International Journal of Bio-resource and Stress Management https://pphouse.org/ijbsm.php

Crossref

IJBSM July 2022, 13(7):718-724 Print ISSN 0976-3988 Online ISSN 0976-4038 **Article** AR2873

Research Article *Natural Resource Management*

DOI: HTTPS://DOI.ORG/10.23910/1.2022.2873

Performance of Broilers on Dietary Supplementation of Black Cumin (*Nigella sativa*) Seed During Monsoon Season

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ABSTRACT

The present research work was conducted with the aim to find out the effect of black cumin seed feeding on the growth, feed efficiency, blood profile and economics of broiler production during summer season. For this, a total of 120 Cobb-400 strains of broilers were selected and subjected to four dietary treatments with 30 birds each having five replications per treatment. The birds of control group were offered standard broiler starter diet till 21 days and thereafter standard finisher diet up to 42 days. The birds of other groups were also offered the same diet as in control group along with black cumin seed powder supplementation at the rate of 1.0, 2.0 and 3.0% of the diet. In monsoon season, feed intake and feed conversion efficiency was significantly (p<0.05) higher in 2% and the poorest in 1% black cumin supplemented group. Black cumin seed had significant (p<0.05) effect on WBC, RBC, PCV and HDL.The haematological and biochemical parameters were found to have positive effect in the treatment groups as compared to control group. However, the control group had the highest net profit return as compared to the treatment groups at which positive effect of black cumin seed was not achieved in terms of economics. Hence, it was concluded that using of black cumin seed as herbal feed additive helps in the improvement of health condition of the birds.

KEYWORDS: Cholesterol, economics, growth, HDL, performance index, LDL

***Citation* (VANCOUVER):** Devi et al., Performance of Broilers on Dietary Supplementation of Black Cumin (*Nigella sativa*) Seed during Monsoon Season. *International Journal of Bio-resource and Stress Management,* 2022; 13(7), 718-724. HTTPS://DOI.ORG/10.23910/1.2022.2873.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

RECEIVED on 01st February 2022 RECEIVED in revised form on 07th July 2022 ACCEPTED in final form on 20th July 2022 PUBLISHED on 31st July 2022

1. INTRODUCTION

The poultry sector constitutes about 65.3 and 34.7% with the monthly turnover of 400 million chicks and 8,400 million eggs, respectively (Anonymous, 2020). India is the third largest egg producing and fourth largest broiler producing country in the world with an estimated production of 103.3 billion eggs and 4.1 million tons of broiler meat (Anonymous, 2019). Feed represents the major part of cost in poultry production and to increase the efficiency of feed utilization and to minimize the cost per unit of production, feed additives including antibiotic, enzyme, antioxidant, pellet-binder, antifungal, colored pigment and flavouring agent were used. However, there is an increased consumers concern over drug residues in meat, resistance in bacteria, environmental contamination and general health. Thus, all the antibiotics used at sub-therapeutic doses for growth promotion were withdrawn (Toghyani et al., 2010).

Herbs and spices stimulate feed intake by the secretion of endogenous enzymes, antibacterial effect and antioxidant potential (Lee et al., 2015) resulting in enhanced absorption of nutrients from the gut. Such natural feed additives had been reported to exert a wide range of beneficial effects on the production performance in broilers in respect to weight gain, feed conversion and meat quality (Aji et al., 2011). Black cumin seeds may increase utilization of nutrients (Saleh, 2014 and Kumar et al., 2017). Yatoo et al. (2012) reported higher dry matter (DM) digestion compared with the control when the diet was supplemented with 1% BCS or 0.5% each of fenugreek and BCS in combination. These benefits may be attributed to enhanced enzymes activity caused by the essential oils in BCS. The black cumin seed is an excellent herb and has revealed its positive effect on broiler chicks performance weight gain, feed conversion ratio (Khan et al., 2012), feed intake, internal organ weight percentages, thigh and breast weight percentages as well as dressing weight percentage (Durrani et al., 2007). Moreover, the effects of NS feed supplementation on growth performance and carcass measurements of broiler chicks have been explored in some studies. The seeds of mangrail appear to be a multipurpose growth promoter and may be promising in improving broiler performance (Al-Beitawi et al., 2009). The addition of black cumin seed in the food of broiler chicks improved their immunity and feed conversion efficacy. The addition of black cumin seed (BCS) instead of bacitracin to broiler diets had increased antibody titre against Newcastle disease and IBD (Al-Beitawi et al., 2009). The favourable effects of N. sativa on performance are thought to be due to high nutritive value as well as pharmacologically active substances present in the seeds. Black seeds contain mixture a of essential fatty acids, particularly oleic, linoleic and linolenic acids that cannot be synthesized in the body. Considering the above facts in view, the present study entitled "Performance of Broilers on Dietary Supplementation of Black Cumin (*Nigella Sativa*) Seed during Monsoon Season" was postulated to see the effect of BCS on overall performance, blood profile and economics of rearing of broiler chicken during summer season in Nagaland.

2. MATERIALS AND METHODS

In order to carry out the trial, 120 Cobb-400 day old chicks were procured and reared during summer season. The chicks were randomly divided into four groups with thirty chicks in each group having five replicates of six birds each. The chicks in the control group (T_1) were fed with standard broiler starter ration from 0-3 weeks of age followed by broiler finisher ration from 4-6 weeks of age. The chicks of other three groups were also offered the same diet as in T_1 along with black cumin seed powder @ 1.0 (T_2), 2.0 (T_3) and 3.0 (T_4) per cent of ration, respectively. The birds were reared under strict hygienic condition. Initial body weight of the chicks was recorded on the day of arrival and thereafter on weekly basis till 42 days of age. The feed conversion efficiency (FCE) was calculated as the ratio of total body weight gain to quantity of feed consumed. Liveability per cent was calculated by subtracting the mortality per cent from 100. Performance Index (PI) was calculated by adopting the formula of Bird (1955). At the end of the experiment, four birds from each group were randomly selected and sacrificed for carcass evaluation studies. For blood profile, 2.0 ml blood samples were collected via wing vein from three birds from each treatment at the end of the trial. Plasma was separated and stored at -20°C. However, for estimation of Red blood cells (RBC) and White blood cells (WBC) fresh whole blood was used. RBC or erythrocytes and WBC were counted by using an improved Neubauer Haemacytometer as per the method described by Sastry (1985). Haemoglobin (Hb) concentration was estimated by Cyanmethemoglobin method as described by Sahli (1909). Packed cell volume (PCV) was calculated as per the formula given by Velguth et al., 2010). Differential leukocytes count was determined by examining whole blood smears. The count includes relative percentages of Lymphocytes, Heterophiles, monocytes, Basophiles and Eosinophils. The blood smear was examined using immersion lens (X100) magnification in the ideal area of the films to give representative sampling of all portions of the blood films. Total serum cholesterol (TC), high density lipoprotein (HDL) and low density lipoprotein (LDL) were determined by using biochemical analysis kits from DIATEK HEALTH care Pvt. Ltd. Total cholesterol concentration was estimated

as per the method described by Richmond (1973). HDL was estimated as per the method described by Izawa et al. (1997) and LDL concentration was estimated as per the method described by Weiland and Seidel (1983). The economics of feeding black cumin powder was calculated on the basis of overall inputs, i.e. the cost of chicks, feeds, test material, labour, medicines and other miscellaneous cost and outputs, i.e. the gross return per bird. The data obtained were subjected to statistical analysis in order to draw a valid interpretation using ANOVA in a Randomized Block Design as described by Snedecor and Cochran (1998).

3. RESULTS AND DISCUSSION

3.1. Body weight

The average body weight of the day-old chicks (Table 1) was 0.043, 0.044, 0.042, and 0.043 kg bird^{-1} for T_1, T_2, T_3 and T_4 groups, respectively. The corresponding body weight in different treatment groups recorded at the end of the trial period was 2.428±0.07, 2.391.90±0.07, 2.533±0.070 and 2.408±0.07 kg bird^{-1}. From the data, it was revealed that there was no significant difference in the average body weight obtained by birds that received black cumin seed based diet and the control group under the prevailing agro-climatic condition. The result indicated that supplementation of black cumin seed powder within the given range in the present study had no influence on the body weight of the birds. These findings were in agreement with the observations of Isalam et al. (2011) who reported that dietary supplementation of *Nigella sativa* seed powder at the rate of 0.0 , 1.5, 3.5 and 4.5% had no significant effects on body weight. These results might be due to factors like strain differences, differences in experimental conditions, type of feed, difference in levels of supplementation of black cumin seed and seasons, etc.

3.2. Gain in body weight

The average gain in body weight for the treatment groups T_1, T_2, T_3 and T_4 was in the range of 141.57 to 534.53, 154.03 to 529.20, 143.50 to 563.93 and 164.63 to 531.13 g bird^{-1}, respectively. From the data, it was revealed that supplementation of black cumin seed powder within the given range in the present study had no significant influence on the gain in body weight of the birds. These findings were in agreement with the observations of Isalam et al. (2011) who also reported that dietary supplementation of *Nigella sativa* seed powder at the rate of 0, 1.5, 3.5 and 4.5% had no significant effects on gain in body weight.

3.3. Feed intake

The total feed intake during the entire trial period for T_1, T_2, T_3 and T_4 groups was 3.659±0.01, 3.642±0.01, 3.886±0.01 and 3.712±0.01 kg bird^{-1}, respectively. From the data, it was observed that feed intake was significantly (p<0.05) higher in T_3 followed by T_4, T_1 and the least in

Table 1: Production performance of broiler birds in different treatment groups

Parameters	Week	Treatments			
		T_1	T_2	T_3	T_4
Body wt (kg bird^{-1} wk^{-1})	Onset	0.043	0.044	0.042	0.043
	6th	2.428±0.07	2.392±0.07	2.533±0.07	2.408±0.07
Gain in body wt (g bird^{-1} wk^{-1})	1st	141.57	154.03	143.50	164.63
	6th	534.53	529.20	563.93	563.93
Feed intake (kg bird^{-1} wk^{-1})	Total	3.642^{a}± 0.01	3.642^{a}± 0.01	3.886^{c}± 0.01	3.712^{b}±0.01
	Mean	0.610	0.607	0.648	0.619
FCE	6th	0.578^{ab}±0.01	0.575^{a}±0.01	0.599^{b}±0.01	0.596^{b}±0.01
Liveability (%)	6th	100	100	100	100
Performance Index	6th	166.66	165.07	167.77	160.30
Dressing (%)	6th	84.08	84.89	84.41	84.32
Carcass Wt (g)	6th	1.964	2.013	2.008	2.000
Heart (g)	6th	11.35	13.30	13.82	11.55
Liver (g)	6th	41.27	48.30	46.47	57.85
Gizzard (g)	6th	40.95	45.07	44.95	55.55
Spleen (g)	6th	2.37	3.12	4.30	3.75

a,b, c: Means bearing different superscripts within the column differ significantly (p<0.05)

T_2 group. However, the difference between T_1 and T_2 and T_1 and T_4 was non- significant. The results of the present study were in agreement with the findings of Massuod et al. (2014) who found increased feed intake in birds with the supplementation of 2.0% black cumin seed in broiler ration. This could be due to experimental conditions such as feed, strains of bird used, level of black cumin seed, agro-climatic, seasons etc.

3.4. Feed conversion efficiency

The mean feed conversion efficiency of broiler birds in different groups at the end of sixth week was recorded as 0.578±0.01, 0.575±0.01, 0.599±0.01 and 0.596±0.01 for T_1, T_2, T_3 and T_4 groups, respectively. The values for feed conversion efficiency was significantly (p<0.05) highest in T_3 followed by T_4, T_1 and the lowest was in T_2. Hence, the result showed positive effect of black cumin seed on feed conversion efficiency. The results of the present study were in line with the observations of Al-Homidan et al. (2002) who reported that feed efficiency was improved by incorporating black cumin seeds in the broiler rations. This might be due to levels of black cumin seed and feed formulation, type of feed, system of agro-climatic differences etc.

3.5. Mortality/liveability and performance index

The mortality (%) of broiler birds was zero, hence, liveability (%) was 100 in all the groups which might be attributed to favourable climatic condition, good quality feed and proper management practices. It was also indicative that supplementation of black cumin seed did not have adverse effect on the survivability of the birds. The performance index was 166.66, 165.07, 167.77 and 160.30 for T_1, T_2, T_3 and T_4 groups, respectively. The values for performance index was observed to be higher in T_3 groups fed with 2% black cumin seed based diet followed by T_1, T_2 and the least in T_4 group. Similar to the present findings, Singh and Kumar (2018) found that inclusion of black cumin seed powder at the rate of 0.5, 1.0 and 1.5% resulted in highest broiler performance efficiency index (BPEI) and 100% liveability. This might be due to levels of black cumin seed used in the diet, the species of the broiler birds and agro-climatic of the experimental site.

3.6. Dressing percentage, carcass yield and organ weight

From the Table 1, it was observed that the average dressing (%) of broiler birds at the end of sixth week was 84.08, 84.89, 84.41 and 84.32 in T_1, T_2, T_3 and T_4 groups, respectively. The highest dressing (%) was in T_2 group followed by T_3 and T_4, and the least in T_1 group, respectively. The average carcass weight of broiler birds was 1.964, 2.013, 2.008 and 2.000 kg bird^{-1} for T_1, T_2, T_3 and T_4 groups, respectively. The average weight of carcass was highest in T_2, T_3 and T_4 group and lowest in T_1 group. The average heart weight was 11.35, 13.30, 13.82 and 11.55 g bird^{-1} for T_1, T_2, T_3, and T_4 groups, respectively. The heart weight was highest in T_3 group followed by T_2, T_4 and the lowest in T_1 group. The average liver weight was 41.27, 48.30, 46.47 and 57.85 g bird^{-1} for T_1, T_2, T_3 and T_4 groups, respectively. The liver weight was highest in T_4 group followed by T_2, T_3 and the lowest in T_1 group. The average gizzard weight was 40.95, 45.07, 44.95 and 55.55 g bird^{-1} for T_1, T_2, T_3 and T_4 groups, respectively. The value of gizzard weight was highest in T_4 group followed by T_2, T_3 and the lowest in T_1 group. The average spleen weight was 2.37, 3.12, 4.30 and 3.75 g bird^{-1}for T_1, T_2, T_3 and T_4 groups, respectively. The spleen weight was highest in T_3 group followed by T_4, T_2 and the lowest in T_1 group.

From the result, it was observed that the value for dressing (%) was better in black cumin seed supplemented group as compared to control group, the values did not follow the linear trend; however, the value was numerically the highest at the higher level of black cumin seed supplementation. The result of the present study was well corroborated with the findings of Guler et al. (2006) and Toghyani et al. (2010) who reported that carcass yield, liver, abdominal fat, breast, thigh, wing and neck weights in broilers were increased in broilers chicken fed 1% black cumin seed in the diet. These results might be due to different levels use of black cumin seed in the diet, species of the broiler birds and agro-climatic of the experimental site.

3.7. Haematological parameters

The mean values (Table 2) for haemoglobin were 9.44±0.30, 9.64±0.31, 9.78±0.32 and 10.11±0.33 g dl^{-1} for T_1, T_2, T_3 and T_4 groups respectively. The corresponding values for total white blood cells (10^3 mm$^{3\ -1}$) were 30.37±1.02, 29.66±0.98, 25.06±0.83 and 29.00±0.96, respectively. Similarly, the corresponding values for total red blood cells (10^3 mm$^{3\ -1}$) for the groups T_1, T_2, T_3 and T_4 were 3.20±0.10, 3.10±0.10, 2.83±0.09 and 3.10±0.30, respectively. The packed cells volume recorded for the treatment groups T_1, T_2, T_3 and T_4 was 32.66±1.08, 31.00±1.03, 30.33±1.01 and 32.00±1.06%, respectively. The value for heterophils was 40.00±1.33, 34.33±1.14, 34.66±1.15 and 47.00±1.56% for T_1, T_2, T_3 and T_4 groups, respectively. The corresponding values for eosinophils were 1.66±0.05, 1.00±0.01, 2.33±0.07 and 2.00±0.06%, respectively. Similarly, the values for lymphocytes for T_1, T_2, T_3 and T_4 were 58.66±1.95, 70.00±2.33, 68.33±2.27 and 53.66±1.78%, respectively. However, monocytes and basophils were recorded as nil for all the groups. There was significant effect on haematological parameters due to inclusion of black cumin seed in broiler feed. Similar findings were reported by Bhardwaj et al. (2012) who

Table 2: Haematological and biochemical parameters of blood of broiler birds in different treatment groups

Parameters	Treatments			
	T_1	T_2	T_3	T_4
Haemoglobin (g dl^{-1})	9.44± 0.30	9.64± 0.31	9.78± 0.32	10.11± 0.33
WBC (10^3 mm^{-3})	30.37^{a}± 1.02	29.66^{b}± 0.98	25.06^{c}± 0.83	29.00^{b}± 0.96
RBC (10^6 mm^{-3})	3.20^{a}± 0.10	3.10^{a}± 0.10	2.83^{b}± 0.09	3.10^{a}± 0.30
PCV (%)	32.66^{a}± 1.08	31.00^{b}± 1.03	30.33^{b}± 1.01	32.00^{a}± 1.06
Monocytes (%)	0	0	0	0
Basophiles (%)	0	0	0	0
Heterophils (%)	40.00^{b}± 1.33	34.33^{c}± 1.14	34.66^{c}± 1.15	47.00^{a}± 1.56
Eosinophils (%)	1.66^{b}± 0.05	1.00^{c}± 0.01	2.33^{a}± 0.07	2.00^{ab}± 0.06
Lymphocytes (%)	58.66^{c}± 1.95	70.00^{a}± 2.33	68.33^{b}± 2.27	53.66^{d}± 1.78
LDL(mg dl^{-1})	91.51± 3.05	95.12± 3.17	97.60± 3.25	92.64± 3.08
HDL(mg dl^{-1})	76.88^{a}± 2.56	62.96^{bc}± 2.09	71.25^{ab}± 2.37	60.67^{c}± 2.02
Cholesterol (mg dl^{-1})	110.77± 3.69	107.10± 3.56	114.28± 3.80	117.65± 3.92

a,b, c: Means bearing different superscripts within the column differ significantly (p<0.05)

Table 3: Economics of broiler production (₹ $bird^{-1}$) in different treatment groups

Sl. No.	Items	Treatment groups			
		T_1	T_2	T_3	T_4
1.	Cost of broiler	41.00	41.00	41.00	41.00
2.	Cost of feed	136.76	138.36	147.63	141.02
3.	Cost of black cumin seed	-	15.65	33.41	47.87
4.	Cost of medicine	4.78	4.78	4.78	4.78
5.	Cost of labour	12.60	12.60	12.60	12.60
6.	Miscellaneous cost	20.00	20.00	20.00	20.00
7.	Cost of production (₹ $bird^{-1}$)	215.14	232.40	259.20	267.27
8.	Average wt of broiler (kg)	2.427	2.391	2.532	2.407
9.	Cost of production (₹ kg^{-1} wt)	88.64	97.20	102.37	111.04
10.	Sale of broiler (₹)	315.51	310.83	329.16	312.91
11.	Sale of gunny bags (₹)	1.333	1.333	1.333	1.333
12.	Total receipt (₹ $bird^{-1}$)	316.87	312.19	330.52	314.27
13.	Profit $bird^{-1}$ (₹)	101.73	79.80	71.32	47.00
14.	Net profit (₹ kg^{-1} wt gain)	41.92	33.37	28.17	19.52
15.	Benefit cost ratio	1.47	1.34	1.27	1.17

observed that supplementation of herbal product improved hemato-biochemical level in the chicken. Similarly, Khan et al. (2012) reported that the birds that were fed with diets containing high levels of BCS (2.5% or 5.0%) had higher (p<0.05) haematological values than birds fed with 1.25% BCS diets, antibiotic or the unsupplemented diet. The value of haemoglobin did not differ significantly irrespective of treatments. The values for monocytes and basophils were observed to be nil. Slight rise in lymphocyte was observed in black cumin seed supplemented groups which might be due to immuno-stimulatory effects of black cumin seed. Further, dietary supplementation of black cumin seed at 1 % level had resulted in lowest Heterophils or Lymphocyte ratio which could be responsible for an anti stress factors activities.

3.8. Biochemical studies

The mean values (Table 3) for LDL were 91.51±3.05, 95.12±3.17, 97.60±3.25 and 92.64±3.08 mg $dl^{-1}$for the treatment groups T_1, T_2, T_3 and T_4 groups, respectively. The corresponding values for HDL were 76.88±2.56, 62.96±2.09, 71.25±2.37 and 60.67±2.02 mg dl^{-1}, respectively. Similarly, the corresponding values for Cholesterol for the groups T_1, T_2, T_3 and T_4 were 110.77±3.69, 107.10±3.56, 114.28±3.80 and 117.65±3.92 mg dl^{-1}, respectively. From the perusal of the data, it was observed that there was no significant difference in LDL and cholesterol due to black cumin seed supplementation. However, addition of black cumin seed powder had positive effect on HDL. The highest amount of HDL (76.88 mg dl^{-1}) was observed in control group. The result of the present finding were not in line with the findings of Sonia et al. (2014) who found that birds fed with 3% black cumin had lowest cholesterol and highest HDL

(high density lipoprotein) as compared to control group.

3.9. Economics

Average cost of production (₹ bird^{-1}) for T_1, T_2, T_3 and T_4 was 215.14, 232.39, 259.20 and 267.27, respectively. Corresponding values for average cost of production (₹ kg^{-1} live weight of bird) was 88.64, 97.20, 102.37 and 111.04, respectively. Profit (₹ bird^{-1}) was 101.73, 79.80, 71.32 and 47.00 for T_1, T_2, T_3 and T_4 groups, respectively while the corresponding values for net profit (₹ kg^{-1} live weight of gain) was 41.92, 33.37, 28.17 and 19.52, respectively. From the results, it was found that the total cost of production (₹ bird^{-1}) was comparable in all the groups; however the cost of production (₹ kg^{-1} live weight of bird)was lowest 88.64 in T_1 followed by T_2, T_3 and the highest (₹ 111.04) in T_4 group. The net profit (₹ kg^{-1} live weight of gain) was highest (₹ 41.92) in T_1 and the lowest (₹ 19.52) in T_4 group. From the results, it was found that the values of total cost of production or net profit were comparable in all the treatment groups. The value of net profit was highest in control group and lowest in treatment group supplemented with 3 per cent level of black cumin seed in the diet of broiler birds. The findings of the present study were contrary to the observation of Khadr and Abdel-Fattah (2006) who had observed higher economical returns from the broiler bird reared on diet supplemented with black cumin seed at different levels as compared to control diet. Variation in the observation might be due to differences in the level of supplementation of black cumin seed, species of broiler birds, agro-climatic conditions etc.

4. CONCLUSION

Based on the above findings, it can be concluded that overall performance in terms of body weight, body weight gain, feed efficiency and performance index, broilers supplemented with black cumin seed at the rate of 2% (T_3) performed better as compared to the other treatment groups during the monsoon season. Moreover, the haematological and biochemical values were improved due to black cumin seed supplementation.

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