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Research Article

EFFECT OF SUPPLEMENTATION OF GINGER ROOT POWDER AND BLACK CUMIN SEED POWDER ON EXTERNAL EGG QUALITY IN WHITE LEGHORN LAYERS

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ABSTRACT

To evaluate the effect of different dietary levels of ginger root powder and black cumin seed powder alone or in combination on egg quality, 270 White Leghorn laying hens of 28 weeks old were randomly distributed among nine groups with 30 layers in each treatment with three replications following the factorial design (3^2). Experimental diets consisted of 0.00%, 0.50% and 1.00% levels of ginger root powder and black cumin seed powder alone or in combination. The experimental period lasted for a total of 84 days. External egg quality focuses on texture and shape, egg weight and shell weight, which are important in consumer's acceptability of shell eggs. Egg weight was significantly ($P<0.01$) highest in T5 (0.00% ginger root powder and 1.00% black cumin seed powder) treatment group. Significantly ($P<0.05$) highest egg weight was observed in 0.00% supplemented group due to main effect of ginger root powder supplementation. Egg shape index and egg shell thickness were not influenced by dietary treatments. Eggshell weight was not influenced by various dietary treatments groups and main effect of black cumin seed powder but significant ($P<0.05$) effect was observed due to main effect of ginger root powder supplementation. Egg shell weight (percent of egg weight) has been affected significantly ($P<0.05$) by various dietary treatments and main effect of black cumin seed powder however, no effect was observed due ginger root powder supplementation. The supplementation of 0.50% of black cumin resulted in better shelled egg with increased egg weight.

INTRODUCTION

External egg quality could be determined of the egg without breaking the egg.External egg quality includes egg weight, egg shape index, egg shell thickness and egg shell weight. Egg weight influences egg quality as well as grading (Farooq*et al*., 2003).Egg size refers to the weight of an egg rather than the dimensions of the egg. The egg weight has positive effect on hatchability and chick hatch weight (Ramaphala and Mnajiorgu, 2013). In market much preference is given to egg sizeand eggs are sold on the basis of egg size. Theconsumer prefer large size egg to small size whichenforces poultry farmers have to give equal emphasis towards the higher egg production along with maximum egg size. The relationship between egg length and egg width was reported by Choprakarn *et al*. (1998). The shape index of egg is a matter of natural convenience rather than aesthetic consideration and it should be smooth in order to assist in laying.Eggshell quality traits play an important role reason being only eggs with an intact shell are considered for hatching or as table eggs. Eggshell thickness plays a major role for eggshell quality. Significant impacts on egg quality and egg weight was reported due the positive impact of herb via reducing the count of pathogens in the digestive tract, enhancing immune response, improve intestine length, width and depth of digestive tract villi along with the activity of digestive enzymes results in increased retention of nutrients and minerals (Alcicek *et al*. 2003,Shahryar *et al*. 2011, Abd El-Wareth 2012). Ginger is a species included in the family Zingiberaceae. Ginger root contains several compounds which have biological activities such as antioxidation, antimicrobial and pharmacological effects (Akoachere *et al*., 2002). The rhizome contains various biologically active compounds such as curcumin, 6-shogoals, zingiberene, 6 gingerol, bisaboline, gingerdiol, gingerdione and numerous lipids which are responsible for characteristic medicinal properties, pungent odour and a stimulant properties of ginger (Bliddal *et al*., 2000; Zhao *et al*., 2011). The major

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components of ginger are zingiberen and zingerol that can stimulate the digestive system, digestive pH, digestive enzyme and intestinal microbial activity.Black cumin seeds are being used as spice from the antediluvian times. The chemical constituents found in nigella seeds are melanthingenin, glucosides-melanthin, crystalline active principle nigellone, essential oil, fixed oil, resins and tannins (Latif and Rehman, 1999). Phenolic fractions of seeds have bactericidal and bacteriostatic effects. Black cumin seed has various biologically active compounds which are nigellone, nigellicine, nigellimine, nigellimine-N-oxide, volatile oil, fatty oil, oleic acid, esters of unsaturated fatty acids with C15 and higher terpenoids, esters of dehydrostearic and linoleic acid, aliphatic alcohol (Desai *et al*., 2015). It was demonstrated that black cumin seeds have considerable antioxidant, antibacterial, digestive and appetite stimulant and hepatoprotective and immunomodulative properties. External egg quality is composed of those characteristics of an egg that affect its acceptability to consumers, preservation and marketing of eggs, therefore important attention is paid to maintain the quality of eggs. Hence, in the present study, this parameter has been considered to assess the effect of supplementation of ginger root powder and black cumin seed powder on external egg quality.

Experimental Section

A total of 270 birds, 28 weeks old of commercial egg type strain White Leghorn layer were randomly allotted to one of the nine treatments with 30 layers in each treatment with three replications. The factorial design (3^2) was adopted for the present feeding trial. Herbal feed additive, ginger root powder and black cumin seed powder were supplemented either alone or in combination to prepare nine different treatment diets for the feeding of birds under different dietary groups. The chemical composition of basal diet, ginger root powder and black cumin seed powder was presented in (table 1).The T_1 *i.e.* control group was fed on basal diet while T_2 and T_3 treatment groups were supplemented with 0.50% and 1.00% ginger root powder in the basal diet, respectively. Whereas, T_4 and T_5 treatment groups were supplemented with 0.50% and 1.00% of black cumin seed powder in the basal diet, respectively. The T_6 group was supplemented with 0.50% of both ginger root powder and black cumin seed powder in the basal diet and T_7 group was supplemented with 1.00% of both ginger root powder and black cumin seed powder in the basal diet. T_8 group was supplemented with 0.50% ginger root powder and 1.00% black cumin seed powder in the basal diet and T_9 group was supplemented with 1.00% ginger root powder and 0.50% black cumin seed powder in the basal diet.

Table 1 Chemical composition of basal diet, ginger root powder and black cumin seed powder (%DM basis)

S.No.	Chemical composition	Basal diet	Ginger root powder	Black cumin seed powder
1.	Dry matter	91.40	96.24	97.20
2.	Crude protein	18.03	10.83	20.32
3.	Ether extract	5.20	2.37	29.30
4.	Crude fiber	4.80	5.50	8.10
5.	Total ash	15.57	4.48	5.32
6.	Nitrogen free extract	56.37	76.82	36.96
7.	Acid insoluble ash	1.59	0.46	0.27
10.	Calcium	5.61	1.42	1.75
11.	Phosphorus	0.90	4.80	0.03

A feeding trial of 84 days was carried out. One egg from each replication (3 from a group) was collected at bi-weekly interval to measure the external egg quality parameters. The egg shape index was calculated by egg width/egg length. Egg shells were dried in the air. After drying, shell thickness was measured using screw gauge. The egg shell along with membrane was sunk in 5 % EDTA solution for 30 minutes. After that shell membrane was removed carefully. Egg shells were dried in the air and weighed using an electronic balance. Weight of egg shell in term of percent of egg weight was calculated by the following formula: Egg shell weight (% of egg weight)=Egg shell weight X 100/Egg weight. Data collected during the present investigation were subjected to statistical analysis by adopting appropriate methods of analysis of variance as described by Snedecor and Cochran (2004). Wherever the variance ratio (F-values) were found significant at 5 percent and 1 percent levels of probability, the significance of mean differences were tested by Duncan's New Multiple Range Test (Duncan's Range Test) as modified by Kramer (Kramer 1956).

RESULT AND DISCUSSION

Egg quality traits of laying hens fed with various levels of ginger root powder and black cumin seed powder during experimental periods are presented in table 2.

The results showed that the egg weight has significant ($P<0.01$) effect among various treatment groups and significantly ($P<0.01$) highest egg weight was observed in T_5 group having 0.00% ginger root powder and 1.00% black cumin seed powder. Due to main effect of ginger root powder supplementation significantly ($P<0.05$) highest egg weight was observed in 0.00% supplemented group where as 0.50% and 1.00% supplemented group have comparable egg weight, whereas non-significant effect was observed on egg weight due to main effect of black cumin seed powder supplementation. This finding is in accordance with the report of Akbarian *et al*. (2011), Zomrawi*et al*. (2014) and Malekizadeh *et al*. (2012) reported decrease in egg weight due to supplementation of ginger root powder at different levels, whereas on contrary Abd EL-galil and Henda (2015) reported significant increase in egg weight. This discrepancy may be explained by the fact that the ginger root powder hascholesterol lowering effectwhich might be resulted in decline in egg weight (Elkin *et al*., 1993). The result in text of black cumin seed powder supplementation was in accordance with findings of Attia*et al*. (2008), Bolukbasi*et al*. (2009), Yalcin*et al*. (2012) and Boka*et al*. (2014) who reported non-significant effect on egg weight. The results are in partial agreement with the findings of Aydin*et al*. (2006), Aydin*et al*. (2008) and Khan *et al*. (2013) who reported significant increase in egg weight due to black cumin supplementation. It is possible that antioxidant property of black cumin seed powder protect hepatic cell from oxidative damage and might have increase the secretion of egg yolk precursor's resulted in increase in egg weight (Bollenger-Lee *et al*., 1998).

Non-significant effect was observed on egg shape index and egg shell thickness (mm). The findings on shape index is consistent with the report of Zomrawi *et al*. (2014), who reported statistically comparable egg shape index in 0.00%, 0.50% and 1.00% ginger supplemented group, whereas on contrary Abd El-Galil and Henda (2015) reported significant

reduction in egg shape index due to supplementation of ginger root powder. Denli *et al*. (2004), Yalcin *et al*. (2012) and Attia *et al*. (2008) reported no influence on egg shape index due to supplementation of black cumin seed powder, similarly Boka *et al*. (2014) reported non-significant effect on egg shape index at day 70 but on contrary reported significant effect at day 30 of experimental period in laying hens. The results of egg shell thickness obtained in present study were well corroborate with the findings of Abd El-Galil and Henda (2015) reported no influence on egg shell thickness due to supplementation of ginger root powder at different levels, whereas on contrary Zomrawi *et al*. (2014) reported significant decrease in egg shell thickness. The results of egg shell thickness due black cumin seed powder supplementation was in accordance with findings of Aydin *et al*. (2006) and Yalcin *et al*. (2012) reported no influence on egg shell thickness due to supplementation of black cumin seed powder, similarly Boka *et al*. (2014) reported non-significant effect at day 35 but on contrary reported significant effect at day 70 of experimental period. The results are in contrary with the findings of Akhtar *et al*. (2003), Denli *et al*. (2004) and Attia *et al*. (2008) who reported significant increase in the egg shell thickness.

Eggshell weight has not been affected by various treatment groups and main effect of black cumin seed powder, however due main effect of ginger root powder, significantly ($P<0.05$) highest egg shell weight was observed in 0.00% supplemented group which was comparable with 1.00% supplemented group but higher than 0.50% supplemented group.Sittiya *et al*. (2017) reported significant effect on egg shell weight due to supplementation of dry fermented ginger powder in phase first (53 to 61 week of age). However, Zomrawi *et al*. (2014) reported no influence on egg shell weight due to supplementation of ginger root powder at different levels. Aydin *et al*. (2006), Aydin *et al*. (2008) and Attia *et al*. (2008) reported no influence on egg shell weight due to supplementation of black cumin seed powder, similarly Boka *et al*. (2014) reported non-significant effect at day 35 and 70 of experimental period in laying hens. This finding is contrary with the report of Denli *et al*. (2004) who reported significant effect on shell weight due to supplementation of black cumin seed powder in diet of quail (*Coturnixcoturnix japonica*). Significant effect ($P<0.05$) was observed on egg shell weight (% of egg weight) due to various treatment groups. Egg shell weight (% of egg weight) in T_1 group was comparable with rest of the groups, whereas it was lowest in T_5 group, which was though comparable with all the groups, except T_3 group. The main effect of ginger root powder supplementation has no influence on egg shell weight percent whereas due main effect of black cumin seed powder the it was significantly highest in 0.00% supplemented group which was though comparable with 0.50% supplemented group but significantly higher than 1.00% supplemented group, whereas it was lowest in 1.00% supplemented group which was comparable with 0.50% supplemented group.

Table 2 Effect of different levels of ginger root powder and black cumin seed powder on egg quality traits of laying hens

Treatment groups							
Ginger X black cumin	Ginger (%)	Black cumin (%)	Egg weight	egg shape index	egg shell thickness (mm)	egg shell weight	Egg shell weight (% of egg weight)
T_1	0.00	0.00	55.73^{a}	75.62	0.368	5.81	10.44^{ab}
T_2	0.50	0.00	56.82^{a}	76.11	0.358	5.48	9.66^{ab}
T_3	1.00	0.00	56.61^{a}	76.70	0.363	5.74	10.14^{b}
T_4	0.00	0.50	57.23^{a}	76.57	0.360	5.58	9.76^{ab}
T_5	0.00	1.00	59.03^{b}	75.85	0.364	5.66	9.59^{a}
T_6	0.50	0.50	55.90^{a}	76.93	0.363	5.53	9.90^{ab}
T_7	1.00	1.00	56.17^{a}	76.60	0.354	5.52	9.85^{ab}
T_8	0.50	1.00	56.17^{a}	76.35	0.366	5.46	9.75^{ab}
T_9	1.00	0.50	56.16^{a}	76.18	0.363	5.58	9.95^{ab}
SEM			0.447**	0.473	0.009	0.089	0.158*
Ginger (%)							
0.00			57.33^{b}	76.01	0.364	5.68^{b}	9.93
0.50			56.30^{a}	76.46	0.362	5.49^{a}	9.77
1.00			56.31^{a}	76.49	0.360	5.61^{ab}	9.98
SEM			0.258*	0.273	0.005	0.051*	0.091
Black cumin (%)							
0.00			56.39	76.14	0.363	5.68	10.08^{b}
0.50			56.43	76.56	0.362	5.56	9.87^{ab}
1.00			57.12	76.27	0.361	5.55	9.73^{a}
SEM			0.258	0.273	0.005	0.051	0.091*

Means with different superscripts in a column differ significantly
** = P<0.01 *= P<0.05

The results obtained on egg shell weight percent in present study were well corroborate with the findings of Incharoen and Yamauchi (2009) and Zomrawi *et al*. (2014) reported no influence on egg shell weight due to supplementation of ginger root powder at different levels in diet of laying hens, whereas on contrary Abd El-galil and Henda (2015) reported significant effect due to ginger root powder root supplementation in diet of Japanese laying quails. Similarly the result in text of black cumin seed powder supplementation was in accordance with findings of Aydin *et al*. (2006) who also reported significant decrees in the egg shell weight percent due to supplementation of black cumin seed powder. The results are in partial agreement with the finding of Khan *et al*. (2013), Bolukbasi *et al*. (2009) and Aydin *et al*. (2008) who reported non-significant decrease in the egg shell weight percent due to supplementation of black cumin seed powder. However, on contrary Yalcin *et al*. (2012) reported no influence on egg shell weight percent due to supplementation of black cumin seed powder in diet of laying hens.

CONCLUSION

In conclusion, the present results indicated that dietary supplementation of black cumin have positive effect on egg weight and egg shape index without affecting the egg shell thickness and shell weight. However supplementation of ginger root powder improves shell weight but egg weight was decreased. The supplementation of 0.50% of black cumin resulted in better shelled egg with increased egg weight.

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