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Effects of Dietary Supplementation of Black Cumin (*Nigella sativa*) Powder on Growth Performance, Carcass Traits, Serum Lipid Profile, and Immunity in Broiler Chickens

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ABSTRACT

Medicinal herbs have long been used in animal feed to enhance productivity and ensure the safety of animal products. In the present study, black cumin seed, a traditional herbal medicine widely used in South Asia, was investigated for its effects on productive performance, carcass traits, serum lipid profile, and immune status in commercial broiler chickens. A total of 144 day-old mixed-sex broiler chicks were randomly distributed to four dietary treatments with three replicates of 12 chickens each. The chickens were provided a balanced mash diet supplemented with 0%, 0.5%, 1% and 1.5% black cumin seed powder (dry matter basis) for up to five weeks. Weekly body weight, feed intake, and feed conversion ratio were evaluated in the current study. After five weeks, the final body weight was significantly higher in the 1% and 1.5% black cumin-supplemented groups compared to the control. Feed conversion ratio was significantly low, while the European production efficiency index and the broiler performance efficiency factor were significantly higher in the 1.5% black cumin-supplemented group compared to the control group. Regarding carcass traits, abdominal fat (0.58%, 0.86%, and 0.77%) was significantly lower, while breast muscle yield (23.70%, 23.77%, and 24.84%) was significantly higher in the black cumin-treated groups of 0.5%, 1%, and 1.5%, respectively, compared to the control group. However, the serum lipid profile indicated no significant differences. Among the immune organs, thymus weight (0.27%, 0.23%, and 0.24%) was significantly higher in the black cumin-supplemented groups than in the control. Immunoglobulin levels of IgM (3.13, 2.27, and 2.4 mg/mL) and IgG (4.57, 3.83, and 3.90 mg/mL) were notably higher in the black cumin-supplemented groups of 0.5%, 1%, and 1.5%, respectively, compared with the control group. These findings suggest that dietary supplementation of black cumin at 1% or 1.5% can have a positive effect on productive performance, some carcass traits, thymus weight, and immunoglobulin levels.

Keywords: Black cumin, Carcass trait, Growth performance, Immunity, Serum cholesterol

INTRODUCTION

Broiler chicken production in Bangladesh has increased significantly in recent years, driven by consumer demand, shaping the sector into an industrialized form. Among poultry species, broiler chickens are the fastest-growing birds due to selective breeding and well-balanced diets (Sarkar et al., 2008). To improve feed efficiency, several feed additives, including antibiotics, are used in poultry diets (Abd El-Hack et al., 2022). Although the European Union has banned antibiotics as growth promoters in animal feed, antibiotics are still used in many developing countries. The addition of antibiotics is associated with the development of antimicrobial resistance (AMR) and poses several health hazards to both birds and humans (Abou-Jaoudeh et al., 2024). Antimicrobial resistance may also be transmitted to humans through the consumption of meat and eggs (Samtiya et al., 2022). Antimicrobial resistance has become a significant concern, as its development and transmission reduce the effectiveness of disease prevention and control in poultry (Abreu et al., 2023). Therefore, there is a necessity for alternatives to antibiotics that can enhance growth and effectively replace antibiotics in poultry farming.

In terms of food safety, producing safe poultry and poultry products using naturally grown, safe ingredients free of hazardous substances can help prevent contamination. Several naturally grown herbs and spices have been reported as alternatives to antibiotics, including

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garlic, thyme, moringa, turmeric, and black cumin. Nutraceutical feed additives have long been used in poultry to enhance gut health and productivity (Ibeen et al., 2025). To enhance productivity while addressing food safety concerns, a combination of nutritional biotechnology and herbal medicinal ingredients, such as black cumin, which possesses antioxidant and anti-inflammatory properties, may effectively improve poultry production (Sarkar et al., 2008). Black cumin is considered an important nutraceutical and a safe medicinal plant (Thomas et al., 2022). It is an aromatic plant widely grown in Asia and the Mediterranean region, well known for its role in preventing and controlling asthma due to its anti-asthmatic compound, nigellone (Wienkötter et al., 2008). It is considered a unique one due to its nutritional composition and functional properties. The chemical composition of black cumin indicates a good source of nutrients (Albakry et al., 2022). The major components are protein, fat, carbohydrates, and crude fiber. It is also a good source of unsaturated fatty acids (linoleic and oleic acids) and saturated fatty acids (palmitic acid) (Hossain et al., 2024). The major bioactive compounds of black cumin are thymoquinone, thymohydroquinone, thymol, dithymoquinone, and carvacrol (Zielińska et al., 2021).

The effects of black cumin as a nutraceutical have been investigated in several studies, yielding several notable findings. The inclusion level of black cumin seed is crucial for optimal growth performance and improved feed efficiency in broiler chickens (Majeed et al., 2010). The effects of black cumin have not been fully elucidated in a dose-dependent manner. Moreover, there is limited and inconsistent information regarding serum cholesterol, immunity, and carcass traits that have not been fully elucidated under various doses of black cumin supplementation. Thus, the present study was designed to investigate the effects of black cumin on productive performance, serum cholesterol levels, immunity, and carcass traits in broiler chickens.

MATERIALS AND METHODS

Ethical approval

The authors obtained institutional approval from Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh (approval number: PSTU/IEC/2025/18; dated 13/05/2025).

Experimental design

A total of 144 commercial broiler chickens (Ross 308) were purchased from a local dealer and distributed among four dietary treatments, with three replicates of 12 chickens each. Before the arrival of chicks, the farm was thoroughly cleaned and disinfected. Upon arrival, the chickens were subjected to standard brooding and rearing procedures in accordance with the Sarkar et al. (2008). Clean and safe drinking water was provided throughout the experimental period. To minimize disease load, a blend of organic acids (0.5 mL/L) and multi-strain probiotics (1.5 g/L) was provided in all the experimental groups. A balanced mash feed was formulated using various feed ingredients (Table 1), and the formulated feed was analyzed (Table 2) at the Department of Livestock Services in Bangladesh. The feeding program was divided into two phases: starter (1-10 days) and grower (11-35 days). Strict biosecurity measures were maintained throughout the experimental period, including a locked gate, a foot bath, and a disinfectant spray.

Growth performances

Initially, all the chicks were weighed to determine the average weight at day-old. Thereafter, the chickens were weighed every week to calculate the weekly average body weight and body weight gain per bird. Feed intake per chicken per day was recorded to calculate the feed conversion ratio (FCR) on a weekly basis. The European Production Efficiency Index (EPEI) and Broiler Performance Efficiency Factor (BPEF) were calculated using the following formulas (Lohakare and Abdel-Wareth, 2022).

$$\text{EPEI: } \frac{\text{Viability\%} \times \text{Body weight (kg)}}{\text{Age (Days)} \times \text{FCR}} \times 100$$

$$\text{BPEF: } \frac{\text{Live weight (kg)} \times 100}{\text{FCR}}$$

Black cumin powder supplementation

Black cumin seeds were purchased from Barishal Sadar, Barishal. Then, dust was removed from the seeds, and they were sun-dried and crushed using a blender. The black cumin powder was added to mash feed in three treatment groups, including T2 (0.5% black cumin powder), T3 (1% black cumin powder), and T4 (1.5% black cumin powder).

Serum chemistry

From the wing vein, 3-4 ml of blood was collected in a clot activator tube at 35 days. Then, the samples were centrifuged at 2500 rpm for 30 minutes. The supernatant was collected, and cholesterol was determined through an enzymatic colorimetric method. Immunoglobulins (IgM, IgG, and IgA) were determined by ELISA Kits, China.

Carcass traits determination and Immune organs

One chicken from each replication was randomly selected from the experimental pen. At 35 days, the broilers were sacrificed by cutting the jugular vein to evaluate carcass traits (dressing percentage, breast muscle percentage, liver percentage, gizzard percentage, heart percentage, and abdominal fat percentage). The chickens were decapitated, defeathered, and eviscerated to determine the dressing percentage, and the relative weights of different organs were measured. Immune organs (bursa, thymus, and spleen) were collected from birds, weighed, and the relative weights of different organs were calculated.

Data analysis

Data are represented as means ± standard deviation. The data were analyzed using the IBM SPSS version 20. Tukey's honestly significant difference test was used to make differences among treatments. The level of significance differences was declared at a p-value less than 0.05.

Table 1. Diet formulation for experimental broiler chickens in the present study

Ingredients (%)	Starter (1-10 days)				Grower (11-35 days)			
	Control	0.5%BC	1%BC	1.5%BC	Control	0.5%BC	1% BC	1.5% BC
Maize	49.80	49.30	48.80	48.30	50.80	50.30	49.80	49.30
Soybean meal	29.90	29.90	29.90	29.90	27.90	27.90	27.90	27.90
Rapeseed meal	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Wheat flour	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Rice polish	6.00	6.00	6.00	6.00	7.50	7.50	7.50	7.50
Limestone powder	1.00	1.00	1.00	1.00	0.90	0.90	0.90	0.90
Soybean oil	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Monocalcium phosphate	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
L- Lysine	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
DL- Methionine	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Vitamin premix	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Enzyme- Phytase	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Choline Chloride	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Prebiotic	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Liver tonic	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Toxin binder	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Antioxidant	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sodium bicarbonate	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Coccidiostat	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
BC powder	−	0.50	1.00	1.50	−	0.50	1.00	1.50

BC: Black cumin; −: Indicates BC powder was not used; Vitamin premix (AD3EK, B-complex, and Niacin); Prebiotic (Oligosaccharides); Toxin binder (HSCAS, Bentonite, Zeolites, and Activated charcoal India), Antioxidant (Butylated hydroxytoluene, Butylated hydroxyanisole, and Ethoxyquin); Coccidiostat (Amprolium hydrochloride, and Vitamin K3)

Table 2. Nutrient composition of formulated basal diets

Proximate analysis (% on Dry Matter basis)	Starter (1-10 days)	Grower (11-35 days)
Moisture	11.89	11.47
Dry matter	88.11	88.53
ME (Kcal/Kg)	3001	2993
Crude protein	22.66	19.39
Total ssh	5.76	6.06
Acid insoluble ash	0.54	0.48
Crude fiber	4.20	4.55
Crude fat	4.44	4.48
Calcium	0.98	1.08
Phosphorus	0.45	0.47

ME: Metabolizable energy

RESULTS

Productive performance

The productive performance of broiler chickens under various dietary treatments of black cumin powder is presented in Table 3. After 35 days, the final body weights were 1672.40, 1689.79, 1713.61, and 1858.14 g/bird for the diets supplemented with 0%, 0.5%, 1%, and 1.5% black cumin, respectively. A significant increase in final body weight was observed in the 1 and 1.5% black cumin groups compared to the control ($p < 0.05$). A similar trend was observed for body weight gain. The weekly body weights (Table 4) and weight gains (Table 5) were also recorded throughout the experimental period. The weekly body weights (Figure 1) and weight gains (Figure 2) increased gradually throughout the experimental period. Although the live weight and weight gain did not differ significantly after the 1st week, significant differences were observed from the 2nd week onwards ($p < 0.05$). In terms of weight gain, maximum weekly gain occurred during the 4th and 5th weeks of the rearing period. Feed intake (g/bird) did not differ significantly among the experimental groups ($p > 0.05$). The FCR were 1.63, 1.64, 1.62, and 1.52 in the diet supplemented with 0, 0.5, 1, and 1.5% black cumin, respectively. Notably, the FCR value was significantly improved in the 1.5% black cumin-supplemented groups compared to others ($p < 0.05$). The mortality rate among the experimental groups did not differ significantly. To assess overall production efficiency, the EPEI and BPEF were calculated and found to be significantly higher in the 1.5% black cumin-supplemented groups, indicating improved performance with black cumin powder supplementation ($p < 0.05$).

Carcass traits

Several carcass characteristics, including breast muscle, liver, gizzard, heart, abdominal fat, and dressing percentage, were evaluated to assess broiler quality (Table 6). The percentage of breast muscle (23.70%, 23.77%, and 24.84%) was significantly higher, and the percentage of abdominal fat (0.58%, 0.86%, and 0.77%) was significantly lower in the black cumin-supplemented groups of 0.5%, 1, and 1.5%, respectively, compared to the control group ($p < 0.05$). However, the other evaluated parameters did not differ significantly among the experimental groups.

Serum lipid profile

Total cholesterol, HDL, LDL, and triglyceride levels were measured in the experimental groups, and no significant differences were observed among treatments, except for a lower triglyceride level in the 1.5% black cumin-supplemented group ($p < 0.05$; Table 7).

Immune status

The immune organs (bursa, thymus, and spleen) were evaluated at 35 days (Table 8). There was no significant difference in spleen weight among the groups ($p > 0.05$). However, the relative weight of the bursa was significantly higher in the 0.5% black cumin-supplemented group compared to the others. Notably, the thymus percentage was significantly higher in all the black cumin-supplemented groups compared to the control ($p < 0.05$). Immunoglobulin levels were evaluated to assess the immune status of birds (Table 9). In the case of IgA, a significantly higher value was observed in 1% black cumin-supplemented group. However, higher levels of IgM and IgG were observed in all black cumin-supplemented groups compared with the control group, indicating an enhanced immune response in the treated groups ($p < 0.05$).

Table 3. Effect of black cumin powder supplementation on productive performance of broiler chickens

Parameters \ Black cumin powder (%)	0	0.5	1.0	1.5
Initial body weight (g/chicks)	42.46 ± 0.00^{a}	42.46 ± 0.00^{a}	42.46±0.00^{a}	42.46 ± 0.00^{a}
Final body weight (g/chicken)	1672.40 ± 3.42^{a}	1689.79 ± 56.63^{ab}	1713.61±23.04^{b}	1858.14 ± 40.48^{c}
Body weight gain (g/chicken)	1629.94 ± 3.42^{a}	1647.33 ± 56.63^{ab}	1671.15±23.04^{b}	1815.68 ± 40.48^{c}
Feed intake (g/chicken)	2720.93 ± 61.11^{a}	2771.65 ± 80.59^{a}	2772.03±29.16^{a}	2832.33 ± 76.1^{a}
FCR	1.63 ± 0.03^{a}	1.64 ± 0.08^{ab}	1.62±0.005^{a}	1.52 ± 0.04^{b}
Mortality (%)	6.67 ± 6.66^{a}	0	2.22±3.85^{a}	0
European Production Efficiency Index (EPEI)	274.43 ± 24.62^{a}	294.78 ± 22.32^{ab}	296.01±14.97^{ab}	348.47 ± 14.56^{c}
Broiler Performance Efficiency Factor (BPEF)	102.82 ± 1.91^{a}	103.17 ± 7.81^{a}	105.93±1.74^{a}	121.97 ± 5.10^{b}

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups ($p < 0.05$). FCR: Feed conversion ratio.

Table 4. Effects of black cumin powder supplementation on weekly body weight (g/bird) of broiler chickens

Weeks	Black cumin powder (%)			
	0	0.5	1.0	1.5
First	141.62 ± 2.55^{a}	148.67±3.65^{a}	147.67±2.92^{a}	146.13±10.44^{a}
Second	323.59±8.70^{a}	364.50±6.50^{b}	382.70±6.06^{c}	392.53±38.25^{c}
Third	659.47±21.49^{a}	761.69±21.25^{b}	768.77±11.89^{b}	792.17±71.01^{b}
Fourth	1110.22±13.02^{a}	1191.72±27.17^{b}	1203.50±31.89^{b}	1316.93±20.50c
Fifth	1672.40±3.42^{a}	1689.79±56.63^{ab}	1713.61±23.04^{b}	1858.14±40.48^{c}

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups ($p < 0.05$).

Table 5. Effects of black cumin powder supplementation on weekly body weight gain (g/bird) of broiler chickens

Weeks	Black cumin powder (%)			
	0	0.5	1.0	1.5
First	99.16 ± 2.55^{a}	106.21±3.65^{a}	105.21±2.92^{a}	103.67±10.44^{a}
Second	181.97±8.15^{a}	215.83±10.02^{b}	235.03±3.61^{c}	246.40±29.32^{bc}
Third	335.88±17.84^{a}	397.19±15.43^{b}	386.07±11.57^{b}	399.63±32.96^{b}
Fourth	450.75±9.14^{a}	430.03±34.27^{a}	434.73±20.18^{a}	524.77±86.91^{a}
Fifth	562.18±14.52^{a}	498.07±39.41^{b}	510.11±11.31^{b}	541.21±25.88^{ab}

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups ($p < 0.05$).

Table 6. Effects of black cumin powder supplementation on carcass traits of broiler chickens

Parameters	Black cumin powder (%)			
	0	0.5	1.0	1.5
Dressing (%)	68.42 ± 2.62^{a}	70.19±4.52^{a}	68.94±7.62^{a}	72.35±7.57^{a}
Breast muscle (%)	19.72±1.64^{a}	23.70±1.57^{b}	23.77±0.67^{b}	24.84±1.65^{b}
Liver (%)	3.21±0.27^{a}	3.31±0.32^{a}	3.29±0.20^{a}	3.3±0.74^{a}
Gizzard (%)	1.64±0.15^{a}	1.77±0.15^{a}	1.68±0.16^{a}	1.69±0.17^{a}
Heart (%)	0.33±0.03^{a}	0.34±0.03^{a}	0.38±0.01^{a}	0.44±0.08^{a}
Abdominal fat (%)	1.35±0.09^{a}	0.58±0.20^{b}	0.86±0.20^{b}	0.77±0.12^{b}

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups; $p < 0.05$

Table 7. Effects of black cumin powder supplementation on serum lipid profile of broiler chickens

Parameters	Black cumin powder (%)			
	0	0.5	1.0	1.5
Total Cholesterol (mg/dL)	94.67^{a} ± 8.74	96.3^{a} 3±10.26	112.67^{a} ±16.62	83.33^{a} ±10.41
HDL Cholesterol (mg/dL)	25.33^{a} ±2.52	23.33^{a} ±3.06	27.33^{a} ±1.15	21.33^{a} ±4.93
LDL Cholesterol (mg/dL)	36.67^{a} ±3.06	48.67^{a} ±9.07	53.00^{a} ±18.08	38.00 ^{a} ±4.00
Triglycerides (mg/dL)	137.67^{a}±15.94	98.33^{ab}±23.63	123.66^{ab}±28.22	83.33^{b}±7.64

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups ($p < 0.05$).
HDL: High-density lipoprotein, LDL: Low-density lipoprotein

Table 8. Effect of black cumin powder supplementation on immune organs (%) of broiler chickens

Parameters	Black cumin powder (%)			
	0	0.5	1.0	1.5
Bursa %	0.11 ± 0.03^{ab}	0.16±0.02^{b}	0.06±0.02^{a}	0.07±0.01^{a}
Thymus %	0.09±0.01^{a}	0.27±0.04^{b}	0.23±0.06^{b}	0.24±0.05^{b}
Spleen %	0.25±0.04^{a}	0.24±0.08^{a}	0.20±0.09^{a}	0.25±0.09^{a}

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups; $p < 0.05$

Table 9. Effect of black cumin powder supplementation on serum immunoglobulin levels in broiler chickens

Parameters	Black cumin powder (%)			
	0	0.5	1.0	1.5
IgM (mg/mL)	1.37^{a} ± 0.21	3.13^{b}±0.35	2.27^{c}±0.21	2.40^{bc}±0.40
IgG (mg/mL)	2.83^{a}±0.42	4.57^{b}±0.80	3.83^{b}±0.40	3.90^{b}±0.40
IgA (mg/mL)	0.35^{a}±0.03	0.34^{a}±0.06	0.84^{b}±0.08	0.35^{a}±0.05

Data are presented as mean ± SD; $^{a, b, c}$ Different superscript letters within the same row indicate significant differences among the treatment groups (p <0.05). IgM: Immunoglobulin M, IgG: Immunoglobulin G, and IgA: Immunoglobulin A

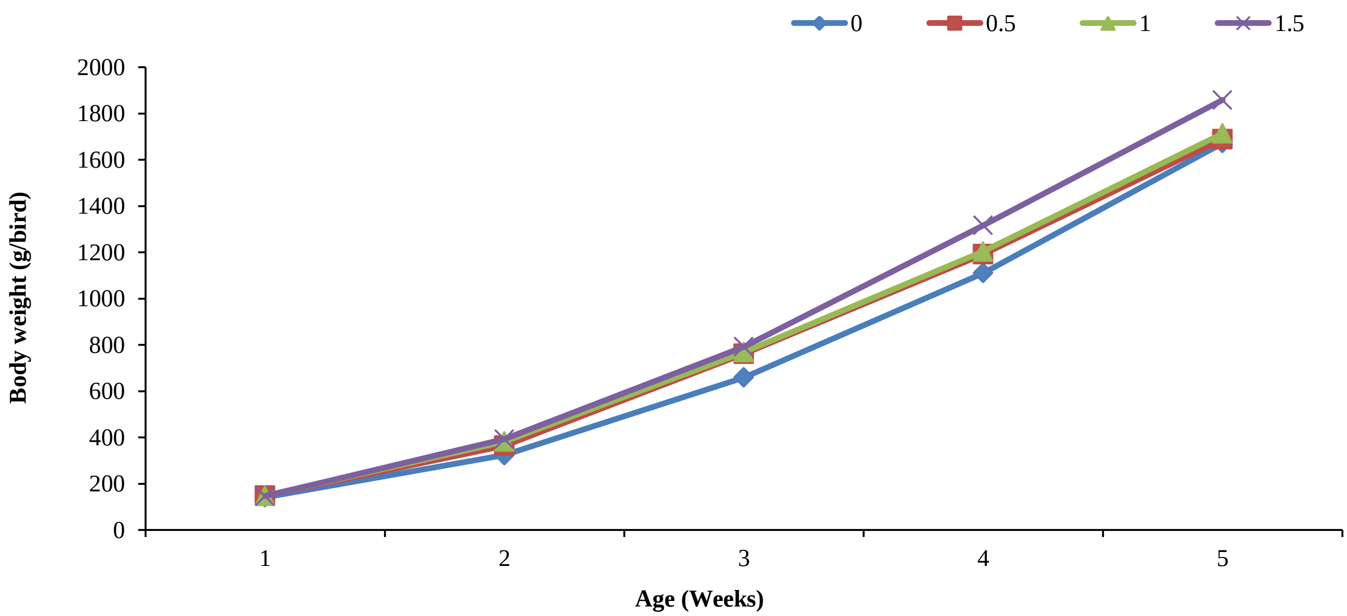

Figure 1. Weekly body weight of broiler chicken under different dietary treatments of black cumin powder. 0: Control, 0.5: 0.5% Black cumin, 1: 1% Black cumin, 1.5: 1.5% Black cumin

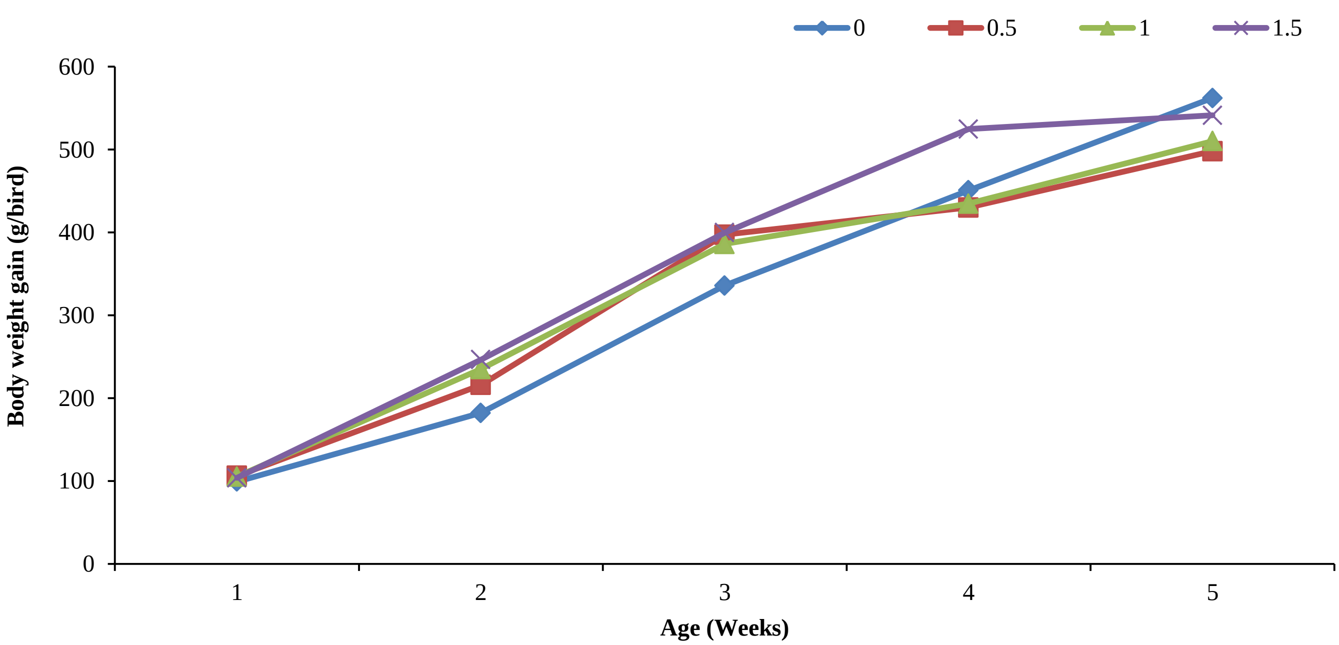

Figure 2. Weekly body weight gain of broiler chicken under different dietary treatments of black cumin powder. 0: Control, 0.5: 0.5% Black cumin, 1: 1% Black cumin, 1.5: 1.5% Black cumin

DISCUSSION

Among the herbaceous seeds, black cumin is considered a potential candidate due to its essential oil and the presence of its main bioactive compound, thymoquinone (TQ) (Srinivasan, 2018). Thymoquinone, the bioactive compound present in black cumin seed, has been used either directly through dietary black cumin seed crush or oil extraction from the seed. It has been reported that black cumin, or its bioactive compounds, generally does not have harmful effects and might be beneficial for animal health (Mashayekhi-Sardoo et al., 2020). The results showed that black cumin powder at 1% and 1.5% significantly enhanced the final body weight. The increase of black cumin supplementation at 2% to diet significantly decreased the body weight and body weight gain in broilers (Abu-Dieyeh and Abu-Darwish, 2008). The increased growth is associated with the multiple health benefits of black cumin, which are mediated through its physiological, digestive, and immunological mechanisms (Hannan et al., 2021). Numerous studies have demonstrated enhanced growth performance in broiler chickens when black cumin or its bioactive compound, thymoquinone, is incorporated into the diet (Fathi et al., 2023; Elbaz et al., 2025). The efficacy and effectiveness of black cumin in broiler chickens depend on the age of the birds and the dosage of black cumin, as the fibre and phytochemical load of black cumin are concerned (Kumar et al., 2017). Additionally, the source and processing method of black cumin are important considerations, as processing and quality are related to the availability and biological activity of its bioactive compounds, which can improve broiler productivity. The growth benefits of black cumin or its bioactive compound, thymoquinone, depend on the stage of broiler chickens. Typically, the growth performance increased after 3 weeks of the rearing period (Asghar et al., 2022). The present study showed that feed intake did not differ significantly among the dietary treatments. However, FCR was significantly reduced in the 1.5% black cumin-supplemented groups. Similarly, Demirci et al. (2019) observed no significant differences in feed intake but observed improved FCR in black cumin-supplemented groups.

In poultry, immune organs such as the spleen, thymus, and bursa are important, as immune cell maturation and function occur in these organs. Their size and weight serve as key indicators of immune status (Thapa and Farber, 2019). In the present study, the thymus weight was significantly higher compared to the control. The thymus plays a vital role in assessing immune status in birds. Supplementation of black cumin in the diet has been shown to enhance the immune function of broiler chickens (Khan et al., 2012) and aid in reducing stress and inflammation in birds (Ghasemi et al., 2014). Black cumin supplementation also increased antibody titers against Newcastle Disease (Kumar et al., 2017), with a significant increase in IgM and IgG levels (Elsayed et al., 2025).

Meat quality traits, particularly the breast muscle percentage, were significantly increased in black cumin-treated groups. Abdominal fat deposition was significantly lower in the black cumin-treated groups. Black cumin powder has been reported to improve the breast muscle weight ratio (Jahan et al., 2016). A significant decline in abdominal fat was observed in the black cumin powder-treated groups (Singh and Kumar, 2018). The increase in breast muscle and low abdominal fat is associated with enhanced protein deposition in muscle and lower fat deposition due to lipolytic properties (Akter et al., 2025).

Thymoquinone, the key bioactive compound in black cumin, exhibits a wide range of beneficial effects in animals. Due to its antimicrobial activity, black cumin has the potential to substitute for antibiotics in poultry (Talayi-Anbaran et al., 2025). In addition, thymoquinone exhibits antioxidant, anti-inflammatory, and immunomodulatory properties (Kocyigit and Guler, 2022). Black cumin seed may effectively replace antibiotics if poultry are provided with balanced nutrition and maintained under strict biosecurity measures. Therefore, black cumin seed could play a significant role in producing and promoting safe poultry products in the poultry industry.

CONCLUSION

This study found that supplementation with black cumin at 1% and 1.5% improved body weight and body weight gain in broiler chickens. Regarding carcass traits, significantly higher breast muscle percentages and lower abdominal fat percentages were observed in the treated groups. However, the serum lipid profile showed no significant differences in total cholesterol, HDL, or LDL, except for a lower triglyceride level in the 1.5% black cumin-treated group. Among the immune organs, the thymus percentage was significantly higher in the black cumin-supplemented groups. Immunoglobulin levels (IgM and IgG) were notably higher in the black cumin-supplemented groups.

DECLARATIONS

Authors' contributions

Prodip Kumar Sarkar planned and conducted the research and wrote the manuscript. Md. Raju Munshi and

Tilottama Saha conducted the research and collected data. All the authors approved the final draft of the manuscript.

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Availability of data and materials

The data from the present study are available upon reasonable request from the corresponding author.

Ethical considerations

This study is original and has not been submitted elsewhere for publication. The authors confirm compliance with ethical standards, including checks for plagiarism, research misconduct, and data fabrication. The authors also confirm that no AI tools were used in preparing the manuscript.

Competing interests

The authors declare no conflict of interest.

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