RESEARCH ARTICLE

Effect of Dietary Supplementation of Black Cumin (*Nigella sativa*) Seeds on the Performance of Commercial Broiler Chickens

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Abstract

This experiment was performed to determine the impact of black cumin (*Nigella sativa*) seeds as a natural growth promoter on the growth performance and feed conversion efficiency of commercial broiler chickens. One hundred and forty four day-old broiler chicks (Ven Cobb) were randomly assigned into 6 treatments, each treatment comprised of 4 replicates with a total of 24 chicks per treatment. The experiment was carried out for a duration of 42 days. The dietary treatments included a control diet (T_1) and T_2 supplemented with 0.01% Antibiotic growth promoter in the basal diet. The remaining experimental diets T_3, T_4, T_5 and T_6 were supplemented with black cumin seeds powder at 0.5, 1.0, 1.5 and 2.0% of the basal diet, respectively. The final mean body weight and body weight gain of birds fed with T_5 diet was significantly ($p<0.05$) higher than the birds fed with the T_2 diet. However, T_3, T_4 and T_6 were at par with T_5 group, while T_1 was at par with T_2 group. Basal diet supplemented with antibiotic growth promoter (T_2) resulted in the lowest body weight and body weight gain at the end of experiment. There was no significant difference in feed consumption among the birds fed with different dietary treatments. The mean feed conversion ratio (FCR) of birds fed with T_2 diet was significantly ($p<0.05$) higher than all other treatments, indicating least efficient FCR, while most improved FCR was recorded in T_5 group. The highest livability was observed in T_4 and T_5 as compared to T_1, T_2, T_3 and T_6 groups. The highest return over feed cost (ROFC) was obtained in the birds fed with T_3 (0.5 % black cumin seeds) diet followed by T_1, T_4, T_5, T_2 and T_6 diet, respectively.

Key words: Antibiotic growth promoter, Black cumin seeds, Broilers, FCR, Growth performance, ROFC

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Introduction

The modern broiler industry presently focuses on maximizing production and improving feed conversion efficiency, for which subclinical levels of antibiotics have been extensively used in commercial poultry production (Markowiak and Slizewska, 2018). However, the application of antibiotics as feed additives possesses risks due to cross-resistance among pathogens and the presence of residues in tissues (Schwarz *et al.,* 2001). Hence, in response to the associated risks, many countries have restricted or completely banned the incorporation of antibiotic growth promoters. Because of this, herbal remedies and plant-derived extracts are becoming popular as feed additives that are found to be safe, less toxic and residue free.

One such herb medicinal plant, black cumin seeds (BCS, *Nigella sativa*), also known as Kalonji or Black Seed, belongs to the Ranunculaceae family and is native to Southwest Asia. Black cumin seeds (BCS), which have a slightly aromatic smell and a bitter taste, have been utilized since ancient times in regions like the Middle East, Northern Africa and Asia for treating asthma and possessing anti-tumour properties. In traditional medicine, BCS are utilized for their diuretic, antihypertensive, digestive and appetite-stimulating effects. These seeds are valued for various pharmacological benefits, including antibacterial (Boka *et al.*, 2014), anticoccidial (Kadhim *et al.*, 2018), anti-diabetic (Ghods *et al.*, 2024), antiparasitic (Mahmoud *et al.*, 2002), antifungal (Forouzanfar *et al.*, 2014), analgesic, renal protective, anticancer, antioxidant, anti-

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inflammatory and immunomodulatory properties (Bourgou *et al.*, 2012). Considering the above nutritional advantages of BCS, the present experiment was performed on commercial broiler chicken to assess the growth performance, feed conversion efficiency and economics of birds fed with different levels of black cumin seeds as a natural growth promoter.

Materials and Methods

The experiment was carried out at Poultry Research Station, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Anand, Gujarat (India). Total 144 straight-run, day-old commercial broiler chicks were purchased from private hatchery for the experiment and were reared under deep litter system for a period of 42 days (15th August to 25th September). The average temperature and relative humidity were 83.4°F (28.6°C) and 82.5%, respectively, during the experimental period.

On arrival, the birds were wing banded and weighed individually. The broiler chicks were randomly assigned to 6 treatments and each treatment consisting of 4 replicates, with 6 chicks in each replicate. Black cumin (*Nigella sativa*) seeds (BCS) were obtained from local market. The seeds were ground into a fine powder using an electric mixer grinder to enhance homogeneity and digestibility. The resulting powder was subsequently incorporated into the broiler basal diet at the experimental supplementation rate. The experimental diets were formulated as per BIS 2024 specifications and offered *ad libitum* to the birds during starter (0-10 days), grower (11-21 days) and finisher (22-42 days) phase, respectively. The dietary treatment included a control diet (T_1) and T_2 supplemented with 0.01% Antibiotic growth promoter in the basal diet. The remaining experimental diets T_3, T_4, T_5 and T_6 were supplemented with BCS powder at 0.5, 1.0, 1.5, and 2.0% of the basal diet, respectively.

The experimental house was cleaned properly and disinfected with glutaraldehyde. Each pen of the house was partitioned into 4 compartments, used as replicates. All brooding and rearing equipments, including curtains, were thoroughly cleaned with water and sun-dried. The curtains were applied in the house and brooding setup was completed prior to chick arrival. Brooder bulbs were activated 12 h before placing chicks underneath, achieving an initial temperature of 95°F for the first week. This temperature was decreased by 5°F weekly, until reaching the temperature of 75°F. Adjustments were also made based on chick behaviour inside the brooder. Floor space was progressively expanded as birds aged. Throughout the experiment, standard health care and management protocols were strictly followed.

Feeders were cleaned once a week. Drinkers were washed every morning. Fresh water was supplied twice each day until 42 days. Chicks were provided with glucose and electrolytes just upon arrival. Paddy husk was used as bedding material with 5 cm thick. Litter was stirred every 2 days to prevent ammonia and maggots. Old litter was replaced with fresh dry husk. All of the experimental broilers were vaccinated against Ranikhet and Infectious Bursal disease at the age of day 7th and 14th, respectively. Booster dose of Ranikhet was vaccinated at the age of 21st day.

During the experimental period, weekly body weight and body weight gain, feed consumption, feed conversion ratio, livability and return over feed cost were recorded. The data were analyzed using Completely Randomized Design as per Snedecor and Cochran (1994).

Results and Discussion

Body Weight (BW)

The mean body weight of birds at day-old age did not differ significantly among various dietary treatments. The final body weight of birds offered with T_5 (1.5% BCS) diet was significantly ($p < 0.05$) higher than T_2 diet. However, T_3, T_4, and T_6 were at par with T_5 group, while T_1 was at par with T_2 group (Table 1). The findings of present study were in agreement with Abu-Dieyeh and Abu-Darwish (2008), Shewita and Taha (2011), Jahan *et al.* (2015), and El-Bahr *et al.* (2021), who observed that dietary supplementation of BCS in the diet of broilers resulted in significantly higher body weight than

Table 1: Body weight of broiler birds fed with different experimental diets

Trait	Treatments					
	T_1	T_2	T_3	T_4	T_5	T_6
BW_0	42.79 ±0.65	43.94 ±0.46	43.86 ±0.53	42.10 ±0.55	42.70 ±0.66	43.42 ±0.32
BW_1	170.50^{b} ±1.75	180.06^{ab} ±1.66	178.03^{b} ±8.71	173.39^{b} ±4.72	187.83^{a} ±4.38	171.22^{b} ±2.92
BW_2	392.50^{a} ±13.42	384.67^{a} ±20.62	335.58^{b} ±15.17	397.08^{a} ±18.85	402.75^{a} ±26.56	400.17^{a} ±9.18
BW_3	600.67^{bc} ±12.68	584.42^{c} ±40.68	621.75^{abc} ±13.09	645.50^{abc} ±54.75	682.59^{a} ±16.27	659.52^{ab} ±21.75
BW_4	1021.68^{ab} ±44.32	947.00^{b} ±56.71	1059.58^{a} ±27.33	1102.67^{a} ±57.47	1101.92^{a} ±26.32	1037.30^{ab} ±49.22
BW_5	1486.10^{ab} ±30.27	1419.44^{b} ±62.07	1559.17^{a} ±41.51	1569.58^{a} ±64.33	1580.08^{a} ±30.69	1530.07^{ab} ±46.07
BW_6	2023.48^{bc} ±24.45	1969.57^{c} ±70.23	2117.60^{abc} ±36.87	2127.42^{ab} ±56.34	2197.33^{a} ±44.08	2104.27^{abc} ±65.47

Means bearing different superscripts within same row differ significantly ($p < 0.05$).

the control group. However, in contrast to finding of present study, Devi *et al.* (2022) and Abdollahi *et al.* (2024) did not observe significant differences in final body weight among the birds fed varying levels of BCS supplementation.

Body Weight Gain (BWG)

The mean body weight gain of the birds offered with T_5 diet was significantly ($p < 0.05$) higher than T_3 group in starter phase and T_2 group in grower phase, while no significant difference in BWG of the birds was observed in finisher phase. During overall experimental period, birds on the T_5 diet exhibited the highest BWG compared to all other groups, whereas those fed with T_2 diet showed the significantly lowest BWG (Table 2). These findings were in accordance with Abu-Dieyeh and Abu-Darwish (2008), Shewita and Taha (2011), Jahan *et al.* (2015), Attia and Al-Harthi (2015), Singh and Kumar (2018), El-Bahr *et al.,* (2021) and Naula *et al.* (2021), who concluded that dietary incorporation of BCS in broiler diets, resulted in significantly greater BWG than the control group. However other researchers (Ahmed, 2013; Devi *et al.,* 2022; Abdollahi *et al.,* 2024) did not observe significant differences in final BWG among birds fed with varying levels of BCS supplementation.

Feed Consumption (FC)

The feed consumption of birds did not show significant variation among different dietary treatments, whether assessed on a weekly basis or phase-wise (starter, grower, and finisher). During whole experimental period (0-6 weeks), the birds fed with T_5 diet recorded the highest mean total feed consumption, followed in descending order by T_4, T_6, T_3, T_2 and T_1 groups (Table 2). It showed that, supplementation of BCS into the broiler diet enhanced feed intake by stimulating the digestive system's functions, and improving appetite and diet palatability. The outcomes of this study aligned with Ahmed (2013), Jahan *et al.* (2015), Singh and Kumar (2018), El-Bahr *et al.* (2021), Al-sile and Ali (2025) and Khan *et al.* (2025), who noted no significant difference in feed consumption among the birds given with different treatment diets. However, contrary to present findings, other workers (Durrani *et al.,* 2007; Abu-Dieyeh and Abu-Darwish, 2008; Shewita and Taha, 2011; Naula *et al.,* 2021; Devi *et al.,* 2022; Abdollahi *et al.,* 2024) observed significant difference in total feed consumption of the birds among the various dietary treatments.

Feed Conversion Ratio (FCR)

Feed conversion ratio of birds fed with different diets showed no significant differences when evaluated phase-wise (starter, grower, finisher), but significant effects were observed when analyzed during entire experimental period. At the end of 6th week, the mean FCR of birds provided with T_2 diet was significantly ($p < 0.05$) higher than all other treatments, indicating least efficient feed conversion. The FCR of T_1 group was at par with T_3, T_4, T_5 and T_6 groups, while T_5 recorded significantly ($p < 0.05$) improved FCR (Table 2). The findings of present study were in agreement with Durrani *et al.* (2007), Abu-Dieyeh and Abu-Darwish (2008), Shewita and Taha (2011), Ahmed (2013), Singh and Kumar (2018), Naula *et al.* (2021) and Khan *et al.* (2025), who reported significant difference in FCR among the birds given with different dietary treatments. However, contrary to present findings, Attia and Al-Harthi (2015), Jahan *et al.* (2015) and Abdollahi *et al.* (2024) reported no significant difference in FCR between the birds fed with various treatment diets.

Table 2: Phase wise body weight gain, feed consumption and feed conversion ratio of broiler birds fed with different experimental diets

Parameter	Treatments	BWG_{0-10}	BWG_{11-21}	BWG_{22-42}	BWG_{0-42}
Body weight gain (g)	T_1	204.84^{b} ±6.95	354.25^{ab} ±16.42	1422.82 ±34.40	1980.68^{bc} ±25.04
	T_2	219.76^{ab} ±5.69	320.92^{b} ±39.04	1391.12 ±35.79	1925.82^{c} ±69.77
	T_3	199.94^{b} ±14.82	377.95^{ab} ±12.10	1494.07 ±26.80	2073.70^{abc} ±36.89
	T_4	217.18^{ab} ±9.01	386.22^{a} ±46.01	1481.92 ±6.20	2085.31^{ab} ±55.82
	T_5	233.84^{a} ±7.26	406.04^{a} ±9.43	1514.75 ±27.86	2154.62^{a} ±43.63
	T_6	215.16^{ab} ±4.99	397.07^{a} ±21.55	1444.67 ±64.27	2060.64^{abc} ±65.52
Feed consumption (g)	T_1	291.79 ±8.59	738.65 ±21.07	2778.37 ±109.98	3808.81 ±130.94
	T_2	309.71 ±7.55	687.25 ±22.84	2856.18 ±95.20	3853.14 ±114.49
	T_3	309.50 ±13.13	749.00 ±27.30	2805.32 ±83.45	3863.82 ±122.68
	T_4	323.00 ±4.82	773.50 ±29.82	2816.67 ±54.33	3913.17 ±82.82
	T_5	323.54 ±5.08	780.25 ±18.80	2892.08 ±22.43	3995.88 ±45.13
	T_6	313.38 ±1.51	765.32 ±20.79	2812.10 ±77.98	3890.79 ±86.27
Feed conversion ratio (FCR)	T_1	1.18 ± 0.02	2.10 ± 0.09	1.95 ± 0.06	1.90^{ab} ± 0.04
	T_2	1.17 ± 0.01	2.23 ± 0.23	2.05 ± 0.04	1.96^{a} ± 0.04
	T_3	1.28 ± 0.05	1.98 ± 0.07	1.88 ± 0.04	1.83^{b} ± 0.03
	T_4	1.24 ± 0.04	2.06 ± 0.17	1.90 ± 0.03	1.84^{b} ± 0.01
	T_5	1.17 ± 0.02	1.92 ± 0.01	1.91 ± 0.02	1.82^{b} ± 0.02
	T_6	1.21 ± 0.02	1.94 ± 0.08	1.95 ± 0.05	1.83^{b} ± 0.03

Means bearing different superscripts within same column for a parameter differ significantly ($p < 0.05$).

Livability

Birds offered with T_1, T_2, T_3, T_4, T_5 and T_6 diets achieved livability rates of 95.83, 95.83, 95.83, 100, 100 and 95.83 %, respectively. T_4 and T_5 group demonstrated the lowest mortality compared to T_1, T_2, T_3 and T_6 groups. The result aligned with findings of Abu-Dieyeh and Abu-Darwish (2008), Jahan *et al.* (2015), Singh and Kumar (2018), El-Bahr *et al.* (2021), Khan *et al.* (2025), who noted that BCS supplementation in broiler diets did not affect bird's livability.

Economics (Return over Feed Cost)

The Return over Feed Cost (ROFC) measures broiler production profitability by deduction of feed expenses from revenue generated through sales of live birds based on weight. This indicator varies with feed prices, bird performance cost and market dynamics. ROFC (Rs. per bird) of the birds consumed with T_1, T_2, T_3, T_4, T_5 and T_6 diets were 42.24, 31.91, 43.67, 37.61, 35.51 and 26.46, respectively. The highest ROFC was obtained in the birds provided with T_3 diet followed by T_1, T_4, T_5, T_2 and T_6 diet, respectively (Table 3). The ROFC obtained in the present showed that dietary supplementation of 0.5% BCS in broiler ration was beneficial economically as compared to all the other dietary treatments including control group. These findings were in agreement with Durrani *et al.* (2007), Abu-Dieyeh and Abu-Darwish (2008), who also found higher economical returns (*i.e.,* profit per bird) when the broilers were fed diets supplemented with BCS as compared to birds fed control diet.

Conclusions

From the study, it can be concluded that the increasing level of Black cumin (*Nigella sativa*) seeds (BCS) powder supplementation @ 0.5%, 1%, 1.5% and 2% in basal diet of the broiler birds influenced the economics by lowering the return over feed cost due to increase in price of feed cost. Dietary supplementation of Black cumin seeds powder @ 0.5% (*i.e.* 5 g/kg feed) can be used as growth promoter in the diets to economize and optimize the overall performance of commercial broilers.

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Table 3: Return over Feed Cost (ROFC) of birds fed with different experimental diets

Particulars		Treatments					
		T_1	T_2	T_3	T_4	T_5	T_6
Feed consumption (g)	Starter	291.79	309.71	309.50	323.00	323.54	313.38
	Grower	738.65	687.25	749.00	773.50	780.25	765.32
	Finisher	2778.37	2856.18	2805.32	2816.67	2892.08	2812.10
	Total	3808.81	3853.14	3863.82	3913.17	3995.88	3890.79
Cost of feed (Rs./kg feed)	Starter	36.20	37.20	37.51	38.81	40.09	41.37
	Grower	36.81	37.81	38.11	39.41	40.69	41.97
	Finisher	36.74	37.74	38.04	39.34	40.63	41.90
Cost of feed consumed (Rs./bird)	Starter	10.56	11.52	11.61	12.54	12.97	12.96
	Grower	27.19	25.98	28.54	30.48	31.75	32.12
	Finisher	102.08	107.79	106.71	110.80	117.50	117.82
Total feed cost (Rs./bird)		139.83	145.30	146.86	153.82	162.22	162.90
Average body weight (kg)		2.023	1.969	2.117	2.127	2.197	2.104
Cost of BCS (Rs./bird)		0.00	0.00	5.99	12.16	18.64	24.14
Cost of feed (Rs./kg. broiler bird)		69.12	73.79	69.37	72.31	73.83	77.42
Income from sell of birds (@ 90 Rs./kg b.wt.		182.07	177.21	190.53	191.43	197.73	189.36
ROFC (Rs./kg broiler bird)		20.87	16.20	20.63	17.68	16.16	12.57
ROFC (Rs./bird)		42.24	31.91	43.67	37.61	35.51	26.46

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