Impact of Coriander seed powder on growth performance, blood parameters, carcass attributes and economies of Broiler Chickens

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Abstract

Herbs and spices can be added to feed and are a good substitute for antibiotics in the raising of chickens. This study analyzed the potential impact of coriander seed powder (CSP) on carcass attributes, blood constraints, growth performance and economies of producing broilers. A total of 120 old male Cobb broiler chickens (initial body weight 40-50 g) were randomly allocated to five dietary treatments under a completely randomized design comprising three replicates of eight birds each. The control group (T1) received the basal diet supplemented with chlortetracycline at 100 g/100kg of feed as an antibiotic growth promoter, whereas T2 (0.5%), T3 (1%), T4 (1.5%), and T5 (2%) received the basal diet without antibiotic inclusion. Diets were formulated to meet Bureau of Indian Standards specifications across pre-starter (1-7d), starter (8-21d) and finisher (22-42 d) phases during a 42-day trial. Birds receiving 1.5% CSP (T4) exhibited the highest final body weight (2162.82g) and lowest overall feed conversion ratio (1.65) compared to control. Carcass evaluation revealed higher drawn carcass percentage and yield in T4 ($P< 0.05$). Meat proximate analysis showed no adverse effects on dry matter. Hematological parameters such as TLC (%), TEC (%) and platelets count showed higher ($P<0.05$) in T4, which indicates the healthy body condition of birds. Therefore, it is concluded that supplementation of CSP (1.5%) enhanced growth performance, feed efficiency, carcass yield and economic returns, suggesting that CSP may serve as a viable natural dietary alternative to antibiotic growth promoters under standard management conditions. However, future research is needed to determine the precise processes underlying medicinal plant effects and appropriate amount of plant to be administered for favorable impacts on broilers performance.

Key words: Broiler, Body weight, Coriander seed, Feed Intake

Introduction

Poultry meat production represents one of the fastest growing livestock globally delivering high-quality animal protein at relatively low production costs. The overall poultry population in India has grown by around 16.81%, increasing from 729.21-851.81 million (DAHD, 2019). India ranks third and sixth globally in terms of both chicken meat and egg production (BAHS, 2023). Poultry production has consistently incorporated new technologies to maintain its competitiveness in global meat market. However, optimal feed use, improved body weight, disease free conditions and low mortality all have significant impact on poultry health and productivity. Seasonal fluctuations raise risk of disease in poultry, with liver being the organ most commonly impacted of all the organs (Wasti et al. 2020). Since feed makes up around 70% of all chicken farming expenses, profitable broiler production depends on rapid development in a short amount of time with optimal feed usage (Wongnaa et al. 2023). Given the current state of the world, there is a rising demand for affordable, high-quality food as the population of the planet rises. Therefore, it is crucial to use growth promoters to increase chicken production efficiency in an economical way.

Dietary antibiotic growth promoters significantly improved animal and poultry production (Pourabedin et al. 2015). However, due to worries about their potential to harm the public health when present in animal products and the emergence of antibiotic resistance in bacteria, the majority of these antibiotics are no longer permitted in many nations (Lu et al. 2020). Nowadays, researchers are increasingly interested in identifying natural alternatives to antibiotic growth promoters. Agricultural livestock, especially poultry and pigs, frequently consume diets supplemented with phytogenic feed additives to improve flavor, palatability and increase productivity (Flees et al. 2020, Kour et al., 2025). It has been demonstrated that herbs and spices have strong antibacterial qualities against a variety of pathogens and can be used as an alternate feeding strategy to antibiotic growth promoters (Sethy et al., 2017). Bioactive compounds found in plants that are added to animal feed to increase their production have direct antimicrobial effects, alleviates intestinal microbiota as well as lowers gut toxic metabolites (Gadde et al. 2017). This improves performance and production by relieving the immunological and intestinal stress (Kim et al. 2015, Fallah & Mirzaei, 2016,).

Coriander is primarily cultivated for its seeds, which are widely used as a flavoring agent (Scandar et al. 2023). The Coriander seed essential oil is rich in linalool, which has a volatile flavor and confer its medicinal properties upon it. Bioactive phytochemicals found in coriander have been shown to have several therapeutic and medicinal qualities such as antioxidant, antifungal, anticancer and anthelmintic effects (Freires et al. 2014; Lee et al. 2017). Linalool has been reported to induce apoptosis in cancer cells via oxidative stress, while also protecting normal cells, and to exert antimicrobial effects through disruption of microbial cell membranes (An et al., 2021). Besides, coriander has an appetizing and stimulating effect on digestion, which enhances growth performance. Supplementing root extracts of C. sativum improved the lipid profile, growth, carcass features and antioxidant of broiler chicken (Gazwi et al. 2022). Phytogenic fodder additive improved the digestibility and growth performance in broilers (Amad et al. 2011). Addition of CSP (1.5%) improved dressing percentage, blood parameters and immunological response in broiler chickens (Khubeiz and Shirif, 2020). It was observed that coriander seed powder along with chicory root powder and probiotic improved the performance and gut health of broiler chicken (Gurram et al. 2022). Coriander seed powder (1.5 and 3.5%) had positive effect on villus height in broiler chicken improved the intestinal gut and growth performance (Khubeiz et al. 2024). Although previous studies have examined the effects of coriander seed powder on growth performance, haematological traits and economic efficiency in broiler chickens, information comparing multiple inclusion levels under Indian production conditions, particularly with respect to the combined effects on growth performance, carcass characteristics, haematological parameters and production economics, remains limited. Therefore, the present study was undertaken to evaluate the effects of graded levels of coriander seed powder (0, 0.5, 1.0, 1.5 and 2.0%) on growth performance, carcass characteristics, haematological parameters and economic efficiency of broiler chickens, with the aim of identifying an appropriate dietary inclusion level.

Materials and Methods

The present study was directed to assess the impact of coriander supplementation on broiler chick's performance. The trial lasted 42 days, beginning on January, 2021, in the chicken shed of the Department of Animal Nutrition at Lala Lajpat Rai University of Veterinary and Animal Sciences in Hisar. A completely randomized design was adopted and study followed conventional management standards.

Procurement of feed ingredients, supplements and their analysis

Feed ingredients and supplements were purchased including corn, soyabean meal, groundnut cake, mineral mixture, vegetable oil, vitamins, coccidiostat, fish meal, choline chloride, DL-methionine, lysine, antibiotics and coriander seed powder.

Feed constituents analysis

Feed components used in formulating the experimental diets were evaluated for proximate analysis **(**AOAC, 2016**)**. The measured values for chemical composition, metabolizable energy and feed components cost are shown in SM1.

Experimental design and dietary treatments

A total of 120-day-old male Cobb broiler chicks, with an initial body weight ranging from 40 to 50 g, were randomly allocated to five dietary treatments following a completely randomized design. Each treatment consisted of three replicates of eight birds each. The feeding trial was conducted for 42 days at the Department of Animal Nutrition, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India. The dietary treatments consisted of a basal diet supplemented with coriander seed powder (CSP) at five inclusion levels: 0% (T1), 0.5% (T2), 1.0% (T3), 1.5% (T4) and 2.0% (T5). The control group (T1) received the basal diet supplemented with chlortetracycline at an inclusion rate of 100 g/100 kg of feed, containing an antibiotic, whereas the CSP-supplemented groups received diets without antibiotic supplementation.

Bird management and feeding schedule

Birds were immunized in contrast to the F1 strain of Ranikhet, or Newcastle illness on the seventh day and Gumboro sickness on the fourteenth day by intraocular method. The chicks were grown using a deep litter structure. Experimental shed was thoroughly dressed and sterile using phenol (2.5%) prior to dispersing bedding material. Following that, the whole poultry house was disinfected with formaldehyde before chick placement. Dry wheat straw that had been finely chopped and evenly distributed up to a thickness of 5 cm was utilized as bedding material. To prevent lump formation, the litter was regularly raked. In each pen, wooden brooders with centrally located, approximately 200-watt lamps were employed for brooding. Through the plastic waterer, the chicks were always given access to clean drinking water. Weighted jaggery is added to hot drinking water for the first three days as a stress-reduction measure.

Himalaya Liv.52 (Himalaya Wellness Company, India), a commercial hepatoprotective preparation, was administered once through drinking water to all experimental groups (T1–T5) at an approximate rate of 2 mL per 10 birds as a routine management practice. Larger waterers were put till the feeding trial, after around two weeks. The feeding schedule included a-pre-starter diet for the first seven days, a starter diet for the next twenty-one days, and a finisher diet for the final 42 days. Weighted maize was spread out on paper sheets and given to the chicks for the first three days. To prevent infection, the newspaper was replaced frequently and then buried beneath the ground. After that, the feeds were moved to automatic feeders so the broilers could eat them until they were 21 days old. Lastly, the finisher diet was offered by hanging feeders that were kept at a proper height.

Feed intake, body weight gain and FCR

A weekly record for supplied feed quantity was kept for each replication in order to analyse consumption of feed in birds. Every week, each bird was individually weighted and body weight were noted to determine the body weight gain up to six weeks of age.

Carcass composition

Five birds were randomly chosen from each treatment for carcass examinations. The birds were starved for 6 h and given no water for 3 hours before sacrificed. Birds were weighed and humanely slaughtered by severing the jugular vein. After slaughter, the heads were removed at the atlanto-occipital joint and the shanks at the hock joints. The dressed carcasses were then weighed to determine dressed weight. Dressing percentage was calculated as the dressed weight divided by live body weight, multiplied by 100.

The dressed carcasses were eviscerated by removing the crop, trachea and viscera as a whole. A horizontal incision was made posterior to the keel bone to slightly elevate the breast and expose the viscera. The visceral organs were then completely removed by gentle traction. The heart, liver and gizzard which together make up the giblets were carefully separated from viscera after the lungs were removed. The liver perforation was avoided by carefully removing the gall bladder. The gizzard was opened, its contents were removed and inner epithelial lining was discarded. The adherent arteries and blood were removed from the heart. The eviscerated weight was recorded. After washing and blotting, weight of the heart, kidney, liver, gizzard, and belly fat measured separately. Samples of breast and thigh muscles were collected from each slaughtered bird and stored in a deep freezer until further analysis. These samples were examined for ether extract, moisture and protein (AOAC, 2016).

Haematological estimation

Blood samples were taken from five broilers per treatment at the end of feeding trial (6^{th} week). Each bird was given a brachial wing vein puncture with sterile syringes to obtain blood. A scalp vein needle was then placed into a vacutainer with EDTA for haemoglobin, total leucocyte and total erythrocyte count that were estimated using an automatic haematology analyser (MS4s2, Melet Schloesing Laboratories, Osny, France).

Economics

The partial production cost was calculated by considering the cost of chicks and feed consumed per bird. The cost of feed additives and supplements was determined using the price lists provided by the respective manufacturers. The total feed cost per bird was added to the chick cost to estimate the partial production cost per bird. Gross returns were calculated using the market price of ₹120 per kg of live body weight, and the partial margin per bird was determined by subtracting the partial production cost from the gross returns. Other production expenses, including labour, medication, electricity, bedding and vaccination, were not included in the analysis. Therefore, the economic assessment represents a partial budget analysis based on chick and feed costs rather than total production costs.

Statistical analysis

The data were statistically analysed using SPSS software (version 16.0). Analysis of variance (ANOVA) was performed, and differences among treatment means were assessed using Duncan's Multiple Range Test (DMRT), as described by Snedecor and Cochran (1994) and Kramer (1956). The results are presented as means ± standard error (SE).

Results

Average feed intake

In the first week (1-7), adding CSP as a feed additive, there was a significant (P<0.05) impact on the birds feed intake. Feed intake of birds with antibiotics (T1) and CSP supplemented treatments (T2, T3, and T4) significantly (P<0.05) varied from T5 (Figure 1). Over a period of 8-21 days or starting phase, the average feed intake varied as 540.40 to 662.59 g/bird, with the supplemented group T2 exhibiting the highest feed intake. T5 showed considerably lower feed intake. The average of feed intake during finisher (22-42d) of broilers were 2933.06, 2820.11, 2806.56, 2825.06 and 2835.08 g/bird, respectively in T1, T2, T3, T4, and T5. Overall T5, T4, and T3 had significantly (P<0.05) lower feed intake over control.

Body weight of broilers

There was a difference (P<0.05) was detected in body weight after different time interval (Table 1). The maximum body weight was recorded in T4 (2162.82 g/bird) followed by T5 (2138.50 g/bird) and T3 (2058.09 g/bird) as compared to control (1925.77 g/bird) after 0-42 days. This showed that when CSP was added to the bird's diet, they gained more body weight than when fed an antibiotic containing ration.

Feed conversion ratio

During pre-starter phase T5 was found to have the lowest (1.13) FCR value, while T1, T2, T3, and T4 had 1.38, 1.45, 1.37 and 1.29 values, respectively. As the level of CSP increased FCR reduced (Figure 1). Overall, the T4 (1.65) had the lowest FCR, followed by T5 (1.68), T3 (1.74) and T4 (1.65), respectively as compared to control T1 (1.98). This shows that adding CSP to the diet resulted in better feed conversion ratios than control group.

Carcass features

No significant difference was observed in carcass characteristics (Figure 2). The maximum dressing % was recorded in T4 (71.01%) followed by T5 (70.83%) and T3 (70.75%) as compared to T1 (70.61%) and T2 (69.95%), respectively. The maximum eviscerated % was recorded in T4 (61.71%) followed by T5 (61.50%) and T3 (60.74%) as compared to T1 and T2, respectively. The drawn percentage was better (P<0.05) in T4 (67.90%), and T5 (68.33%) compared to other groups. The breast weight (%) was also significantly (P<0.05) higher in T4 (14.34%) as compared to other groups. Supplementation of CSP as feed additive had no significant impact on thigh, heart, liver and gizzard percentage but higher values was observed in T4 as compared to other treatments. The drumstick values were also significantly higher (P<0.05) in T4 (10.14%) followed by T5 (10.08%) and T3 (9.16%), respectively.

Thigh and Breast meat composition

There was no substantial alteration in dry matter, crude protein, and ash (%) of breast and thigh meat. However higher values were observed in T4 compared to others. The maximum EE % was noted in T1 (4.55%) as compared to other treated groups in breast and thigh meat (Table 2).

Hematological parameters

The values of hemoglobin in different treatments were not significant, but higher value was observed in T4 (11.82 g/dl) followed by T5 (11.00 g/dl), T3 (10.86 g/dl) and T2 (10.54 g/dl), respectively (Figure 3). The total leucocyte count (TLC) value was higher (P<0.05) in T4 (29.66 mm^3) followed by T5 (28.00 mm^3), T3 (26.45 mm^3), T2 (26.33 mm^3) and least was observed in T1 (25.05 mm^3). The total erythrocyte count (TEC) value was higher (P<0.05) in T4 (3.36 mm^3) followed by T5 (2.88 mm^3), T3 (2.48 mm^3), T2 (2.36 mm^3) and least was observed in T1 (2.22 mm^3). The platelets count value was significantly (P<0.05) higher in T4 (13.50 m/mm^3) followed by T5 (11.80 m/mm^3), T3 (10.86 m/mm^3), T2 (10.41 m/mm^3) and least was observed in T1 (9.42 m/mm^3).

Table 1: Body weight gain in birds in different treatments

Treatments	Phases			
	Pre-starter	Starter	Finisher	Overall
T1	47.08±0.97	403.56±1.15	1475.12^{b} ±1.60	1925.77^{b} ±1.92
T2	46.16±0.31	403.67±0.95	1447.00^{a} ±1.56	1896.70^{a} ±1.10
T3	47.94±1.15	404.28±1.67	1605.86^{c} ±1.70	2058.09^{c} ±4.26
T4	50.25±2.30	404.88±2.22	1707.68^{e} ±4.53	2162.82^{e} ±4.16
T5	48.43±1.13	403.76±0.80	1686.30^{d} ±2.54	2138.50^{d} ±2.16

^{abc} Means with different superscripts differ significantly ($p< 0.05$)

Table 2: Composition of thigh and breast meat (%) of birds

Treatments	Breast				Thigh			
	Dry matter	Crude protein	Ether extract	Ash	Dry matter	Crude protein	Ether extract	Ash
T1	24.17±0.33	18.59±1.50	4.55±0.014^{d}	0.023±0.008	27.26±1.18	17.84±0.20^{ab}	6.27±0.008^{e}	0.020±0.005
T2	23.98±1.00	18.41±1.22	4.40±0.011^{c}	0.020±0.005	26.46±1.85	16.55±0.78^{a}	6.20±0.005^{d}	0.020±0.005
T3	24.22±0.80	18.63±1.54	4.30±0.006^{b}	0.023±0.003	28.16±1.87	18.68±0.66^{b}	6.16±0.005^{c}	0.023±0.003
T4	24.41±0.79	19.03±0.63	4.28±0.014^{b}	0.026±0.008	30.66±0.74	19.59±0.72^{b}	6.13±0.008^{b}	0.026±0.003
T5	24.23±1.13	18.68±0.72	4.19±0.012^{a}	0.026±0.003	29.87±1.08	18.91±0.62^{b}	6.08±0.011^{a}	0.023±0.003

Table 3: Broiler production economics in dietary treatments

Groups	Chick cost (Rs.)	Intake of feed (kg)	Feed total cost (Rs)	Bird wt (kg)	Price/kg live wt (Rs.)	Gross return/ bird (Rs.)	Production cost/ bird (Rs.)	Profit (Rs.)
T1	36.00	3.65	117.89	1.97	120.00	237.12	153.89	83.22
T2	36.00	3.54	118.05	1.94	120.00	233.52	154.05	79.46
T3	36.00	3.47	119.36	2.10	120.00	252.96	155.36	97.59
T4	36.00	3.46	122.65	2.21	120.00	265.20	158.65	107.14
T5	36.00	3.43	125.19	2.19	120.00	262.80	161.19	101.60

^{abc} Means with different superscripts differ significantly ($p< 0.05$)

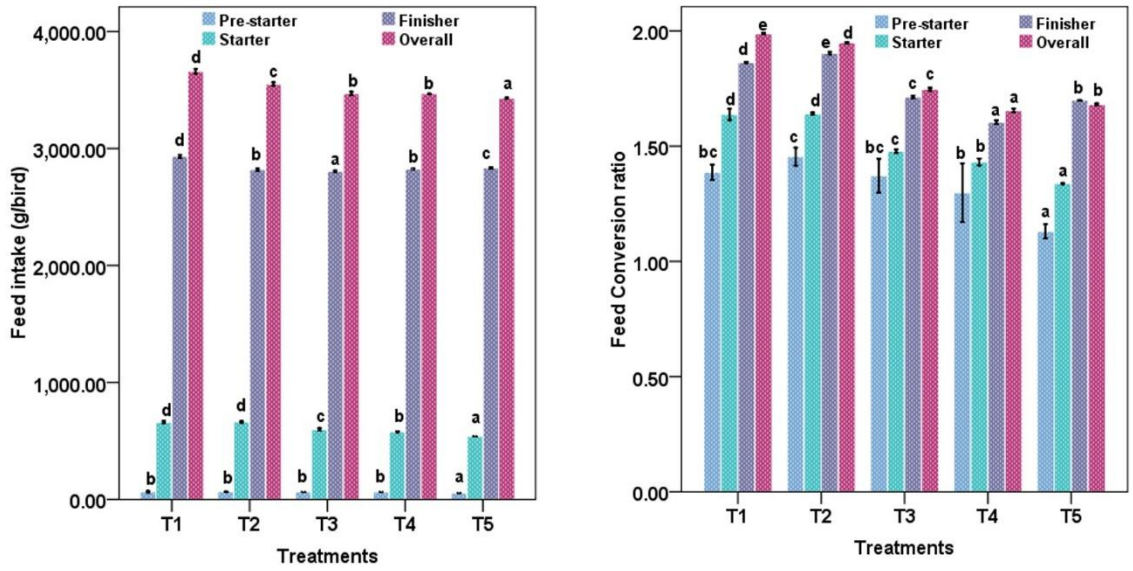


Figure 1: Feed intake and Feed conversion ratio in different treatments

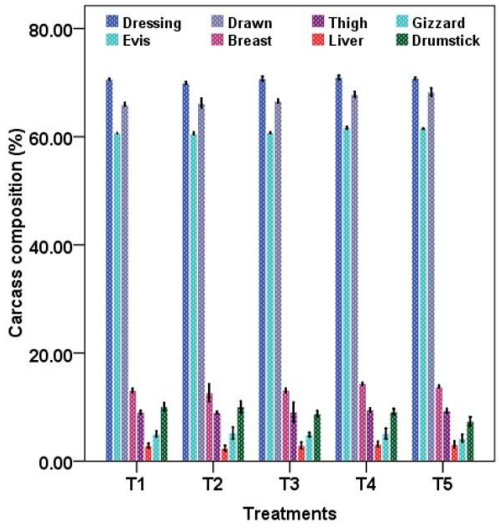


Figure 2: Carcass composition (%) in different treatments

Economies of broiler chickens

The feeding cost per chick (Rs) was highest in T5 (125.19) followed by T4 (122.65), T3 (119.36), T2 (118.05), and lowest in T1 (117.89), respectively (Table 3). The T5 had the highest overall production cost (Rs. 161.19), whereas T1 had the lowest (Rs. 153.89). The T4 group supplemented with 1.5% CSP had largest profit per bird (Rs. 107.14), whereas T2 had the lowest (79.46).

Discussion

It is critical to enhance poultry production to satisfy the escalating mandate for animal protein brought on by the increasing global human population. It plays an important role in the life and well-being of the population by providing financial revenue, satisfying religious and socio-cultural demands, employing families spare time and meeting family's nutritional needs (Banda and Tanganyika, 2021). It is well known that several herbal plants have shown extraordinary efficiency in improving broilers growth performance by altering gut health, resulting in improved nutrient absorption and decreased susceptibility towards disease (Dedousi *et al.* 2023). Then, the purpose of this study was to explore the impact of varied quantities of coriander seed powder on broiler performance. The present study revealed that adding 1.5% CSP to broiler basal diet improved body weight gain, and hematological parameters significantly over control.

The application of CSP to diet of broilers showed significantly lower overall feed intake in T5 and T4 as compared to other groups. Lower feed intake in CSP treated group may be due to the unpleasant taste and strong odor of seeds. Supplementation of coriander essential oil in chickens enhanced feed intake, FCR ratio and body weight gain (Ghazanfari *et al.* 2015). Coriander essential oil had better effect on FCR and body weight gain, but not have significant effect on feed intake in broilers (Sholiha *et al*. 2023). There was no difference was observed in feed intake during starter and finisher period in coriander extract supplemented groups (Gazwi *et al*. 2022).

The presence of essential oil with a nice flavor and aroma may have contributed to the enhancement in birds body weight in CSP treated groups as well as better nutrient digestibility. Supplementation of coriander (2%) to broilers diet enhanced body weight significantly (Hamodi *et al*. 2010). They demonstrated that enhanced hunger, better digestive enzyme activity, effective nutrient absorption and antibacterial action may boost bird's immunity and improved growth. Ahmad *et al*. (2016) also stated that application of CSP (2.5 g) showed enhancement in overall body weight and feed consumption efficiency in broilers chicken. Application of herbal feed improved the broiler chicken growth performance and antioxidant enzyme activities due to phenolic content (Giannenas *et al*. 2018).

FCR improved as a result of lower feed intake and greater BWG, which could be attributed to higher feed digestibility. Coriander essential oil are excellent appetite stimulants that promote the proper release of stomach enzymes and digestive juices. This improved digestion, which improves growth and FCR (Rajeshwari and Andallu, 2011). Naeemasa *et al*. (2015) found that FCR improved by coriander powder and extract in the broiler chicken. This

characteristic may also be linked to genetic and environmental variations that impact the chemical makeup of plant vital oils and their extract.

The rise in the proportion of dressings could be explained by the stimulation of pancreatic secretions, which could lead to an upsurge in secretion of digestive enzymes. This would increase the nutrients including amino acids that are absorbed and digested from digestive tract, improving the carcass characteristics (Rahimi *et al*. 2011**)**. It was observed that herbal extract application to broiler chicken carcass breast was improved by 1.2% due to the presence phenolic compounds (Abo Omar *et al.* 2016). The fat % in treated groups reduced considerably over control. This could be because coriander has a hypolipidemic impact. Application of medicinal plant improved performance of broiler chickens, carcass features, fatty acid and meat quality (Al-Baadani *et al*. 2023). The CSP supplementation in Koekoek chickens improved growth performance and carcass features at different temperatures (Welay *et al*. 2023). According to the findings, hematological parameters were significantly affected by supplementing with CSP except Hb. The hematological values such as RBC, WBC and platelets count in broilers fed with CSP were improved in control, still there was no significant change in HB content in dietary treatments. Increase in TLC could be attributed due to the existence of flavonoids and antioxidant nature of CSP. Taha *et al*. (2019) stated that CSP (0.4%) application improved the hemoglobin and platelets content as well as improved dressings and thymus percentage in broilers chicken.

In this study, there was difference in values of economy was observed in different CSP supplemented groups. Increase in profit margins for broilers fed diets including herbal growth enhancers could be attributable to improved feed utilization efficiency. Broiler diets containing CSP (0.6%) boost economic efficiency by 27.06% and yielded higher profits than broilers fed rations lacking herbal growth stimulant (Farag, 2013). Taha *et al*. (2019) observed that CSP application in broilers chicken improved economic efficiency in treated groups as compared to control. Our finding revealed that adding CSP to broiler chicken diets can improve production efficiency of broilers.

Conclusion

According to the findings, adding coriander seed powder (1.5%) to broiler diets improved growth performance by reducing feed intake, improving body weight gain and better feed conversion rate. Therefore, dietary supplementation with coriander seed powder (CSP) at 1.5% improved broiler performance under the conditions of the present study. These findings suggest that CSP may serve as a potential alternative to antibiotic growth promoters; however, further research is required to establish its efficacy as a replacement and to evaluate its effects under different production conditions. More research is required to observe the impact of coriander seed powder on various species with different concentration.

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Ethics approval and consent to participate

Approval was obtained from the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) with 1669/GO/ReBiBt-S/Re-L/12/CPCSEA number.

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