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Use of Different Levels of High Fiber Sunflower Meal in Commercial Leghorn Type Layer Diets

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Abstract: An experiment was conduced to evaluate the inclusion of high fiber Sunflower Meal (SFM) in commercial layer diets in a completely randomized design with 4 treatments, 8 replicates and 4 hens in each replicate. After determining chemical composition of sunflower meal 4 diets with equal CP (14.5%) and other nutrients except energy containing 0, 5, 10, 15 percent of high fiber sunflower meal were formulated. During the experiment feed consumption, hen-day egg production, egg weight, feed conversion ratio, haugh unit, egg specific gravity and mortality, were measured weekly. In the beginning and the end of the experiment body weight of the hens were measured individually. The results indicated that use of 10 percent of sunflower meal hadn't significant effect on feed consumption, hen-day egg production. However increasing sunflower meal up to 15 percent decreased feed consumption, egg production and egg weight, 5.70, 7.06 and 5.49 percent respectively, while feed conversion ratio increased significantly ($p<0.05$). Egg parameters were not affected by the SFM inclusion rate. According to the results of this experiment it can be concluded that 10 percent of high fiber sunflower meal can be used in laying hen diets without adverse effect on performance and egg parameters.

Key words: Sunflower meal, laying hen, diet, egg production, egg parameters

Introduction

Soybean meal has been the main protein source in poultry rations since its nutritional value has been realized worldwide. However, most of the European and Asian countries import this strategic feed ingredient. Therefore cottonseed, rapeseed, sunflower and groundnut meals have been suggested as an alternative vegetable protein sources for poultry (Ravindran and Blair, 1992). As the cultivation of soy bean is limited in Iran, annually a large amount of SBM is imported. In recent years cultivation of some oil seed such as sunflower seed (Heliantus annus) is undertaken in some provinces of Iran. It contains 45 percent oil and a good source of protein and B-group vitamins. In addition, it can be harvested two or three times a year in tropical areas, being a good alternative for oil producers and for the feed mill sector (Vieira *et al.*, 1992). Sunflower Meal (SFM) is a well-established and relatively inexpensive protein source for poultry diets. In addition, it can be harvested two or three times a year in tropical areas, being a good alternative for oil producers and for the feed mill sector (Vieira *et al.*, 1992). However, the use of SFM in poultry diets is limited by variations in its chemical composition and the two main components apparently restricting its use are high fiber/low energy and low lysine contents (Senkoylu and Dale, 1999). Variations in the chemical composition of SFM are a consequence of the different processing methods, which determine the composition of this ingredient. The extent of dehulling is an important determinant of the protein and fiber content of the SFM, whereas the processing method influences fat content. High temperatures associated with processing can damage proteins and reduce the availability of several amino acids, particularly lysine. (Ravindran and Blair, 1992; Dale, 1996). According to Cuca *et al.* (1973) and Michael and Sunde (1985), SFM is relatively rich in sulfur amino acids, but if not used together with other proteins sources or synthetic amino acids, two amino acid deficiencies should be expected: lysine, as first limiting amino acid and threonine. Lysine supplementation to SFM based layer diets does not appear to be as critical as in broiler diets because their lysine requirement is much lower (Senkoylu and Dale, 1999).

Unlike most other oilseed meals, SFM does not contain high concentrations of anti-nutritive factors. Milic *et al.* (1968) detected 1.56% of a tannin-like chlorogenic acid compound, which inhibits the activity of digestive enzymes, including trypsin, chymotrypsin, amylase and lipase in sunflower seeds. Heating the seeds at 100°C for 5 hours destroyed about 43% of this chlorogenic acid. The addition of methionine and choline are required to counteract the effect of chlorogenic acid when SFM is used in the diet (Swick, 1999). Reports on the use of SFM in poultry diets are not always consistent, probably due to differences in plant variety, chemical composition, processing method, bird age and food formulation techniques used in the various studies. Vieria *et al.* (1992) used 13-40.5 percent SFM in layer diet and observed this inclusion did not significant effect

Table 1: Chemical composition and metabolizable energy content of high fiber SFM

Nutrients	Dry Matter	Crude Protein	Ether Extract	Crude Fiber	Ash	NFE	Me_n (Kcal/kg)	Ca	P	Na
(%)	91.52	35.94	1.21	25.70	6.80	30.35	1221	0.41	0.72	0.22

Table 2: Composition of experimental diets (%)

Diets	1	2	3	4
Maize	71.55	70.69	68.51	68.35
Soybean meal	15.55	12.19	9.36	4.50
Sunflower meal	0.00	5.00	10.00	15.00
Fish meal	2.00	2.00	2.00	2.00
Limestone	7.92	7.90	7.91	7.89
Di-calcium phosphate	1.34	1.33	1.32	1.32
Salt	0.30	0.30	0.30	0.30
DL-methionine	0.07	0.07	0.07	0.07
L-lysine	0.00	0.02	0.03	0.07
Vitamin+Mineral Supplement[1]	0.50	0.50	0.50	0.50
Total Composition	100.00	100.00	100.00	100.00
ME (Kcal/kg)	2800.00	2730.00	2700.00	2670.00
Crude protein%	14.45	14.45	14.45	14.45
Calcium%	3.20	3.20	3.20	3.20
Available phosphorus%	0.34	0.34	0.34	0.34
Lysine%	0.67	0.66	0.64	0.63
Methionine%	0.37	0.34	0.35	0.35
Methionine+ Cystine%	0.55	0.56	0.57	0.57
Threonine%	0.59	0.59	0.59	0.59
Tryptophan%	0.19	0.19	0.20	0.20
Crude fiber	2.85	4.55	5.27	6.09

[1]Vitamin+Mineral supplement provides per kilogram of diet: vitamin A, 8,000 IU; vitamin E, 20 IU; menadione, 3.0 mg; Vitamin. D_3, 2,000 IU; riboflavin, 4.0mg; Ca pantothenate, 12 mg; nicotinic acid, 50 mg; choline 300 mg; vitamin B_{12}, 15 mg; vitamin B_6, 0.12 mg; thiamine, 1.5 mg; folic acid, 1.00 mg; d-biotin, 0.10 mg. Trace mineral (milligrams per kilogram of diet): Mn, 100; Zn, 70; Fe 50; Cu 10; Iodine 1; Se, 0.30; antioxidant 50

on egg production, egg weight, egg shell quality and mortality. Adding Lysine to diets only improved body weight of birds. Pinheiro *et al.* (1999) observed that, up to 21 percent SFM (without lysine addition) in layer diet did not affect performance. Serman *et al.* (1997), evaluating the effect of decorticated SFM as protein source in commercial layer diets on production performance and concluded that diets formulated with this ingredient needed to be supplemented with lysine and also with an energy source. The objective of the present study was to evaluate the performance and the egg parameters of commercial Leghorn laying hen fed diets with increasing levels of high fiber SFM.

Materials and Methods

In this experiment at first chemical composition of SFM was determined (AOAC, 1990). The chemical composition of SFM is presented in Table 1. The metabolizable energy content of SFM was estimated based on the following equation (NRC, 1994): ME_n = 26.7 (DM) + 77 (EE) -51.22 (CF). In this equation DM, EE and CF are dry matter, ether extract and crude fiber percentage of SFM respectively. One hundred and twenty-eight 22- weeks old Leghorn-type laying hens were housed in individual cages and kept under similar management condition. The hens were allocated in individual cages (41×23×43) cm and 4 cages were considered to be one replicate. Before of starting the experiment, egg production of hens was measured individually and hens with equal egg production were replaced in each replicate. Diets were formulated basis on linear programming by using of UFFDA software. Treatments consisted of diets containing (0, 5, 10 and 15%) of high fiber SFM. Composition of diets is shown in Table 2. The experimental diets were formulated to supply the requirements as recommended by NRC (1994). Crude protein and other nutrients except energy in all diets were similar. Feed and water were offered *ad libitum* during the experiment. Light was provided for 14 hours per day during the trial period. The experiment lasted 12 weeks. During the experiment daily feed intake, egg weight, egg mass, egg production, feed conversion ratio, egg specific gravity, haugh unit score and mortality were measured. Body weight of hens was recorded at the beginning and at the end of the experiment. Egg production was recorded every day. All eggs produced during the last 3 days of each two weeks were collected, weighed and their egg parameters were evaluated (AOAC, 1990). The data from this experiment were subjected to one-way analysis of variance with 4 treatments and 8 replicates and 4 hens in each replicate. The obtained data were submitted to analysis of variance, using the General Linear Model procedure (GLM) of SAS software (SAS Institute, 2001). Means were compared by the Duncan's multiple range tests at 5% probability.

Results and Discussion

Performance and egg parameters of hens are presented in Table 3. Use of up 10 percent SFM in diets hadn't significant effect on feed intake of birds. CF levels were 2.85, 4.55, 5.27 and 6.09% respectively for treatments with 0, 5, 10 and 15% SFM. Heavy medium hens increased their feed intake to compensate for the reduction in energy concentration of the diet with SFM. Light hens did mot compensate in the same fashion. SFM inclusion reduced the metabolizable energy of the diets because of its high fiber level. Use of 15 percent SFM in diet significantly reduced feed intake of hens ($p<0.05$). As the same trend egg production, egg weight and feed conversion ratio reduced in hens fed with diets containing 15 percent SFM ($p<0.05$). The fiber content of the diets was also responsible for the poor feed conversion of hen fed with graded levels of SFM when compared to the control diet. Egg production reduced in hens fed with diet containing 15 percent SFM ($p<0.05$). The most limiting nutrients in the diets with SFM used in this study was energy. Thus after 10 percent SFM, the hens probably did not get sufficient energy to maintain egg production. The above traits were better in diet containing 5 percent SFM. With increasing SFM Feed

Table 3: Effect of experimental diets on performance and egg parameters of laying hens

Diets	1	2	3	4	SEM
Traits					
Feed consumption (g/b/d)	110.7[a]	110.5[a]	108.8[a]	104.4[b]	0.86
Egg production (%)	84.46[a]	87.78[a]	86.75[a]	78.49[b]	1.17
Egg weight (g)	60.90[a]	60.50[a]	58.65[b]	57.28[c]	0.25
FCR (kg feed:kg egg)	2.23[b]	2.13[b]	2.25[ab]	2.34[a]	0.03
Body weight change (g)	102	105	103	98	-
Egg specific gravity	1.090	1.091	1.092	1.091	0.10
Haugh unit	95.70	94.60	95.11	95.60	0.72

Means with different superscripts in each rows are significantly different ($p<0.05$)

intake, egg production and egg weight of layer fed with diet 4 (containing 15% SFM) in comparison to laying hen fed with control diet (containing 0% SFM) were reduced 5.7, 7.1 and 5.9% respectively. Results of the present study are in agreement with findings of other researches (Casartelli *et al.*, 2006; Karunajeewa *et al.*, 1989; Vieira *et al.*, 1992), but in contrast with the results of other studies (Uwayjan *et al.*, 1983). The differences are probably related to fiber content and digestibility of amino acids of SFM. In other experiments the fiber content of SFM was below 20% and for balancing the energy supplemental oil was used. When evaluating decorticated SBM levels for layers (0, 5.79, 12.19, or 18.97%), Karunajeewa *et al.* (1989) did not find significant effects of these inclusion levels on egg production, egg mass, or feed conversion ratio; however, the authors observed that, as SFM inclusion levels increased, there was a trend of reduction in Haugh units. Similar results were found by Vieira *et al.* (1992). Egg weight, eggshell quality and egg production were not affected by graded levels of SFM inclusion in layer diets (13.5, 27, or 40.5%). On the other hand, positive linear effects were observed for feed intake and feed conversion ratio with SFM inclusions. Serman *et al.* (1997) used 24% decorticated SBM in layer diets and observed that, when lysine and energy were supplemented, bird performances were similar or higher as compared to birds fed diets with no SFM. Evaluating the same SFM inclusion levels as those used in the present study (0, 4, 8 and 12%) in broiler chicken diets, Pinheiro *et al.* (2002) did not observe any effect on feed intake or weight gain, but birds fed diets with no SFM (0%) had a better feed conversion ratio from 3 to 35 days of age. Egg quality results showed that SFM did not influence Haugh units and egg specific gravity. There was no effect of SFM on mortality of hens. There are no known toxic substances in SFM that restrict its use in poultry diets. Results of this experiment indicated that high fiber SFM could be an alternative source of protein for laying hen ration. Intake of nutrients by hens fed low energy rations with crude fiber levels greater than 5.27% was not sufficient to maintain high levels of egg production. In general it can be concluded that soybean and SFM are used nearly in equal amount in layer diets (10%), without adverse effect on performance. In this case 3.68 and 3.60% of dietary crude protein is supplied by soybean meal and SFM respectively.

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