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Effects of Black Seed (*Nigella sativa* L.) Supplementation on Feed Efficiency, Egg Yield Parameters and Shell Quality in Chickens

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Abstract: This study was carried out to investigate the effects of different levels of black seeds in diet of laying chickens on egg yield parameters, feed efficiency and egg shell quality. In this study, 24 week old laying hens were randomly distributed into four groups with four replicates of 5 birds each (20 laying hens per group) and were fed diets containing 0% (Group A, control), 1% (Group B), 2% (Group C), or 3% black seeds (Group D) for 49 days. Laying performance, egg quality and feed efficiency were evaluated. Eggs were examined for interior and exterior quality. Egg weights, yolk and albumen index, shape index, albumen weights, yolk weights, shell weights and shell thickness were measured in the daily collected eggs. Any level of black seed supplementation had no effects on live weight, egg production, feed consumption, feed efficiency, yolk index and albumen index. At the 6th and 7th weeks of the feeding study, weights of the eggs from the laying hens fed the Diet D were significantly greater than those from the laying hens fed the Diet A ($p<0.05$). And also the diet supplemented with 3% black seeds influenced the albumen weights of the eggs positively, compared to the control group ($p<0.05$). This study showed that supplementation of black seeds to the diet at the level of 3% increased egg weights from laying hens.

Key words: Black seeds, egg parameters, feed efficiency, chickens

INTRODUCTION

Poultry industry is under increasing pressure to produce high quality products for the consumers. Antibacterial feed additives such as antibiotics have been used for years to improve the profitability of poultry production by helping to control pathogen bacteria in the gut mucosa, thereby improving weight gain, feed conversion rate and uniformity. However, there is a potential development of resistance to a number of pathogen bacteria when antibiotics are used in the animal diets (Wegener *et al*., 1998). And also it was reported that the widespread use of anti-microbial agents has led to the emergence of antimicrobial drug resistance organisms (Shea, 2003). Therefore, feed antibiotics which have been used for promoting growth in the farm animals will be banned in the European Union. Removal of antibiotics from the diet may negatively affect profitability in the animals. Therefore, feed industry will have to research alternatives for the antibiotics (Hertrampf, 2001; Humphrey *et al*., 2002). Recently, feed additives of plant origin such as essential oils or extracts of aromatic plants have received considerable attention as alternatives to the traditional antibacterial feed additives. One of the alternatives used as feed additives is black seed oil. Black seed (*Nigella sativa* L.) which is a herbaceous plant has also been known as "black cumin" and grows in Asian and Mediterranean countries. The seed of *Nigella sativa* L. has been used traditionally for centuries in the Middle East, Norhern Africa, Far East and Asia for the treatment of asthma (El-Tahir *et al*., 1993) and as an anti-tumor agent (El-Daly, 1998). The seed has been reported to have many biological properties including anti-parasitic (Mahmoud *et al*., 2002), anti-diabetic (Al-Hader *et al*., 1993) and diuretic (Zaoui *et al*., 2000). Studies showed that black seed has also bactericide activity (El-Kamali *et al*., 1998; Mouhajir *et al*., 1999). Recently, black seed oil was also shown to have antibacterial activity against Listeria monocytogenes (Nair *et al*., 2005).

There are some studies conducted on the effects of dietary black seed or oils on the performance of poultry. In two experiment of a study conducted in the broiler, the effects of diets supplemented with essential oil (0.1 or 1 g kg^{-1}) or oilseed (10 or 50 g kg^{-1}) of black seed on body performance was determined (Halle *et al*., 1999). In

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the first experiment, it was reported black seed and oil affected feed intake and body weight positively in the broilers (Halle *et al*., 1999). However, in the second experiment of the same study, no positive results related to those parameters were found (Halle *et al*., 1999). In another study conducted in the Hibro broiler chicks, it was reported that diet supplemented with 10% black seed had no adverse effects on the performance (Al-Homidan *et al*., 2002). In a study conducted in Japanese quail, it was shown that black seed essential oil at the level of 60 mg kg^{-1} diet had no effect on carcass weight, but caused a lower percentage of abdominal fat (Denli *et al*., 2004a). According to the authors' best knowledge, there have been a limited number of studies associated with the effect of diets supplemented with black seeds or oils on the egg parameters in the poultry. Recently, it was shown that black seed extract at the level of 0.1% significantly increased egg weight, shell weight and shell thickness, albumen height, albumen length and yolk height in the quail (Denli *et al*., 2004b). However, there is no study known about the effects of black seeds on the egg parameters and laying hens performance in the chickens. Therefore, the objective of this study was to study the effects of black seeds on the egg quality characteristics, egg production, egg weights and shell quality.

MATERIALS AND METHODS

Laying hens and composition of experimental diets: In this study, eighty 24-wk-old Single Comb White Leghorn (SCWL) laying hens were randomly assigned into 4 groups with four subgroups of 5 birds each (20 laying hens per group) and fed a commercially prepared diets containing 0% (Group A, control), 1% (Group B), 2% (Group C), or 3% black seeds (Group D) for 7 weeks. Chemical Analysis of the commercial laying hen diet: Dry matter, 88%; crude protein, 160 g kg^{-1}; crude fiber, 7%; ash, 13%, NaCL, 0.35%, calcium, 3%, phosphorus, 1%; lysine, 0.7%; methionine, 0.33%; cysteine, 0.31%; metabolic energy, 2700 kcal kg^{-1}; vitamin A, 8000 IU kg^{-1}; vitamin D, 1500 IU kg^{-1}, riboflavin, 4 mg kg^{-1}; cobalamine, 10 mg kg^{-1}; vitamin E, 15 mg kg^{-1}; vitamin K, 2 mg kg^{-1}; choline, 500 mg kg^{-1}; niacin, 25 mg kg^{-1}; mangan, 60 mg kg^{-1}; zinc, 50 mg kg^{-1}. Black seeds were used after crushed by using a grinder. Water and feed were provided *ad libitum* during the study. The photoperiod was set at 16L:8D throughout the study. Body weights of laying hens were determined at the beginning and end of the experimental study.

Feed consumption was recorded on a subgroup basis at weekly intervals. Feed efficiency (kg feed/kg eggs) was calculated for every group in the study. Sixteen eggs per group (four eggs per each subgroup) were collected on every week and they were weighed, broken open and the weights of egg, albumen, yolk and shell recorded. And also egg yolk index, albumen index, yolk color, Haugh units, shell thickness of those eggs were measured. Shell thickness was measured by micrometer (Mitutoyo, 0.01 mm, Japan).

Statistical analysis: Data were analyzed by SPSS 10.0 versions for windows. The differences between groups were determined by analysis of variance (ANOVA). When the differences were significant ($p<0.05$), Duncan's Multiple Range Test was performed. Data were expressed as means±SE.

RESULTS

Table 1 represents the effect of different levels of black seeds on the body weight, egg production, feed consumption and weights of eggs in chickens. Diets containing 1, 2, or 3% black seeds had no effects on body weight, egg production, feed consumption (g/d) and feed efficiency (kg diet/kg egg). The weights of eggs from the Group D were greater than those from the Group A (Table 1). The weights of the eggs from the Group D (especially laid on the weeks of 6th and 7th in the experimental study) were found to be significantly greater than those from the control group (Fig. 1).

Table 2 shows the effects of diets supplemented with black seeds on the egg weights, yolk weights, albumen weights and shell weights. Eggs from the Group D had significantly greater percentage of albumen weights. However, yolk weights of the eggs from the Group D were not different from these other groups. There were no adverse effects of feeding any levels of black seeds used in this study on the quality of the eggs. Feeding diets supplemented with black seeds did not influence albumen index, yolk index, Haugh unit and specific gravity (Table 3). Although there was no effect of dietary treatments on the shell thickness of the eggs, the percentage of egg shells from the Group D were significantly lower than the control group ($p<0.05$) (Table 3).

DISCUSSION

Antibacterial feed additives such as antibiotics have been used for many years to improve the profitability of poultry production by helping to control pathogen bacteria in the gut mucosa, thereby improving weight gain, feed conversion rate and uniformity. However, there is a potential development of resistance to a number of pathogen bacteria when antibiotics are used in the animal

Table 1: The effects of black seed supplementation on body performance, egg production, feed efficiency and egg weights

	[1]Dietary treatments			
	Group A	Group B	Group C	Group D
Initial Body Weight (g)	1916.0±16	1926.25±15	1918.75±12	1923.75±14
Final Body Weight (g)	2115.0±40	2110.00±31	2097.00±11	2070.00±10
Egg production (%)	93.6±2.0	92.90±2.3	95.70±1.4	95.00±3.0
Feed intake (g/d)	132.1±0.2	132.20±0.5	132.80±0.3	132.60±0.5
Egg weight (g)	60.5±0.76^{b}	60.89±0.75^{b}	62.59±0.78^{ab}	63.59±0.82^{a}

Table 2: The effects of [1]diets supplemented with different levels of black seeds on the [2]egg parameters

	Dietary treatments			
	Group A	Group B	Group C	Group D
Egg weight (g)	60.50±0.76^{b}	60.89±0.75^{b}	62.59±0.78^{ab}	63.59±0.82^{a}
Yolk weight (g/egg)	15.49±0.11	15.74±0.11	15.46±0.12	15.75±0.13
Albumen weight (g/egg)	37.57±0.30^{b}	37.77±0.25^{b}	39.86±0.31^{ab}	40.54±0.30^{a}
Shell weight (g/egg)	7.44±0.11	7.38±0.10	7.27±0.11	7.30±0.12
Percentage of eggs (%)				
Yolk	25.60±0.40	25.85±0.22	24.70±0.21	24.77±0.18
Albumen	62.10±0.20^{b}	62.03±0.21^{b}	63.68±0.20^{ab}	63.75±0.21^{a}
Shell	12.30±0.11^{a}	12.12±0.12^{ab}	11.62±0.12^{ab}	11.48±0.27^{b}

Table 3: The effects of diets supplemented with different levels of black seeds on the quality of laying chickens

	[1]Dietary treatments			
	Group A	Group B	Group C	Group D
Albumen index	10.33±0.21	10.45±0.18	10.18±0.23	10.87±0.25
Yolk index	44.04±0.31	43.74±0.22	43.98±0.25	43.45±0.24
Shell thickness (mm 10^{-2})	0.37±0.003	0.37±0.002	0.37±0.003	0.37±0.002
Haugh unit	88.53±0.71	89.02±0.63	87.89±0.76	89.14±0.85
Specific gravity (g c^{-3})	1.67±0.06	1.76±0.06	1.69±0.06	1.68±0.04

[1]Dietary treatments: Group A: Commercially prepared diet (no additional black seeds); Group B: Commercially prepared diet containing 1% black seeds; Group C: Commercially prepared diet containing 2% black seeds; Group: Commercially prepared diet containing 3% black seeds, [2]Within a row, values without a common superscript are significantly different ($p<0.05$). Values are expressed as means±SE

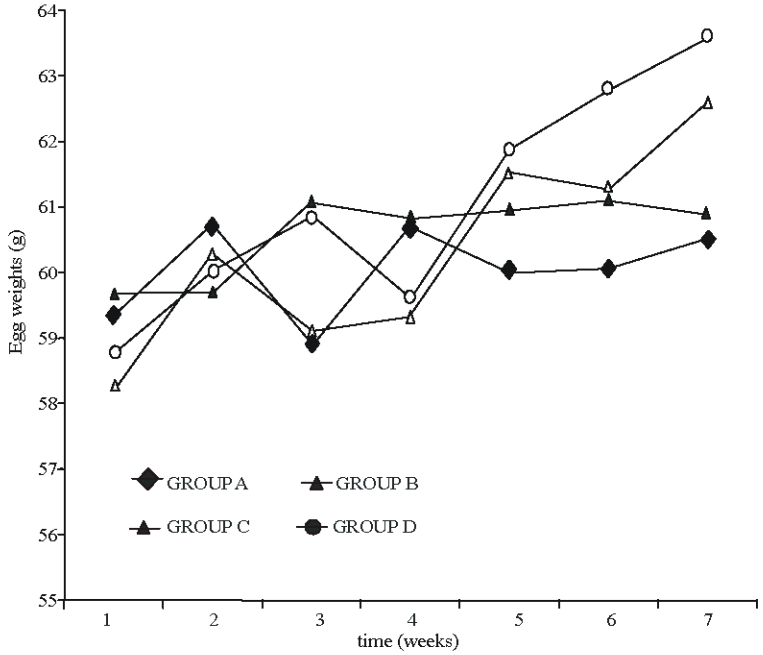

Fig. 1: The effects of [1]diets supplemented with different levels of black seeds on the egg weights. [1]Dietary treatments: Group A: Commercially prepared diet (no additional black seeds); Group B: Commercially prepared diet containing 1% black seeds; Group C: Commercially prepared diet containing 2% black seeds; Group: Commercially prepared diet containing 3% black seeds

diets (Wegener *et al*., 1998). Therefore, feed antibiotics which have been used for promoting growth in farm animals will be banned in the European Union. Removal of antibiotics from the diet may negatively affect profitability in the animals. Therefore, feed industry will have to find substitutes for antibiotics (Hertrampf, 2001; Humphrey *et al*., 2002). Recently, feed additives of plant origin such as essential oils or extracts of aromatic plants have received considerable attention as alternatives to the traditional antibacterial feed additives. One of the alternatives to be used as feed additives is black seed oil. Black seed (*Nigella sativa* L.) has been shown to have bactericide activity (El-Kamali *et al*., 1998; Mouhajir *et al*., 1999; Nair *et al*., 2005).

Although there are some studies conducted on the effects of dietary black seed or oils on the performance of broilers, in poultry only limited numbers of feeding studies related to the black seed were conducted about the laying hen performance, feed efficiency and egg parameters. Recently, it was shown that black seed extract at the level of 0.1% significantly increased egg weight, shell weight and shell thickness (Denli *et al*., 2004b). It was also shown that diet supplemented with 0.5% black seed extract increased albumen height, albumen length and yolk height in the quail (Denli *et al*., 2004b). In the present study, black seed at the level of 3% (Group D) significantly increased overall egg size compared to the control. The weights of eggs from laying hens fed the Diet D were significantly greater than those from the control on the 6th and 7th week of the experimental study.

In conclusion, the present study data showed that there were no significant differences in egg production, feed conversion efficiency, yolk index, albumen index, Haugh units and shell thickness among the dietary groups of A, B, C or D. Diet supplemented with black seeds at the level of 3% (Diet D) significantly increased egg weights in the laying hens. Also, eggs from the Group D had a significantly higher percentage of albumen weights compared to those from the Group A and Group B ($p<0.05$). The weights of egg yolk and shell in the Group A, Group B, Group C or Group D did not differ significantly. However, percentage of the shell weights of the eggs was significantly decreased in the Group D fed a diet supplemented with 3% black seeds.

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