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Unveiling the Effect of Garlic and Black Cumin Oil on Egg Yolk Lipid Profile of Birds: A Comparative Study

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ABSTRACT

The present study was aimed to assess the effect of garlic (*Allium sativum*) and black cumin (*Nigella sativa*) oil on egg yolk lipid profile of adult layer birds. Forty eight 40-weeks-old birds were randomly divided into two preparation trials of 24 birds each. Each trial was further divided into 4 groups of 6 birds each. Birds were caged individually and diets were supplemented with 0 (control), 250, 500 and 750 mg garlic and black cumin oil/kg of feed in groups T_1, T_2, T_3 and T_4 respectively for 56 days. The birds of T_4 group showed maximum reduction in egg yolk lipid profile on day 56. The present study revealed that Allium sativum oil @750mg/kg of feed is the most effective supplementation in reducing the egg lipid profile in birds.

HIGHLIGHTS

- Effect of garlic (*Allium sativum*) and black cumin (*Nigella sativa*) oil on egg yolk lipid profile of adult layer birds.
- Supplementation of *Allium sativum* oil @750mg/kg of feed was found most effective in reducing the egg lipid profile.

Keywords*:* Garlic and Black cumin oil, Egg yolk cholesterol, Egg yolk total lipids, Egg yolk triglycerides, Jabalpur color birds

Natural medicinal products derived from herbs and spices that are used to improve performance in animal and poultry nutrition have been called "phytogenic feed additives" (Windisch *et al.,* 2008). In addition to traditional antibiologies, probiotics and prebiotics, the use of phytogenic foods or herbal plants has recently been given much greater attention. These plants are considered to be natural products and can therefore be voluntarily accepted into poultry feed. Extensive studies of plant growth, antimicrobial, antioxidant and anti-inflammatory functions of plant phytogenes have been identified (Gheisar and Kim, 2017). Furthermore, they stimulate the digestive system by increasing the production of digestive enzymes and improving feed utilization efficiency by enhancing liver functions (Abou-Elkhair *et al.,* 2014). Plant-based feed additives have recently received a lot of attention as alternatives to traditional antibacterial feed additives (Choudhary *et al.,* 2014; Singh and Kumar, 2018). Antibacterial, antifungal, antiparasitic, antioxidant, antimicrobial, and other pharmacological activities are possessed by black cumin (Ahmad, 2013). Since antiquity, many cultures have used garlic (*Allium sativum*) as both a food and a medicine. Garlic has hypocholesterolemic and antioxidant properties (Jang *et al.,* 2018) due to the presence of compounds such as allin, allicin, ajoene, S-allyl cysteinediallyl sulfide, and diallyltrisulfide (Amagase *et al.,* 2001). Kansal *et al. (*2017) declared a positive effect on broilers' biochemical parameters in a mixed diet to be 0.75 per cent garlic. Nigella sativa commonly known as Kalonji, has been reported to have hypolipidemic effects (Zaoui *et al.,* 2000). Solvent extracted fixed oil of black cumin has 42.76% linoleic acid, 16.59% oleic acid, 8.51% palmitic acid, 4.71% eicosatrienoic acid, 5.98%

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eicosapentaenoic acid (EPA) and 2.97% decosahexaenoic acid (DHA) (Kaskoos, 2011). The Nigella sativa seeds have also been reported to reduce serum and yolk total cholesterol, LDL-cholesterol, triglycerides content and increased HDL-cholesterol (Akhtar *et al.,* 2003). In view of above, the present study was undertaken to compare the hypolipidemic effect of garlic and black cumin oil supplementation in Jabalpur color birds.

MATERIAL AND METHODS

The study was conducted on 48 healthy Jabalpur color birds (pure line developed by the *inter-se* mating of 3rd generation among the selected stock of Krishna J. Commercial Broiler/Breeder and one color line from Poultry Breeding Farm, Adhartal, Jabalpur) of 40 weeks age. Birds were procured from All India Coordinated Research Project (AICRP) on Poultry Breeding, Adhartal, Jabalpur, MP, India. They were kept separately in individual cages and maintained under similar hygienic conditions at Poultry Farm Adhartal, Jabalpur. The birds were randomly divided into 8 groups having 6 birds each. These groups were fed with diets supplemented with garlic and black cumin oil @ 0, 250, 500 and 750 mg kg^{-1}. The basal diet consisted of 2700 Kcal ME kg^{-1} and 17% protein. Six eggs were collected from each group on 0th, 14th, 28th, 42th and 56th days of feeding. Egg-yolk total lipids were extracted as per Folch *et al.* (1957) and estimated as per Frings *et al.* (1972). The egg yolk cholesterol and triglycerides were estimated by standard diagnostic kits (Erba).

STASTISTICAL ANALYSIS

The data obtained was analyzed using hierarchical analysis of variance (Steel and Torrie, 1992). Comparisons among the treatment means were made by Duncan's (Duncan, 1955) multiple range test.

RESULTS AND DISCUSSION

The variations in egg-yolk total lipids and cholesterol between groups and between intervals within treatments were highly significant ($P<0.01$) whereas those between treatments within groups were significant ($P<0.05$) except for egg-yolk triglycerides. The reduction in egg yolk total lipids was 22.96% in birds fed with 250 mg garlic oil kg^{-1} diet on 56th day of experiment whereas it was 31.15 and 42.12% in birds fed with 500 and 750 mg garlic oil kg^{-1} diet, respectively and 16.04% in group T_2, 20.23% in group T_3 and 31.22% in group T_4 of black cumin oil on day 56 of the experiment (Table 1). No significant change was observed in control. Similar pattern of reduction in egg-yolk total lipids has been reported by Hebbar (2010) on dietary supplementations consisting of five plants, *A. sativum, Cuminum cyminum, Terminalia arjuna, cinnamon* and *Tinospora cordifolia* in the ratio of 3:2:2:2:1 @ 4500 mg kg^{-1} feed in adult layer birds. Similar pattern of reduction (14%) in egg yolk total lipids was reported by Bagir *et al.* (2006) on dietary supplementations of black cumin seed of feed in adult White Leghorn birds.

The egg-yolk cholesterol was reduced by 22.75, 29.60 and 35.61% in birds fed with 250, 500 and 750 mg garlic oil kg^{-1} diet, respectively and 11.97 in group T_2, 21.73 in group T_3 and 27.36 in group T_4 in the black cumin oil fed group on day 56 of the experiment (Table 2). Chowdhury *et al.* (2002) observed 5-24% reduction in yolk cholesterol of laying hens when fed on diets supplemented with garlic

Table 1: Egg yolk total lipids (mg g^{-1}) in Jabalpur color birds fed with diets supplemented with garlic and black cumin oils (mean ± SE; n=6)

Groups	Treatments	Day 0	Day 14	Day 28	Day 42	Day 56
Garlic oil	T_1	314.29±5.47	314.89±1.02	311.63±2.30	313.76±1.97	313.49±3.29
	T_2	315.11^{a}±2.23	308.83^{a}±2.61	295.64^{b}±3.66	274.07^{c}±3.41	242.76^{d}±1.35
	T_3	317.05^{a}±3.38	306.77^{b}±1.94	285.06^{c}±3.96	261.94^{d}±2.14	218.28^{e}±2.08
	T_4	312.82^{a}±1.79	299.19^{b}±2.91	265.55^{c}±3.05	232.16^{d}±1.84	181.06^{e}±4.85
Black cumin oil	T_1	347.08±2.69	345.26±1.55	344.17±1.23	344.71±0.86	343.44±3.09
	T_2	317.64^{a}±1.11	306.57^{b}±1.79	290.29^{c}±0.79	273.77^{d}±1.22	266.68^{d}±0.91
	T_3	316.21^{a}±1.95	303.99^{b}±2.48	286.97^{c}±2.74	273.89^{d}±3.81	252.56^{e}±2.59
	T_4	315.55^{a}±2.72	292.28^{b}±2.37	267.88^{c}±2.62	226.38^{d}±3.39	217.02^{e}±1.83

Mean values with different superscripts in a row vary significantly ($p< 0.01$).

Table 2: Egg yolk cholesterol (mg g^{-1}) in Jabalpur color birds fed with diets supplemented with garlic and black cumin oils (mean ± SE; n=6)

Groups	Treatments	Day 0	Day 14	Day 28	Day 42	Day 56
Garlic oil	T_1	17.47±0.19	17.98±0.39	17.72± 0.23	17.68±0.29	17.95±0.20
	T_2	17.40^{a}±0.14	16.32^{b}±0.17	15.61^{b}±0.13	14.71^{c}±0.21	13.44^{d}±0.13
	T_3	17.33^{a}±0.19	16.93^{a}±0.24	15.36^{b}±0.21	14.33^{c}±0.19	12.20^{d}±0.32
	T_4	17.41^{a}±0.15	16.86^{a}±0.12	15.22^{b}± 0.18	13.96^{c}±0.28	11.21^{d}±0.09
Black cumin oil	T_1	18.43±0.19	18.48±0.31	18.31±0.19	18.31±0.12	18.11±0.23
	T_2	17.71^{a}±0.15	17.65^{a}±0.11	17.03^{ab}±0.12	16.52^{b}±0.11	15.59^{c}±0.06
	T_3	17.44^{a}±0.13	16.64^{b}±0.12	15.76^{c}±0.22	15.13^{c}±0.27	13.65^{d}±0.14
	T_4	17.62^{a}±0.27	17.29^{a}±0.26	16.11^{b}±0.19	15.09^{c}±0.25	12.80^{d}±0.21

Mean values with different superscripts in a row vary significantly ($p< 0.01$).

Table 3: Egg yolk triglyceride (mg g^{-1}) in Jabalpur color birds fed with diets supplemented with garlic and black cumin oils (mean ± SE; n=6)

Groups	Treatments	Day 0	Day 14	Day 28	Day 42	Day 56
Garlic oil	T_1	181.09^{b}±1.14	180.36^{b}±0.72	181.58^{b}±1.44	183.27^{a}±1.69	180.91^{b}±1.429
	T_2	184.51^{a}±0.89	178.45^{b}±1.57	168.98^{c}±1.64	158.84^{d}±1.77	153.59^{e}±1.28
	T_3	185.73^{a}±0.64	180.77^{b}±1.74	171.39^{c}±1.75	162.15^{d}±0.62	152.40^{e}±0.96
	T_4	186.80^{a}±0.61	176.46^{b}±1.21	165.56^{c}±0.75	155.46^{d}±1.31	145.46^{e}±0.881
Black cumin oil	T_1	182.63^{b}±1.33	182.81^{b}±3.60	184.55^{a}±4.19	181.66^{b}±4.16	182.38^{b}±2.048
	T_2	185.96^{a}±0.94	181.20^{b}±0.92	176.71^{c}±1.15	171.09^{d}±1.34	165.96^{e}±1.792
	T_3	181.01^{a}±1.06	176.83^{b}±1.15	171.79^{c}±1.46	161.41^{d}±1.48	152.07^{e}±0.704
	T_4	185.94^{a}±1.13	179.48^{b}±2.19	170.34^{c}±2.79	160.63^{d}±1.95	149.76^{e}±0.983

Mean values with different superscripts in a row vary significantly ($p< 0.01$).

paste. Khan *et al*. (2008) observed a significant reduction in egg yolk cholesterol concentration with increasing level of oven-dried garlic powder from 0 to 8% in native desi-layers for 6 weeks. Yalcin *et al*. (2009) reported significant reduction ($p<0.01$) in egg yolk cholesterol levels in Lohmann Brown laying hens 36 weeks of age after administration of black cumin seed. Significant ($p<0.05$) decrease in egg cholesterol was also reported by Akhtar *et al*. (2003) and Aydin *et al*. (2008).

Like egg-yolk total lipids and cholesterol, triglyceride values were reduced in birds fed with all the preparations in all the treatments in a dose-dependent manner (Table 3). The reduction was 16.76, 17.94 and 22.13% in birds fed with 250, 500 and 750 mg garlic oil kg^{-1} diet, respectively, whereas the reduction was 10.75, 15.99 and 19.46 % in black cumin oil fed group respectively on day 56 of the experiment. Hebbar (2010) reported 19.19% reduction in egg yolk triglyceride values on supplementing the diet by a polyherbal preparation. Bagir *et al.* (2006) observed reduction of 21% and 23% in egg yolk triglycerides in White Leghorns on supplementation of black cumin.

CONCLUSION

The study revealed that garlic and black cumin oil supplementation @ 750 mg kg^{-1} diet significantly reduced egg yolk lipid level in birds on 56th day of feeding, but on comparison between these two, garlic oil shows better results than the black cumin oil. Garlic oil can be effectively used for reducing total lipids, cholesterol and triglyceride contents in egg-yolk of poultry birds and these eggs can be consumed safely without the risk of cardiovascular diseases. We can also conclude that both the oils can be used in prevention of cardiovascular diseases.

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