Journal of Natural Science Review

Vol. 4, No. 1, 2026
https://kujnsr.com
e-ISSN: 3006-7804

Influence of Black Cumin and Coriander Seed Powders on Growth Performance, Feed Efficiency, and Economic Evaluation of Broiler Chickens

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ABSTRACT

This study evaluated the effects of black cumin (*Nigella sativa* L.) and coriander (*Coriandrum sativum* L.) seed powders as natural growth-promoting feed additives on Ross 308 broiler chickens. The experiment was conducted using a CRD design with four treatments and three replications, from August 12 to November 17, 2022, at a local farm in Sharana, Paktika Province, Afghanistan. Parameters measured included feed intake, live body weight, weight gain, feed conversion ratio (FCR), and economic value. The results showed that supplementation with black cumin and coriander seed powder significantly improved broiler performance. Feed intake, live body weight, and weight gain increased, while FCR decreased. Economically, significant differences were observed among treatments, with Treatments 2 and 4 performing the best. T4 (2% black cumin + 2% coriander) achieved the highest feed intake (1019 g), live body weight (1641.8 g), weight gain (544.4 g), lowest FCR (1.87), and highest benefit–cost ratio (BCR =1.12 AFN). LSD analysis revealed no significant difference between T2 and T4. However, T4 was considered optimal as it not only enhanced performance but also improved the nutritional quality of broiler meat and yielded a high economic return. Based on these findings, T4 is recommended as the most effective dietary supplementation strategy. Future studies are suggested to explore the effects of higher inclusion levels of black cumin and coriander seed powder on other broiler breeds over varying durations.

ARTICLE INFO

Article history:
Received: October 3, 2025
Revised: February 19, 2026
Accepted: March 2, 2026
Published: March 31, 2025

Keywords:
Black Cumin; Broiler Chickens; Coriander; Growth Promoting; Performance

To cite this article: Hilal, M. B., Niazi, M. H., Bandarkhil, A. M., & Langar, H. (2026). Influence of Black and Coriander Seed Powders on Growth Performance, Feed Efficiency, and Economic Evaluation of Broiler Chickens. *Journal of Natural Science Review, 4*(1), 37-48. https://doi.org/10.62810/jnsr.v4i1.329
Link to this article: https://kujnsr.com/JNSR/article/view/329

INTRODUCTION

Growth-promoting feed additives are substances incorporated into poultry diets in small amounts to enhance desirable traits and reduce or eliminate undesirable characteristics. They promote growth and weight gain, improve egg production, feed utilization efficiency, and play a major role in reducing mortality rates (Al-Zuhairi et al., 2017).

For many years, antibiotics have been incorporated into poultry diets as growth-promoting feed additives to enhance production, growth, feed efficiency, and overall health

(El-Fateh et al., 2024; Ishaq et al., 2025). However, the extensive use of antibiotic growth promoters (AGPs) in poultry feed has led to increased resistance of pathogenic bacteria and the accumulation of harmful chemical residues in poultry tissues and products (Denli and Demirel, 2018; Mnisi et al., 2024; Wang et al., 2024). These concerns have led to bans on AGPs in many countries, prompting scientists to explore natural and plant-derived alternatives (Alloui et al., 2014; Denli and Demirel, 2018).

Natural growth promoters (NGPs), also referred to as phytogenic growth promoters (PGPs), include aromatic and medicinal plants with numerous beneficial effects. These effects include stimulating digestion, enhancing feed intake, promoting digestive enzyme secretion and appetite, strengthening the immune system, and exhibiting antimicrobial properties (Barad, 2026; Jin et al., 2020; Urban et al., 2025).

Black cumin *(Nigella sativa L.*) and coriander (*Coriandrum sativum L.*) are examples of aromatic plants with multiple beneficial properties, making them promising alternatives to AGPs in poultry nutrition. Black cumin, a member of the *Ranunculaceae* family, is cultivated in Asia and the Mediterranean region. It is one of the most well-known medicinal plants, possessing diverse biological and pharmacological properties, such as antimicrobial, anti-inflammatory, anticancer, antioxidant, and hepatoprotective effects (Elnour and Abdelsalam, 2018; Ahmad et al., 2013; Gharby et al., 2015; Siddiqui et al., 2015). The chemical composition of black cumin includes fats, proteins, carbohydrates, vitamins, minerals, crude fiber, alkaloids, and saponins. Chemical analyses have shown that black cumin contains approximately 21% protein, 35.5% fat, 5.5% moisture, and 3.7% minerals, with the remainder mainly carbohydrates (Gharby et al., 2015; Siddiqui et al., 2015).

Coriander, a member of the *Apiaceae* family, is an annual plant native to the Mediterranean and Middle Eastern regions. It is mainly grown for its seeds, which have been used in traditional medicine for thousands of years to treat various disorders. Coriander seeds possess several health benefits, including antimicrobial, antidiabetic, antioxidant, and anthelmintic properties, as well as appetite stimulation and improvement of digestive processes (Bhat et al., 2014; Barad et al.,2016; Jamshidian et al., 2017). Coriander seeds contain various essential nutrients in their composition. They consist of approximately 7.6–8.7% oil, 15–17% protein, 0.179% fructose, 0.877% glucose, 0.219% sucrose, 19% saturated fatty acids, 63% monounsaturated fatty acids, and 17% polyunsaturated fatty acids. In addition, they contain small amounts of minerals (P, K, S, Mg, Ca, Na, Zn, Mn, Fe, and Cu) as well as certain vitamins (Hamama & Bhardwaj, 2022; Barad et al.,2016).

As the global population continues to grow, the demand for food—particularly protein sources—is steadily increasing. Humans not only require sufficient quantities of food but also safe and healthy products that pose no health risks (Muazzam et al., 2025). Therefore, this research is crucial, as it offers an opportunity to increase poultry production more quickly and at lower cost while reducing the use of antibiotic growth promoters in poultry diets.

Poultry meat and eggs are not only complete foods but are also highly nutritious, palatable, affordable, and considered healthier protein sources due to their low fat and high protein content. Consequently, the consumption of poultry meat as a food source is steadily increasing. To meet this growing demand, it is essential to adopt strategies that maximize poultry production while ensuring efficient, cost-effective production (FAO, 2026; Grigore et al., 2025). One such strategy is the supplementation of poultry diets with growth-promoting feed additives. The specific objective of this study is to evaluate black cumin and coriander seed powders as natural alternatives to antibiotic growth promoters by assessing their individual and combined effects on broiler growth performance. To systematically address this objective and provide a comprehensive understanding, the following research questions were formulated:

1. How does *Nigella sativa* L. (black cumin powder) supplementation influence the growth performance and feed efficiency of broiler chickens?
2. What is the effect of *Coriandrum sativum* L. (coriander seed powder) on the growth performance and feed efficiency of broiler chickens?
3. How do the combined dietary effects of Nigella sativa L. and Coriandrum sativum L. seed powder interact to influence the overall growth performance of broiler chickens?

METHODS AND MATERIALS

Research Area

This study was conducted to evaluate the effects of black cumin (*Nigella sativa* L.) and coriander seed powder (*Coriandrum sativum* L.) as natural growth-promoting feed additives on broiler performance. The experiment was carried out using a Completely Randomized Design (CRD) with four treatments and three replications, from August 12, 2022, to November 17, 2022, at a local farm in Sharana, the capital of Paktika Province, Afghanistan (latitude 33°10′45.03″ N, longitude 68°47′31.21″ E).

Excremental Materials and Treatment Groups

A total of 96 one-day-old commercial broiler chicks of the Ross 308 breed, supplied by SB Company, were purchased from the market. Before the chicks' arrival, the farm was disinfected in accordance with biosecurity standards, and all requirements, including temperature, litter, lighting, and ventilation, were properly met.

Upon arrival, the chicks were randomly allocated into four equal groups—one control and three treatments—as presented in Table 1. Each group had three replications, with 8 chicks per replication, for a total of 24 chicks per treatment. The trial lasted 35 days (five weeks). Body weights were recorded five times during the experiment: on day 1 and weekly thereafter until the end of the trial, with average weights recorded each time.

Table 1. *Treatments and details of the experiment*

Treatments	Feed Additives	No. of Chicks	Replications
T1	Control	8	3
T2	2% black cumin powder	8	3
T3	2% coriander seed powder	8	3
T4	2% black cumin + 2% coriander powder	8	3

The basal diet was a commercial feed produced by Habib Hesam Company, purchased from the local market as needed. Black cumin and coriander seeds were obtained from herbal and spice stores, ground into powder, and incorporated into the commercial feed according to the treatment plan shown in Table 1.

Performance Traits and Data Collection

At placement, chicks were given glucose in drinking water for the first three hours, after which a starter diet was provided for two weeks, followed by a finisher diet until the end of the trial. To prevent viral diseases, vaccination was uniformly applied to all chicks: ND+IB on day 6, IBD on day 12, ND on day 18, and IBD on day 24.

The parameters measured included:

- Feed intake (FI),
- Live Body Weight (LBW),
- Body weight gain (WG),
- Feed conversion ratio (FCR).
- Economic Analysis (EA).

Feed intake was determined by weighing the offered feed and the leftover feed weekly. Body weight was recorded individually on days 1, 7, 14, 21, 28, and 35. Feed conversion ratio (FCR) was calculated using the following formula (Ghasemi et al., 2014).

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Feed intake (FI)}}{\text{Body weight gain (WG)}}$$

Statistical Analysis of Data

The collected data were statistically analyzed using Statistical Tool for Agricultural Research (STAR) software with one-way analysis of variance (ANOVA), followed by the least significant difference (LSD) test for mean separation. The results were presented in the form of graphs and tables, with confidence intervals (CI) of 95% and 99%, and statistical significance was considered at $p \leq 0.05$ and $p \leq 0.01$.

FINDINGS

As previously mentioned, this study was conducted to evaluate the use of black cumin and coriander seed as natural growth-promoting substances to improve the growth performance of broiler chickens and to determine their effects. In this section, the research findings are presented under five headings, corresponding to the study's key parameters.

Feed intake (FI)

Table 2 presents the effects of dietary supplementation with black cumin and coriander seed on the feed intake of broiler chickens. The results, at a probability level of P ≤ 0.01, indicate that the inclusion of black cumin and coriander seeds in the diet had no significant effect on feed intake from the first to the fourth week of the birds' lives. However, a significant effect was observed in the fifth week, with the highest feed intake in Treatment 4 and the lowest in the control group.

Table 2. *Effects of black cumin and coriander seed on feed intake of broiler chickens (g)*

Treatments	First week	Second week	Third week	Fourth week	Fifth week
T1	127.0	324.0	455.0	772.0	912.3[b]
T2	129.3	326.0	444.0	835.3	999.7[a]
T3	129.0	325.0	456.7	810.3	1005.0[a]
T4	127.0	323.7	437.3	817.3	1019.0[a]
F-test	Ns	Ns	Ns	Ns	**
SE±	7.96	16.92	27.89	21.22	15.91
LSD $_{(0.01)}$	-	-	-	-	53.38
CV	7.61	6.38	7.62	3.21	1.98

Ns: not significant; **: P ≤ 0.01 (highly significant); *: P ≤ 0.05 (significant); CV: Coefficient of Variation; LSD: least significant difference; SE: standard error; Means within the same column followed by different letters (a, b, c…) are significantly different from according to the LSD test; The unit of measurement is grams (g).

Live Body Weight (LBW)

Table 3 shows the effect of adding black cumin and coriander seeds to broiler chick feed over a period of five weeks. The results of the study, at a significance level of P ≤ 0.05, indicate that from the first to the fourth week, the inclusion of black cumin and coriander seeds had no significant effect on the live body weight of broiler chicks. However, in the fifth week, a noticeable effect was observed, with the highest weight recorded in Treatment 4 and the lowest in the control treatment.

Table 3. *Effects of black cumin and coriander seed on live body weight gain of broiler chickens (g)*

Treatments	Initial	First week	Second week	Third week	Fourth week	Fifth week
T1	35.0	125.4	331.5	613.3	1059.7	1452.2[b]

T2	34.9	124.8	330.6	611.4	1096.8	1596.4[a]
T3	34.9	124.8	330.1	612.1	1070.9	1501.6[b]
T4	34.8	125.4	332.4	611.0	1097.4	1641.8[a]
F-test	Ns	Ns	Ns	Ns	Ns	*
SE±	1.03	2.5	9.7	12.3	18.5	23.74
LSD (0.05)	-	-	-	-	-	79.65
CV	3.6	2.46	3.61	2.45	2.10	1.88

Body weight gain (WG)

Table 4 illustrates the effects of dietary supplementation with black cumin and coriander seed on body weight gain of broiler chickens. The results, at a probability level of P ≤ 0.01, show that the use of black cumin and coriander seeds had no significant effect on body weight gain from the first to the fourth week. However, a significant effect was observed in the fifth week, with the highest body weight gain recorded in Treatment 4 and the lowest in Treatment 1 (control).

Table 4. *Effects of black cumin and coriander seed on body weight gain of broiler chickens (g)*

Treatments	First week	Second week	Third week	Fourth week	Fifth week
T1	90.71	206.1	281.8	446.4	392.5[b]
T2	89.88	205.9	280.7	485.6	499.6[ab]
T3	89.91	205.5	282.0	458.8	430.7[b]
T4	90.64	207.0	278.6	486.4	544.4[a]
F-test	Ns	Ns	Ns	Ns	**
SE±	2.12	7.87	12.97	23.73	32.9
LSD (0.01)	-	-	-	-	110.31
CV	2.87	4.68	5.66	6.19	8.63

Feed conversion ratio (FCR)

Table 5 presents the effects of dietary supplementation with black cumin and coriander seed on the feed conversion ratio (FCR) of broiler chickens. The results, at the P ≤ 0.05 level, indicate that supplementation had no significant effect on FCR from the first to the fourth week. However, a significant effect was observed in the fifth week, with the highest FCR in Treatment 1 (control) and the lowest in Treatment 4.

Table 5. *Effects of black cumin and coriander seed on the feed conversion ratio of broiler chickens*

Treatments	First week	Second week	Third week	Fourth week	Fifth week
T1	1.40	1.56	1.62	1.73	2.36[a]
T2	1.43	1.58	1.58	1.72	2.00[bc]
T3	1.43	1.58	1.62	1.77	2.33[ab]
T4	1.40	1.56	1.57	1.67	1.87c
F-test	Ns	Ns	Ns	Ns	*
SE±	0.73	0.09	0.13	0.07	0.15
LSD (0.05)	-	-	-	-	0.35
CV	6.28	6.74	9.90	5.05	8.78

Economic Analysis (EA)

Table 6 shows the effect of adding black cumin and coriander seed to feed on the economic value of broiler chickens. The results of the study, at the P ≤ 0.01 significance level, indicate

that the inclusion of black cumin and coriander seeds significantly affected the cost and income of broilers. Regarding cost, the highest was recorded in Treatment 4, and the lowest in the control treatment. Regarding income, the highest income was obtained in Treatment 4 and the lowest in the control treatment.

Furthermore, the results at $P \leq 0.05$ indicate that adding black cumin and coriander seed had a significant effect on profit and the benefit-cost ratio (BCR) of broilers. For profit, the highest value was recorded in Treatment 4 and the lowest in the control treatment. For the benefit-cost ratio, the highest values were observed in Treatments 4 and 2, and the lowest value was recorded in the control treatment.

Table 6. *Effects of black cumin and coriander seed on the economic analysis of broiler chicken*

Treatments	Cost	Income	Profit	BRC
T1	164.33 ^{b}	175.00 ^{c}	10.67 ^{b}	1.06 ^{b}
T2	169.33 ^{ab}	190.00 ^{ab}	20.67 ^{a}	1.12 ^{a}
T3	170.33 ^{ab}	181.67 ^{bc}	11.33 ^{b}	1.07 ^{b}
T4	175.33 ^{a}	196.67 ^{a}	21.33 ^{a}	1.12 ^{a}
F-test	**	**	*	*
SE±	2.21	3.33	3.86	0.02
LSD	7.40	11.18	8.89	0.05
CV	1.59	2.20	29.54	2.50

DISCUSSION

The present study demonstrated that the inclusion of black cumin and coriander seed in broiler diets significantly influenced feed intake during the five-week rearing period. The highest feed intake was recorded in Treatment 4 (1019 g), while the lowest was observed in the control group (912 g). This enhancement in feed intake may be attributed to the high nutritional value of black cumin and coriander seeds, which are rich in carbohydrates, fatty acids, proteins, and lipids. These nutritional components likely encouraged the chicks to consume more feed to meet their physiological needs. Moreover, the bioactive compounds present in both seeds, including essential oils, phenolics, and flavonoids, are known to possess digestive and appetite-stimulating properties, which further contribute to increased feed intake. Based on the LSD test, there were no significant differences among Treatments 2, 3, and 4; however, significant differences were observed compared to the control group. These findings are consistent with previous studies that reported similar positive effects of phytogenic feed additives on feed intake and growth performance in broilers. For instance, Hamodi et al. (2010) observed improved feed consumption and growth efficiency in broilers supplemented with black cumin and other herbal additives. More recent studies by Zaazaa et al. (2023), Mohammed et al. (2023), Hafeez et al. (2024), and Uttam (2024) further support the role of these seeds in enhancing feed intake through their nutritional and bioactive properties.

Regarding LBW, results showed no significant differences during the first four weeks, but a significant difference was observed in the fifth week. The highest LBW was recorded in

Treatment 4 (1641.8 g), while the lowest was in the control group (1452.2 g). This increase in LBW is attributed to the nutritional richness of black cumin and coriander seeds, which are good sources of protein and fatty acids and are highly digestible. According to LSD analysis, no significant differences existed between Treatments 2 and 4, and between Treatments 1 and 3. These results are in agreement with previous studies by Zaazaa et al. (2023), Mohammed et al. (2023), Hafeez et al. (2024), and Uttam (2024), who reported improved growth performance in broilers supplemented with phytogenic feed additives, the findings highlight the potential of black cumin and coriander seed powders as effective natural growth promoters capable of LBW, particularly during the later stages of broiler production.

Regarding weight gain, adding black cumin and coriander seeds to the diet had a significant positive effect. The highest weight gain was recorded in Treatment 4 (544.4 g) and the lowest in the control treatment (392.5 g). This is because these seeds are rich in protein and lipids, which enhance nutrient absorption and contribute to weight gain. LSD analysis indicated no significant difference between Treatments 2 and 4, or between Treatments 1 and 3. The present findings are consistent with earlier reports by Al-Mufarrej (2014), Karadağoğlu et al. (2019), and Hamodi et al. (2010), who documented improved weight gain in broilers supplemented with herbal feed additives. More recent studies by Zaazaa et al. (2023), Mohammed et al. (2023), Hafeez et al. (2024), and Uttam (2024) further confirm the growth-promoting potential of phytogenic additives in poultry nutrition. Collectively, these results indicate that black cumin and coriander seeds can serve as effective natural growth promoters, enhancing weight gain and supporting improved production performance in broiler chickens.

The FCR results showed that the inclusion of black cumin and coriander seeds positively influenced feed efficiency. The highest FCR was recorded in the control group (2.36), while the lowest was in Treatment 4 (1.87). In the control treatment, 2.23 g of feed were consumed per gram of weight gain, whereas in Treatment 4 only 1.87 g were consumed per gram of gain. This improvement is due to the high nutritional content, protein, and fat of the seeds, which are efficiently digested and absorbed, leading to greater weight gain with less feed. LSD results indicated no significant differences between Treatments 2 and 4, and between Treatments 1 and 3. These results are consistent with previous studies by Ghasemi et al. (2014) and EL-Shoukary et al. (2014), as well as more recent investigations by Zaazaa et al. (2023), Mohammed et al. (2023), Hafeez et al. (2024), and Uttam (2024), all of which reported improved feed efficiency in broilers supplemented with phytogenic feed additives.

From an economic perspective, the most cost-effective treatments were Treatments 2 (Cost: 169.33, Income: 190.00, Net Profit: 20.67, BCR: 1.12 AFN) and 4 (Cost: 175.33, Income: 196.67, Net Profit: 21.33, BCR: 1.12 AFN), which achieved the highest incomes and BCRs. Among these, Treatment 4 is preferable due to its higher income and because the nutritional value of black cumin and coriander seeds enhances the quality of broiler meat.

CONCLUSION

This study demonstrated that supplementation with black cumin and coriander seeds significantly improved the growth performance and economic efficiency of broiler chickens. Inclusion of these seeds enhanced feed intake, live body weight, and weight gain, while reducing the feed conversion ratio. From an economic perspective, significant differences were observed among treatments, with Treatments 2 and 4 performing better. Overall, the highest feed intake, live body weight, and weight gain, the lowest feed conversion ratio, and the highest benefit-cost ratio were observed in Treatment 4 (2% black cumin + 2% coriander seed). Based on the LSD test, there was no significant difference between Treatment 2 (2% black cumin) and Treatment 4. However, because Treatment 4 also improves the nutritional value of broiler meat and has a high BCR of 1.12 AFN, it is considered the most optimal treatment.

Recommendations

Based on the study results, Treatment 4 (2% black cumin + 2% coriander seed) was identified as the most effective treatment and is therefore recommended. Furthermore, future research should investigate the effects of higher levels of black cumin and coriander seeds on other broiler chicken breeds over different time periods.

AUTHORS CONTRIBUTIONS

- Mir Hatem Niazai. conceptualized and supervised the study.
- Mohammad Bilal Hilal. investigated and analyzed data.
- Abdul Majid Bandarkhil and Hihmatullah Langar. wrote the manuscript with input from all authors.
- All authors reviewed and approved the final version.

ACKNOWLEDGEMENTS

We extend our gratitude to Kabul University and our senior professors for providing a supportive academic environment and for their valuable assistance in conducting this research.

FUNDING INFORMATION

No funding is available for this research.

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest regarding this study.

DATA AVAILABILITY STATEMENT

The data can be accessed upon request from the corresponding author, with the approval of the appropriate ethics committee.

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