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Egg Yield and Quality in Laying Hens Fed Diets Containing Black Cumin Seed and/or White Wormwood Leaves

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Abstract: Laying hens were fed diets containing either black cumin seed or white wormwood leaves or the combination of the two additives and the effects on egg production and egg quality characteristics were determined. Final body weights were significantly increased in the birds fed the diet with 1% black cumin seed and in those fed the diet with 0.5% of both black cumin seed and white wormwood leaves. Feed intake was numerically lower after the feeding of the diets with 1% white wormwood leaves. Egg production was not significantly influenced by dietary treatment but group-mean egg production was lowered in the hens fed the diet with 1% black cumin seed. Feed conversion efficiency was significantly decreased by the diet containing 1% white wormwood leaves and by the diet with the combination of 1% of black cumin seed and 1% white wormwood leaves. The diet containing 0.5% black cumin seed plus 0.5% white wormwood leaves also significantly decreased feed conversion. Egg weight, shape index, albumen height, Haugh unit, shell thickness and yolk color were not significantly affected by the dietary treatments. The major finding of this study may be that dietary white wormwood improved feed efficiency in laying hens whereas black cumin seed did not.

Key words: Chickens, egg production, egg quality, diet, black cumin, *Nigella sativa*, white wormwood, *Artemisia herba-alba*

INTRODUCTION

Black cumin (*Nigella sativa*) seed and white wormwood (*Artemisia herba-alba*) leaves have comparable biological effects. The oil fraction of black cumin seeds contains thymoquinone which exerts anti-bacterial, anti-parasite, anti-oxidant, anti-hypertensive, hypolipidemic and hypoglycemic effects (Swamy and Tan, 2000; Salem, 2005; Ragheb *et al*., 2009; Mahmoud *et al*., 2002; Abu-El-Ezz, 2005; Ayaz *et al*., 2007). Similar effects have been documented for extracts derived from white wormwood leaves (Yashphe *et al*., 1979; Idris *et al*., 1982; Twaij and Al-Badr, 1988; Abid *et al*., 2007; Zeggwagh *et al*., 2008).

In laying hens, the impact of dietary black cumin seed on egg quality and egg production has been studied. The feeding of black cumin seed has consistently been found to lower egg cholesterol content (Akhtar *et al*. 2003; El-Bagir *et al*., 2006; Aydin *et al*., 2008; Yalcin *et al*., 2009). In different studies, diets containing black cumin seed lowered (El-Bagir *et al*., 2006), increased (El-Sheikh *et al*., 1998; Aydin *et al*., 2008) or did not affect egg production (Yalçin *et al*., 2009). Egg weight and shell thickness were increased by dietary black cumin in two studies (Akhtar *et al*., 2003; Aydin *et al*., 2008) but not in another feeding trial (Yalcin *et al*., 2009). El-Sheikh *et al*. (1998) reported that the feeding of black cumin seed increased shell thickness but left unchanged egg weight.

For the present study there were two inducements. First, the inconsistent literature data on the influence of dietary black cumin on egg yield and egg quality characteristics. Secondly, the comparability of the biological effects of black cumin seed and white wormwood leaves. In this study, laying hens were fed diets containing either black cumin seed or white wormwood leaves or the combination of the two additives. The diet effects on egg production and egg quality characteristics were determined.

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MATERIALS AND METHODS

Animals, housing and diets: For this study, White Leghorn laying hens aged 50 weeks were used. They were kept in raised wire cages (40×50 cm). There were two or three birds per cage. Water was supplied through a pipe and nipple system. The chickens had free access to drinking water. The cages were placed in an open-sided house but jute sacks were used to damp direct sunlight. Additional lighting was provided to obtain a photoperiod of 17 h.

The birds were allocated to five dietary treatments. There were 26 or 27 chickens per treatment. The control birds (group A) were fed the base diet consisting of the following ingredients (g/100 g): sorghum, 55; groundnut cake, 19; wheat bran, 10.7; poultry concentrate, 5; sodium chloride, 0.3; limestone, 10. Table 1 shows the analyzed macronutrient composition of the base diet. The experimental diets contained black-cumin (*Nigella sativa*) seeds and/or dried white wormwood (*Artemisia herba-alba*) leaves. The dietary supplements were ground and mixed with the base diet as indicated in Table 1. All chickens received the basal diet for 2 weeks and were then fed the experimental diets for another 7 weeks. The diets were provided *ad libitum*.

Body weights were recorded at the beginning and the end of the experiment. Eggs were collected daily for the calculation of egg production per experimental unit. Feed intake per cage was determined. Feed efficiency was calculated as g feed intake per g egg production.

Analytical methods: The proximate composition of the basal diet, black-cumin seeds and white-wormwood leaves was measured according to the Weende methods. For each cage, two eggs were randomly taken out of the eggs produced during the last week of the experiment. These eggs were used to determine egg weight and to assess the various egg-quality variables. The shape index of the eggs was measured as width/length×100. Albumen height was measured with a caliper as close as possible to periphery of the fresh egg content on a plate. The Haugh unit was calculated as 100 log ($H - 1.7.W^{0.37} + 7.57$) where H is height of the inner thick albumen in mm and W is the egg weight in g. The color of the yolk was scored with the use of a color fan. The yolk index was determined from the fresh egg content spread on a plate and calculated as yolk height/yolk diameter. Shell thickness was measured with a caliper to the nearest 0.01 mm.

Table 1: Ingredient and macronutrient composition of the experimental diets

	Diet code				
Ingridients	A	B	C	D	E
Ingredient (g/100 g)					
Base diet	100.0	99.0	99.0	99.0	98.0
Black cumin seed	-	1.0	-	0.5	1.0
White wormwood leaves	-	-	1.0	0.5	1.0
Macronutrient (g/100 g)					
Dry matter	89.4	89.5	89.5	89.4	89.5
Crude protein	19.9	19.8	19.8	19.8	19.6
Crude fat	3.3	3.7	3.4	3.5	3.8
Crude fiber	4.0	4.2	4.2	4.2	4.4
Ash	13.2	13.1	13.1	13.1	13.0
Carbohydrates (NFE)	49.0	48.7	49.0	48.8	48.7

Data analysis: The results are presented as means±SD for 26 or 27 chickens per treatment. Statistically significant differences between groups were identified with the use of the LSD test. The level of statistical significance was pre-set at $p<0.05$.

RESULTS AND DISCUSSION

The black-cumin seeds had the following analyzed composition (g/100 g): dry matter, 95.0; crude protein, 9.4; crude fat, 44.6; crude fiber, 18.9 and ash, 6.1. The analyzed composition of the white-wormwood leaves was as follows (g/100 g): dry matter, 94.1; crude protein, 4.7; crude fat, 9.8; crude fiber, 27.0 and ash, 4.7. Table 1 shows the analyzed macronutrient composition of the base, control diet and the calculated composition of the experimental diets. The addition of black-cum seed and/or white-wormwood leaves to the base diet had no major impact on the macronutrient composition of the experimental diets (Table 1).

Initial body weights were similar for the five dietary groups (Table 2). Final body weights were significantly increased in the birds fed diet B with 1% black cumin seed or in those fed diet D with 0.5% of both black cumin seed and white wormwood leaves. Feed intake was numerically lower in groups C and E but the lowering was not statistically significant.

Egg production expressed as percentage of maximum production was not significantly influenced by dietary treatment (Table 2). However, group-mean egg production was much lower in the birds fed diet B than in their counterparts fed one of the other diets. Feed conversion efficiency was significantly decreased by diet C containing 1% white wormwood leaves and by diet E with the combination of 1% of black cumin seed and 1% white wormwood leaves. Diet D containing 0.5% black cumin seed plus 0.5% white wormwood leaves also significantly decreased feed conversion but not as much as did diets C and E.

Egg weight, shape index, albumen height, Haugh unit and shell thickness were not significantly affected by the dietary treatments (Table 3). There was no diet effect on yolk color (results not shown). However, the yolk index was significantly reduced by diet B containing 1% of black cumin seed.

Table 2: Performance of the laying hens fed the experimental diets

	Diet code				
Parameters	A	B	C	D	E
Initial body weight (kg)	1.35±0.09	1.37±0.150	1.26±0.110	1.36±0.040	1.29±0.050
Final body weight (kg)	1.30±0.15[a]	1.40±0.110[b]	1.29±0.110[a]	1.39±0.130[b]	1.31±0.070[a]
Feed intake (g day^{-1})	95.60±1.73	92.20±17.04	84.30±8.110	92.90±4.880	85.80±4.200
Egg production (%)	94.80±10.9	85.50±20.29	95.30±14.97	99.60±11.31	99.80±11.52
Feed conversion (g feed/g egg)	1.81±0.36[a]	1.81±0.900[a]	1.53±0.250[b]	1.66±0.300[c]	1.47±0.720[b]

Means within the same row not sharing a common superscript letter are significantly different

Table 3: Egg weight and quality in the laying hens fed the experimental diets

	Diet code				
Parameters	A	B	C	D	E
Egg weight (g)	55.80±1.36	59.70±2.44	57.90±1.41	56.30±2.22	58.40±3.51
Shape index	83.8±0.950	84.10±0.62	84.50±1.00	84.70±0.47	84.80±0.76
Albumen height (cm)	0.99±0.07	1.00±0.05	1.00±0.01	1.02±0.03	0.98±0.02
Haugh unit	87.3±0.340	87.20±0.29	87.00±0.64	87.40±0.16	87.20±0.02
Yolk index	0.36±0.02[a]	0.33±0.03[b]	0.37±0.02[a]	0.38±0.01[a]	0.37±0.02[a]
Shell thickness (mm)	0.38±0.02	0.39±0.02	0.39±0.06	0.37±0.02	0.37±0.02

Means within the same row not sharing a common superscript letter are significantly different

The addition of 1% black cumin seed to the base diet lowered group-mean egg production from 95-86%. In the earlier study (El-Bagir *et al*., 2006) the diet with 1% black cumin seed caused a fall in egg production from 67-61% while a dietary level of 2% black cumin further decreased egg yield to 56%. Aydin *et al*. (2008) used diets with 0, 1, 2 or 3% black cumin seed and reported egg production values of 77, 81, 78 and 84%, respectively. Yalcin *et al*. (2009) fed laying hens on diets containing 0, 0.5, 1 or 1.5% black cumin seed and measured egg yields 91, 91, 92 and 92%, respectively. El-Sheikh *et al*. (1998) used diets with 0, 0.5, 1 or 2% black cumin seed and found egg production values of 69, 79, 79 and 77%, respectively. The outcomes of the present study and that of Yalçin *et al*. (2009) are comparable with regard to the egg production level by the control group and the lack of effect of dietary black cumin seed. In the studies of El-Sheikh *et al*. (1998), El-Bagir *et al*. (2006) and Aydin *et al*. (2008), baseline egg production was similar but the feeding of black cumin had inconsistent effects.

Aydin *et al*. (2008) did not observe an effect of dietary black cumin seed on feed efficiency. Yalçin *et al*. (2009) noted a slight but significant improvement. In contrast, El-Sheikh *et al*. (1998) found a marked deterioration of feed efficiency when a diet containing 2% black cumin seed was fed. In this study, the feeding of black cumin seed did not affect feed conversion. In contrast, dietary white wormwood leaves significantly improved feed conversion efficiency. The beneficial effect of white wormwood was seen at the inclusion levels of 0.5 and 1% and showed a dose dependency. The data indicate that there was no interaction between black cumin seed and white wormwood leaves with regard to feed conversion efficiency. The diets containing 1% white wormwood produced the most pronounced decrease in feed conversion and also lowered final body weights of the laying hens. Thus, the improved feed efficiency seen after the feeding of white wormwood may relate to the lower body weight, requiring less dietary energy for maintenance. This reasoning is supported by the observation that the feeding of white wormwood leaves lowered group-mean feed intake but did not clearly increase egg production.

In the present study, the egg quality characteristics such as egg weight, shape index, albumen height, Haugh unit and shell thickness were not significantly affected by the feeding of black cumin seed or white wormwood leaves. The yolk index was significantly reduced by the diet containing 1% of black cumin seed but this was not seen for the diet with the combination of 1% black cumin seed and 1% white wormwood leaves. The lack of effect of black cumin seed on egg quality characteristics found in this study corroborates the observations of Yalçin *et al*. (2009). Other workers have observed an increase in egg weight (Akhtar *et al*., 2003; Aydin *et al*., 2008), shell thickness (El-Sheikh *et al*., 1998; Akhtar *et al*., 2003, Aydin *et al*., 2008) and Haugh unit and yolk index (Akhtar *et al*., 2003) in laying hens fed diets containing black cumin seed. However, El-Sheikh *et al*. (1998) reported that the feeding of blackcumin seed induced a decrease in Haugh unit and yolk index.

CONCLUSION

In this study, shows that dietary white wormwood improved feed efficiency in laying hens whereas black cumin seed did not. The diet with 1% black cumin seed lowered group-mean egg production. The two feed additives did not affect egg quality characteristics.

REFERENCES

Abid, Z.B., M. Feki, A. Hedhili and M.H. Hamdaoui, 2007. *Artemisia herba-alba* Asso (*Asteraceae*) has equivalent effects to green and black tea decoctions on antioxidant processes and some metabolic parameters in rats. Ann. Nutr. Metab., 51: 216-222.

Abu-El-Ezz, N.M., 2005. Effect of *Nigella sativa* and *Allium cepa* oils on *Trichinella spiralis* in experimentally infected rats. J. Egypt. Soc. Parasitol., 35: 511-523.

Akhtar, M.S., Z. Nasir and A.R., Abid, 2003. Effect of feeding powdered *Nigella sativa* L. seeds on poultry egg production and their suitability for human consumption. Veterinarski Arch., 73: 181-190.

Ayaz, E., H. Yilmaz, H. Ozbek, Z. Tas and O. Orunc, 2007. The effect of *Nigella sativa* oil against *Aspiculuris tetraptera* and *Hymenolepsis nana* in naturally infected mice. Saudi Med. J., 28: 1654-1657.

Aydin, R., M. Karaman, T. Cicek and H. Yardibi, 2008. Black cumin (*Nigella sativa* L.) supplementation into the diet of the laying hen positively influences egg yield parameters, shell quality and decreases egg cholesterol. Poult. Sci., 87: 2590-2595.

El-Bagir, N.M., A.Y. Hama, R.M. Hamed, A.G. Abd-El-Rahim and A.C. Beynen, 2006. Lipid composition of egg yolk and serum in laying hens fed diets containing black cumin (*Nigella sativa*). Int. J. Poult. Sci., 5: 574-578.

El-Sheikh, A.M.A., A.E. Amin and A.A. Khadiga, 1998. The effect of feeding different levels of *Nigella sativa* seeds on layer performance and egg quality characteristics. Sudan. J. Vet. Sci. Amin. Hus., 37: 121-128.

Idris, U.E., S.E. Adam and G. Tartour, 1982. The antihelmintic efficacy of *Artemisia herba-alba* against *Haemonchus contortus* infection in goats. Natl. Inst. Anim. Health, 22: 138-143.

Mahmoud, M.R., H.S. El-Abhar and S. Saleh, 2002. The effect of *Nigella sativa* oil against the liver damage induced by *Schistosoma manosi* infection in mice. J. Ethnopharmacol., 79: 1-11.

Ragheb, A., A. Attia, W.S. Eldin, F. Elbarbry, S. Gazarin and A. Shoker, 2009. The protective effect of thymoquinone and anti-oxidant and anti-inflammatory agent, against renal injury: A review. Saudi J. Kidney Dis. Transpl., 20: 741-752.

Salem, M.L., 2005. Immunomodulatory and therapeutic properties of the *Nigella sativa* L. seed. Int. Immunopharmacol., 5: 1749-1770.

Swamy, S.M. and B.K. Tan, 2000. Cytotoxic and immunopotentiating effects of ethanolic extract of *Nigella sativa* L. seeds. J. Ethnopharmacol., 70: 1-7.

Twaij, H.A.A. and A.A. Al-Badr, 1988. Hypoglycemic activity of *Artemisia herba alba*. J. Ethnopharmacol., 24: 123-126.

Yalcin, S., S. Yalcin, H. Erol, K.E. Bugdayc, B. Ozsoy and S. Cakir, 2009. Effects of dietary black cumin seed (*Nigella sativa*) on performance, egg traits, egg cholesterol content and egg yolk cholesterol and egg yolk fatty acid composition in laying hens. J. Sci. Food Agric., 89: 1737-1742.

Yashphe, J., R. Segal, A. Breuer and G. Erdreich-Naftali, 1979. Antibacterial activity of *Artemisia herba-alba*. J. Pharm. Sci., 68: 924-925.

Zeggwagh, N.A., O. Farid, J.B. Michel and M. Eddouks, 2008. Cardiovascular effect of *Artemisia herba alba* aqueous extract in spontaneously hypertensive rats. Methods Find. Exp. Clin. Pharmacol., 30: 375-381.