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AK Parade
Ph.D. Scholar, Department of Animal Husbandry and Dairy Science, PGI, MPKV, Rahuri, Ahmednagar, Maharashtra, India

DK Deokar
Senior Scientist, RCDP on Cattle, Department of Animal Husbandry and Dairy Science, MPKV, Rahuri, Ahmednagar, Maharashtra, India

SB Adangale
Assistant Professor, Department of Animal Husbandry and Dairy Science, COA, Pune, Maharashtra, India

DK Kambale
Head, Department of Animal Husbandry and Dairy Science, MPKV, Rahuri, Ahmednagar, Maharashtra, India

PB Meshram
Ph.D. Scholar, Department of Animal Husbandry and Dairy Science, PGI, MPKV, Rahuri, Ahmednagar, Maharashtra, India

Corresponding Author:
AK Parade
Ph.D. Scholar, Department of Animal Husbandry and Dairy Science, PGI, MPKV, Rahuri, Ahmednagar, Maharashtra, India

Effect of addition of ginger (*Zingiber officinale*), and black cumin (*Nigella sativa* L.) on growth performance of white leghorn layer

AK Parade, DK Deokar, SB Adangale, DK Kambale and PB Meshram

Abstract
The experiment was conducted to study Effect of Addition of Ginger (*Zingiber Officinale)*, and Black Cumin (*Nigella sativa* L.) on Growth Performance of White Leghorn Layer. A total one hundred fifty 28-week old 150 white leghorn laying hens were randomly divided into three replication and ten treatments, and fed a basal diet with T_0- Control i.g. 0% GP+0% BCP, T_1- 1% GP + 3% BCP, T_2-1% GP + 4% BCP, T_3-1% GP + 5% BCP, T_4-2% GP+ 3% BCP, T_5-2% GP+ 4% BCP, T_6-2% GP+ 5% BCP, T_7- 3% GP+ 3% BCP, T_8-3% GP+ 4% BCP and T_9-3% GP+ 5% BCP, respectively. Experimental period periods lasted for a total of 70 days. Although body weight was significantly (p<0.01) highest in T_1 (1% ginger root powder + 3% black cumin seed powder). Significantly (p<0.01) highest body weight was observed in T_1 (1% ginger root powder + 3% black cumin seed powder) supplemented group. Ginger root powder and black cumin seed powder rich vitamin and mineral content, including calcium and iron. It is concluded that the use of 1% ginger root powder and 3% black cumin seed powder in diet may positively improving the body weight and body weight gain.

Keywords: Ginger root powder, black cumin seed powder, body weight, body weight gain

Introduction
The rising global demand for animal proteins, propelled by rapid population growth, necessitates the modern egg production industry to implement strategies addressing the escalating need for high-quality animal products. Meeting this demand requires the enhancement of laying performance while minimizing the feed to egg ratio. The feed to egg ratio, a crucial production metric representing the quantity of feed consumed per unit of eggs, holds significant importance, given that feed constitutes approximately 60 – 70% of the overall production costs in the egg production industry. Consequently, the optimization of feed efficiency is paramount for ensuring the sustainability and profitability of egg production enterprises. A promising approach to achieving this optimization involves the use of phytogenic—products derived from plants incorporated into animal feed to augment growth rate and productivity.

To delve into the potential impact of this approach, the current research focuses on the incorporation of two noteworthy botanicals, ginger (*Zingiber officinale*) and black cumin (*Nigella sativa* L.), into the diets of White Leghorn layers. This investigation aims to contribute to the understanding of how these botanical additives may influence key growth parameters, feed efficiency, and overall performance in White Leghorn layers. The rationale for exploring these botanicals lies in their rich composition of bioactive compounds, as documented in various studies (Shukla and Singh, 2007; Prasad, 2011; Ali and Blunden, 2003; Ahmad *et al*., 2013) [14, 13, 4, 2]. By systematically evaluating the effects of ginger and black cumin supplementation, this research endeavors to provide valuable insights into the potential application of these botanical additives as natural growth promoters in commercial layer diets.

White Leghorn layers are renowned for their prolific egg-laying capabilities and are extensively employed in the egg production industry. The pursuit of sustainable and effective strategies to boost the growth performance of these layers is crucial for maintaining economic viability and meeting the increasing demand for eggs. The utilization of botanical additives, such as ginger and black cumin, is rooted in their rich composition of bioactive compounds, including antioxidants, essential oils, and other phytochemicals minerals, vitamin and irons.

Ginger, a well-documented spice and medicinal herb, has been associated with various health-promoting properties.

It possesses anti-inflammatory, antioxidant, and antimicrobial attributes (Shukla and Singh, 2007; Prasad, 2011) [14, 13]. Similarly, black cumin, also known as *Nigella sativa*, has been recognized for its nutritional benefits and pharmacological activities. It is a rich source of bioactive components, including thymoquinone, which has demonstrated antioxidant and immune-modulatory effects (Ali and Blunden, 2003; Ahmad *et al*., 2013) [4, 2].

Despite the extensive literature on the medicinal and nutritional properties of ginger and black cumin in humans and animals, there is a notable gap in understanding their potential impact on the growth performance of White Leghorn layers. This study aims to bridge this gap by systematically evaluating the effects of ginger and black cumin supplementation on key growth parameters, feed efficiency, and overall performance in White Leghorn layers. The findings of this research are anticipated to provide valuable insights into the application of these botanical additives as natural growth promoters in commercial layer diets.

Materials and Methodology

A total of 150 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 (32) was adopted for the present feeding trial. Herbal feed additive, ginger root powder and black cumin seed powder were supplemented either 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_0 i.e. control group was fed on basal diet while T_1 supplemented with 1% ginger root powder + 3% black cumin seed powder, T_2- supplemented with 1% ginger root powder + 4% black cumin seed powder, T_3 supplemented with 1% ginger root powder + 5% black cumin seed powder, T_4- supplemented with 2% ginger root powder + 3% black cumin seed powder, T_5- supplemented with 2% ginger root powder + 4% black cumin seed powder, T_6- supplemented with 2% ginger root powder + 5% black cumin seed powder, T_7- supplemented with 3% ginger root powder + 3% black cumin seed powder, T_8- supplemented with 3% ginger root powder + 4% black cumin seed powder and T_9- supplemented with 3% ginger root powder + 5% black cumin seed powder, respectively. A feeding trial of 70 days was carried out. Weekly body weight was measured with the help of weighing balance. 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) [15]. 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) [20].

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

Parameter	Basal	Ginger root powder	Black cumin Seed Powder
DM	91.45	91.2	95.4
CP	18.00	8.85	10.16
EE	5.14	2.8	6.6
CF	4.80	5.3	7.8
Ash	4.0	1.5	3.7
Calcium	1.04	1.5	1.8
Phosphorus	0.90	1.2	0.05
ME (kcal/kg)	2800.00	2830.00	2850.00

Results and Discussion

Body Weight

Table 2 represents the effect of ginger powder and black cumin seed powder on body weight (g) of White Leghorn layers in different treatments and periods. The comparison of body weight (g) at different bi-weeks revealed that all treatments were non-significant (p<0.05%) from initial body weight up to third bi-week's period, Statistically the significant (p<0.05%) body weight (g) was observed in fourth and fifth bi-weeks period.

Similarly, the findings related to black cumin seed powder supplementation in the present trial align with studies by Aydin *et al.* (2008) [6], Yalcin *et al.* (2012) [18], Khan *et al.* (2013) [12], Attia *et al.* (2008) [5], and Denli *et al.* (2004) [7], all reporting a non-significant effect on body weight in hens. Akhtar *et al.* (2003) [3] observed a decline in body weight and weight gain with the inclusion of black cumin in the diet, though statistically non-significant. The numeric decrease in body weight gain is noteworthy, considering the negative correlation between increased body weight in layers and egg production. This suggests that a reduction in body weight, even if not statistically significant, may be a favorable factor for increasing egg production.

However, conflicting findings exist, as El-Sheikh *et al.* (1998) [8] showed that the addition of black cumin seeds significantly decreased body weight in chickens. This discrepancy underscores the need for a nuanced understanding of the interaction between dietary components and body weight regulation in laying hens. Contrary to the negative correlations observed in some studies, Szczerbinska *et al.* (2020) [16] demonstrated in the present study that black cumin supplementation did not negatively influence the final body weight of laying chickens.

The impact of ginger root powder and black cumin seed powder on body weight in laying hens is multifaceted and appears to be influenced by factors such as species, dosage, and interaction with other dietary components.

Body weight gain

Table 3 shows the effect of ginger powder and black cumin seed powder on body weight gain (g) of White Leghorn layers in different treatments and period. The comparison of means of body weight gain at different bi-weeks revealed that at Ist bi-weeks that all treatments were non-significant. Statistically the significant (p<0.05%) body weight gain (g) was observed in second to fifth bi-weeks period and overall average body weight gain was also significant.

An overall average the statistically better body weight gain (g) was recorded in T_1 (13.18 g) treatment as compared to other treatments and lower body weight was recorded in T_0

(Control, 11.91 g) however, treatment T_1 (13.18 g) and T_4 (13.03 g) significantly superior and at par to each other.

The findings from the present study regarding the supplementation of ginger root powder are consistent with several studies that have reported non-significant effects on body weight gain in layers. Abd El-khalek and ELnaggar (2016) [1] observed no significant gain in Gimmizah chicks over a twelve-week period with the supplementation of ginger oil at 1 ml/kg. Similarly, Zomrawi *et al.* (2014) [19] found no effect on body weight gain in broilers when ginger root powder was supplemented up to the 1% level. Fakhim *et al.* (2013) [9] also reported a non-significant effect on body weight gain in male broiler chicks with the supplementation of aqueous extract of ginger.

The consistency in non-significant effects on body weight gain is further supported by studies conducted by Ghazaiah *et al.* (2007) [10], and Tollba *et al.* (2007) [17], who all observed no significant changes in body weight due to ginger supplementation in broilers. Similarly, the present study's findings on black cumin seed powder supplementation align with those of Khan *et al.* (2013) [12], Aydin *et al.* (2008) [6], and Incharoen and Yamauchi (2009) [11], who reported non-significant effects on body weight gain in Leghorn crossbreed birds. Denli *et al.* (2004) [7] and Attia *et al.* (2008) [5] also found non-significant effects in quails. However, Akhtar *et al.* (2003) [3] reported a slightly decreased weight gain with black cumin supplementation in contrast to the majority of the studies.

Present investigation underscores the potential nutritional benefits of these supplements, emphasizing the need for further research to explore the specific mechanisms by which these plant-based additives may influence body weight and overall performance in layers.

Table 2: Effect of ginger powder and black cumin seed powder on body weight (g) of White Leghorn layers in different treatments and periods

	Period (Bi-Weekly)					
Treatment	**Initial**	**I**	**II**	**III**	**IV**	**V**
T_0	1310.33	1327.93	1351.52	1374.68	1399.25^{d}	1423.18^{d}
T_1	1310.30	1329.98	1356.47	1383.32	1411.23^{a}	1438.30^{a}
T_2	1310.30	1328.88	1354.30	1380.65	1407.37^{ab}	1433.65^{abc}
T_3	1310.33	1328.52	1353.07	1377.38	1403.62^{bcd}	1429.25^{bcd}
T_4	1310.30	1329.29	1355.12	1381.77	1408.97^{ab}	1435.53^{ab}
T_5	1310.30	1328.83	1353.85	1379.50	1405.92^{abc}	1432.05^{abc}
T_6	1310.30	1328.43	1352.70	1377.05	1402.93^{bcd}	1428.27^{cd}
T_7	1310.33	1328.63	1353.35	1378.60	1403.53^{bcd}	1429.18^{bcd}
T_8	1310.33	1328.28	1352.22	1375.72	1399.45^{d}	1423.70^{d}
T_9	1310.33	1327.98	1351.82	1375.32	1399.58^{cd}	1424.28^{d}
SE	1.797	1.822	1.928	2.112	2.162	2.335
CD @ 5%	NS	NS	NS	NS	6.378	6.888

Table 3: Effect of ginger powder and black cumin seed powder on body weight gain (g) of White Leghorn layers in different treatments and period

	Period (Bi-Weekly)					
Treatment	**I**	**II**	**III**	**IV**	**V**	**Overall Average**
T_0	11.77	11.77^{d}	11.70^{c}	11.00^{c}	11.95^{e}	11.64^{e}
T_1	12.67	13.35^{a}	13.60^{a}	12.77^{a}	13.50^{a}	13.18^{a}
T_2	12.84	12.83^{abc}	13.35^{a}	12.47^{ab}	13.12^{ab}	12.92^{ab}
T_3	11.93	12.33^{bcd}	12.33^{bc}	11.33^{bc}	12.70^{bcd}	12.13^{cde}
T_4	12.74	13.05^{ab}	13.50^{a}	12.63^{a}	13.22^{ab}	13.03^{a}
T_5	12.30	12.48^{bcd}	13.00^{ab}	12.43^{ab}	12.98^{abc}	12.64^{abc}
T_6	12.71	12.13^{cd}	12.35^{bc}	11.70^{abc}	12.62^{bcd}	12.30^{cd}
T_7	12.17	12.40^{bcd}	12.80^{ab}	12.17^{abc}	12.65^{bcd}	12.44^{bcd}
T_8	12.37	11.92^{d}	11.88^{c}	11.20^{bc}	12.17^{de}	11.91^{de}
T_9	12.22	11.88^{d}	11.87^{c}	11.20^{bc}	12.37^{cde}	11.91^{de}
SE	0.292	0.276	0.307	0.437	0.212	0.196
CD @ 5%	NS	0.814	0.906	1.289	0.626	0.578

Conclusion

The inclusion of 1% Ginger powder and 3% Black cumin powder in white leghorn layers diet is beneficial in improving the live weight, weight gain, feed consumption of white leghorn layer.

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