Journal of Animal Research: v.9 n.5, p. 683-688. October 2019

DOI: 10.30954/2277-940X.05.2019.8

Effect of Supplementation of Ginger Root Powder and Black Cumin Seed Powder on Performance of White Leghorn Layers

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Received: 24 June, 2019 **Revised:** 27 Aug., 2019 **Accepted:** 07 Sept., 2019

ABSTRACT

This study was conducted to investigate the effects of different levels of ginger root powder and black cumin seed powder alone or in combination on performance and egg production in laying hens. A total of 270 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 (32). 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 and laying hens' performance was measured. Non-significant effect was observed on feed intake due to supplementation of black cumin seed powder whereas, significant ($P<0.05$) effect was observed due to ginger root powder supplementation. T_5 treatment group which was supplemented with 0.00% ginger root powder and 1.00% black cumin seed powder had significantly ($P<0.01$) highest egg weight, egg production and egg mass along with best feed conversion ratio. It can be concluded that supplementation of 1.00% level of black cumin seed powder was recommended for best layer performance.

Keywords: Ginger root powder, black cumin seed powder, performance, egg production

The growing appreciation for poultry products along with increasing pressure to decrease or eliminate the application of antibiotics in poultry feed because of the negative issues related to human health has encouraged researches to be focused on safe natural additives in poultry feeds such as phytobiotics. Phytobiotics are include a very wide range of substances and four subclasses in animal feeding and may be classified as herbs, botanicals, essential oils and oleoresins (Windisch and Kroismayr, 2006). Phytobiotics have stimulating effect on peptic juices, such as bile and salivary, gastric, pancreatic and intestinal juices (Stoilova *et al*., 2007) along with various pharmacological effects including immunomodulatory, antitumorigenic, antiinflammatory, antihyperglycemic, antilipidemic, and antiemetic effects (Ali *et al*., 2008). 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; Zhang *et al*., 2009; Zhao *et al*., 2011). The major 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 in preparation of pickles. The chemical constituents found in nigella seeds are melanthingenin, glucosides-melanthin, crystalline active principle nigellone, essential oil, fixed oil, resins

How to cite this article: Kumar, M., Arya, R.S., Dhuria, R.K., Nehra, R. and Jain, D. (2019). Effect of supplementation of ginger root powder and black cumin seed powder on performance of white leghorn layers. *J. Anim. Res.*, **9**(5): 683-688.

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 (Herve *et al*., 2019). Therefore, the objective of the present study was to evaluate the effects of ginger root powder and black cumin seed powder on layer's performance and egg production.

MATERIALS AND METHODS

A total of 270, 28 weeks old of commercial egg type strain White Leghorn layers were reared on deep litter. The factorial design (3^2) was adopted for the present feeding trial. The birds were equally and randomly allotted to one of the nine treatments with 30 layers in each treatment with three replications. The chemical composition of the basal diet, ginger root powder and black cumin seed powder was presented in table 1.

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

Chemical composition	Basal diet	Ginger root powder	Black cumin seed powder
Dry matter	91.40	96.24	97.20
Crude protein	18.06	10.83	20.32
Ether extract	5.20	2.37	29.30
Crude fiber	4.80	5.50	8.10
Total ash	15.57	4.48	5.32
Nitrogen free extract	56.37	76.82	36.96
Acid insoluble ash	1.59	0.46	0.27
Calcium	5.61	1.42	1.75
Phosphorus	0.90	4.80	0.03

Nine different treatment diets were prepared for the feeding of birds under different dietary groups (Table 2). Herbal feed additive, ginger root powder and black cumin seed powder were supplemented either alone or in combination. The T_1 *i.e.* control group was fed on basal diet while T_2 and T_3 treatment group's basal diets were supplemented with 0.50% and 1.00% ginger root powder, respectively. Whereas, T_4 and T_5 treatment group's basal diets were supplemented with 0.50% and 1.00% of black cumin seed powder, respectively. The T_6 and T_7 group's basal diets were supplemented with 0.50% of both ginger root powder and black cumin seed powder and 1.00% of both ginger root powder and black cumin seed powder, respectively. T_8 group's basal diets was supplemented with 0.50% ginger root powder and 1.00% black cumin seed powder and T_9 group's basal diets was supplemented with 1.00% ginger root powder and 0.50% black cumin seed powder. A feeding trial of 84 days was carried out. The feed offered and residual feed from the feeding trough of each replicate was quantitatively weighed at bi-weekly interval and actual feed intake of each replicate was calculated. One egg from each replication (3 from group) was collected at bi-weekly interval to measure the egg weight. Eggs were collected twice a day and egg production (%) was calculated at bi-weekly intervals as following: Egg production (%) = (Number of egg laid per replicate)/(Number of hen per replicate)×100. The average weight of egg is determined by weighing the eggs of each replicate at two last consecutive days of biweek and egg mass is calculated at bi-weekly intervals as following: Egg mass(g) = (Number of egg laid per replicate)/(Number of hen per replicate) × Average weight of egg. Feed conversion ratio values (kg feed/kg egg mass) were calculated at bi-weekly interval. 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, 1956).

RESULTS AND DISCUSSION

The effects of different levels of ginger root powder and black cumin seed powder on laying hens performance were presented in Table 3. Feed intake was not influenced in various treatment groups. On observing the main effect, the feed intake was significantly lower in both ginger root powder supplemented groups as compared to the non-supplememted group. Non-significant effect was observed due to main effect of black cumin seed powder

Table 2: The chemical (% DM basis) composition of experimental feed offered during feeding trial to White leghorn layers

Parameters	Treatment groups								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
DM	91.40	91.43	91.45	91.43	91.46	91.46	91.51	91.49	91.48
CP	18.06	18.02	18.00	18.07	18.08	18.04	18.01	18.05	18.00
EE	5.20	5.18	5.17	5.32	5.44	5.30	5.41	5.42	5.29
CF	4.80	4.80	4.81	4.82	4.83	4.82	4.84	4.84	4.82
TA	15.57	15.52	15.46	15.52	15.47	15.46	15.36	15.41	15.41
AIA	1.587	1.581	1.575	1.580	1.573	1.574	1.562	1.568	1.569
Ca	5.61	5.59	5.57	5.59	5.57	5.57	5.53	5.55	5.55
P	0.900	0.920	0.939	0.896	0.891	0.915	0.930	0.911	0.935

supplementation. This finding is consistent with the results of Eltazi (2014) who reported significant reduction in feed intake upto 2% level of ginger powder in broiler diet. Consequently, the groups showing higher feed intake are might be due the more energy requirement to support the higher egg production and egg mass. The feed intake was in correspondence with the result of egg production and egg mass tended to decrease with higher level of ginger root powder. The effect of herbal supplementation on feed intake may be dependent on its dietary level, taste and birds age. The significant reduction in feed intake in this study was might be due to the bitter taste of ginger having phenolic terpens (Hashemi *et al*., 2008; Dai *et al*., 2013 and Rahman *et al*., 2013). The result in text due to supplementation of black cumin seed powder was in accordance with findings of Aydin *et al*. (2006) and Yalcin *et al*. (2012) who reported non-significant effect on feed intake in laying hens. Similarly Bolukbasi *et al*. (2009) also reported non-significant effect due to supplementation of black cumin oil in the diet of laying hens.

The results showed that 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. Significantly ($P<0.05$) lower egg weight was observed in ginger supplemented group as compared to non-supplemented group. However, 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 decline in egg weight was due cholesterol lowering effect of ginger root powder 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).

Significantly ($P<0.01$) highest egg production and egg mass were recorded in T_5 treatment group. On observing main effect, significantly higher egg production and egg mass were recorded in ginger supplemented groups than those of ginger non-supplemented group. Due to main effect of black cumin seed powder significantly highest egg production and egg mass were recorded in 1.00% supplemented group, whereas both 0.00% and 0.50% supplemented group have comparable egg production and egg mass.

This finding were well corroborate with the results of Malekizadeh *et al*. (2012), who reported decrease in egg production on supplementation of ginger rhizome powder at 3% level in comparison of 1% level in single comb White Leghorn layers. Zomrawi *et al*. (2014) reported decrease in egg production in comparison to control due to supplementation of ginger root powder in diet of laying hens. Sittiya *et al*. (2017) reported non-significant

Table 3: Effect of different levels of ginger root powder and black cumin seed powder on performance of laying hens

Treatment groups			Feed intake	Egg weight	Egg production	Egg mass	Feed conversion ratio (Kg feed/Kg egg mass)
Ginger × black cumin	Ginger (%)	Black cumin (%)					
T_1	0.00	0.00	112.07	55.73^{a}	82.40^{a}	47.24^{a}	2.38
T_2	0.50	0.00	111.11	56.82^{a}	86.16^{cd}	48.87^{c}	2.28
T_3	1.00	0.00	108.45	56.61^{a}	86.24^{cd}	49.43^{c}	2.19
T_4	0.00	0.50	111.87	57.23^{a}	87.35^{d}	49.17^{c}	2.28
T_5	0.00	1.00	117.03	59.03^{b}	94.85^{e}	54.61^{d}	2.15
T_6	0.50	0.50	107.42	55.90^{a}	87.28^{d}	48.59^{bc}	2.23
T_7	1.00	1.00	107.51	56.17^{a}	84.54^{bc}	47.67^{ab}	2.26
T_8	0.50	1.00	107.51	56.17^{a}	84.84^{bc}	47.19^{a}	2.28
T_9	1.00	0.50	105.97	56.16^{a}	83.20^{ab}	47.33^{a}	2.24
SEM			2.643	0.447**	0.603**	0.338**	0.062
Ginger (%)							
0.00			113.66^{b}	57.33^{b}	88.19^{c}	50.34^{b}	2.27
0.50			108.68^{a}	56.30^{a}	86.08^{b}	48.22^{a}	2.26
1.00			107.31^{a}	56.31^{a}	84.65^{a}	48.14^{a}	2.23
SEM			1.526*	0.258*	0.348**	0.195**	0.036
Black cumin (%)							
0.00			110.55	56.39	84.93^{a}	48.51^{a}	2.28
0.50			108.42	56.43	85.93^{a}	48.36^{a}	2.25
1.00			110.69	57.12	88.07^{b}	49.82^{b}	2.23
SEM			1.526	0.258	0.348**	0.195**	0.036

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

decrease in egg production due to supplementation of dry fermented ginger at 500 ppm level, similarly Incharoen and Yamauchi (2009) reported non-significant decrease in egg production at 5% level of dry fermented ginger in comparison to 1% level. The egg production was in correspondence with the result of feed intake tended to decreases with supplementation of higher level of supplementation of ginger root powder. Consequently, the groups showing lower egg production require less energy and less feed intake. In contrary Akbarian *et al*. (2011), who reported positively influence on egg production due to supplementation of ginger root powder in diet of hen at 0.25, 0.50 and 0.75% level. The result in text of black cumin seed powder supplementation was in accordance with findings of Aydin *et al*. (2008) and Khan *et al*. (2013) who reported significant increase in egg production due to supplementation of black cumin seed powder in White Leghorn layers. Similarly Denli *et al*. (2004) reported significant increase in egg production in quails. However, Bolukbasi *et al*. (2009) and Yalcin *et al* (2012) reported non-significant effect on egg production. Whereas, on contrary El-Bagir *et al*. (2006) reported significant decreases in egg production due to supplementation of black cumin at 1% and 3%. It was demonstrated that hepatic cell functions was disturbed by enhancing free radicals, which causes reduction in plasma concentrations of egg yolk precursors (Bollengier-Lee *et al*., 1998). Therefore, it is possible that antioxidant property of black cumin seed powder might have increase the secretion of egg yolk precursor's from liver, by preserving hepatocytes from oxidative damage, resulted in increase in egg production. Platel and Srinivasan (2000), Ali *et al*. (2008) and Incharoen and Yamauchi (2009) reported positive effects of herbal supplementation on gastric secretion and found to be enhancing digestive enzyme activities. All of these have favorable effects on animal productivity, which may have

partially contributed to the increased egg production of laying hens in this study.

Feed conversion ratio in term of kilogram of feed consumed to produce one kilogram of egg mass was not affected among various treatment group, however on comparison of means it was best in T_5 treatment group having 0.00% of ginger root powder and 1.00% black cumin seed powder. Non-significant effect was observed on feed conversion ratio due to main effect of ginger root powder and black cumin seed powder supplementation.

The results were in accordance with findings of Incharoen and Yamauchi (2009), Akbarian *et al*. (2011), Malekizadeh *et al*. (2012), Zhao *et al*. (2011) and Zomrawi *et al*. (2014) who reported non-significant effect on feed conversion ratio due to supplementation of ginger root powder in laying hen, whereas Abd El-galil and Henda (2015) reported significant effect on feed conversion ratio due to supplementation of ginger root powder in diet of hen. The result in text of black cumin seed powder supplementation was in accordance with findings of Aydin *et al*. (2008), Attia *et al*. (2008), Bolukbasi *et al*. (2009) and Yalcin *et al*. (2012) showed non-significant effect on feed conversion ratio in laying hens. Boka *et al*. (2014) reported significant effect on feed conversion ratio in second 35 day trial whereas, non-significant effect in the entire experimental period on supplementation of black cumin seed powder in laying hens. On contrary Khan *et al*. (2013) reported significant effect on feed conversion ratio due to supplementation of black cumin seed powder in diet of laying hens. No difference was observed on feed intake whereas the increase in egg production was due to positive effects of black cumin seed powder on gastric secretion and digestive enzyme activities along with antioxidant property results in better feed conversion ratio.

CONCLUSION

Thus, looking to the performance of White Leghorn layers in terms of egg production and egg mass it could be concluded that supplementation of black cumin seed powder at 1.00% level was recommended for best poultry production.

ACKNOWLEDGMENTS

Authors are thankful to Poultry Farm of College of Veterinary and Animal Science, Bikaner (Rajasthan) for smooth pursue of research work.

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