we may conclude that addition of 10% rapeseed meal significantly improves egg weight and Adding 15% of rapeseed meal helps to decrease total feed cost without any harm effect on performance of laying hens.

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