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Effect of dietary supplementation of coriander seed powder on performance, nutrient digestibility, immunity, antioxidant activity and serum parameters of broilers

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ABSTRACT

The aim of this experiment was to reduce the antibiotic usage in broiler ration by incorporating the coriander seed powder (CSP). The experiment was conducted from December 2019 to January 2020 with 250 broiler chicks that were randomly divided into 5 treatment groups with 10 replications of 5 birds each. The experimental design consisted of T1: basal diet (BD) without antibiotic; T2: BD + antibiotic (Bacitracin Methylene Disalicylate @ 500 g/tonne); T3: BD + CSP (0.5%); T4: BD + CSP (1.0%); T5: BD + CSP (1.5%). Group supplemented with 1.5% CSP recorded significantly higher body weight gain, feed intake, better feed conversion ratio (FCR) and higher returns compared to antibiotic, control and 0.5 and 1.5% CSP groups. Among all the treatments, significantly better energy retention was recorded in 1.5% CSP group whereas significantly improved protein utilization and dry matter digestibility was noticed in CSP (0.5, 1.0 and 1.5%) supplemented groups. Supplementation of coriander seed powder (CSP) at various levels significantly increased the activity of glutathione peroxidase (GSHPx), glutathione reductase (GSHRx) and superoxide dismutase (SOD) enzymes as well as increased the immune organ weights and antibody response to Newcastle Disease vaccine. Supplementation of 1.5% CSP significantly decreased the serum cholesterol as compared to other groups. Hence 1.5% coriander seed powder can be used as an alternative to antibiotic growth promoter for improving overall performance of broilers.

Keywords: Body weight, Coriander seed powder, Glutathione peroxidase, Immunity, Nutrient utilization

Antibiotics are being used as growth promoters in the poultry diets all over the world. However, in recent years, there has been a rising demand to reduce or abolish the use of antibiotics as growth promoters due to the detrimental human health issue of antibiotic resistance (Dibner and Richards 2005). Consumers' awareness of poultry products that do not contain antibiotic residues has increased, encouraging the use of suitable alternatives to antimicrobial compounds (Huyghebaert *et al.* 2011).

Coriander (*Coriandrum sativum*) is regarded as both herb and spice, and has been used in medicine for thousands of years. Coriander seeds possess antioxidant, diuretic, anti-diabetic, hypocholesterolemic, antimicrobial, anthelmintic and anti-mutagenic qualities (Chithra and Leelamma 1997, Pathak *et al*. 2011). Coriander seed powder contains 0.5–1.0% essential oil (carvone, geraniol, limonene, borneol, camphor, elemol and linalool) having antimicrobial properties against food borne pathogen such as *Salmonella* species (Silva *et al*. 2011). In addition, it has appetizing and stimulatory effects in the digestion process by increasing production of digestive enzymes and juices, which stimulates digestion and peristaltic motion, thus improving feed efficiency (Langhout 2000, Rajeshwari and Andallu 2011). Coriander seed powder as an alternative to antibiotic growth promoter has been recommended for feeding in broilers by Naeemasa *et al*. (2015), Barad *et al*. (2017) and Taha *et al*. (2019).

Coriander seed powder increased the activity of beta-hydroxy, beta-methyl glutaryl CoA reductase (HMG CoA) and plasma lecithin cholesterol acyl transferase activity (LCAT) in liver. HMG CoA reductase is the key enzyme in the pathway of cholesterol biosynthesis in liver. These enzymes enhanced the degradation of cholesterol to faecal bile acids and neutral sterols, thus lowering the cholesterol levels in serum (Dhanapakiam *et al*. 2008). Similarly, Hesam *et al*. (2014) reported decreased serum cholesterol levels with coriander seed powder in broilers. Coriander seed powder is noble source of essential oil (Linalool) which have hydrophobic properties (Bruland Coote 1999) that affect cell wall lipids of the bacteria by disturbing bacterial

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structures and rendering them more permeable, thus resulting in lower number of harmful bacteria and improved the immunity of broilers (Rashid *et al*. 2014). In view of the above, this experiment was designed to assess the effect of dietary supplementation coriander seed powder as an alternative to antibiotic growth promoter on broiler performance.

MATERIALS AND METHODS

To conduct the study, 250 day-old male broiler chicks (Vencobb) were distributed randomly into five dietary treatments of 10 replicates with five chicks in each replicate. Chicks were wing banded on day one and reared in optimal brooding conditions. The broilers were kept in battery brooders with *ad lib.* feed and water from 1 to 42 days age. The birds were fed with maize and soybean meal-based diets containing 2958, 3074 and 3163 kcal ME and 22.76, 21.58 and 19.68% crude protein, respectively (NRC 1994) during pre-starter (0–14 d), starter (15–28 d) and finisher (28–42 d) phases (Table 1). The experimental design consisted of T1: Basal diet (BD) without antibiotic; T2: BD + antibiotic (Bacitracin methylene disalicylate @ 500 g/tonne); T3: BD + coriander seed powder (0.5%); T4: BD + coriander seed powder (1.0%); T5: BD + coriander seed powder (1.5%).

Weekly body weight, feed intake and feed conversion ratios were calculated as feed intake per unit body weight gain at weekly intervals. The mortality rate was recorded throughout the experiment. On day 42, one bird from each replicate was sacrificed to estimate the various carcass parameters. The metabolic trial was conducted with one bird from each replicate to determine the retention efficiency of dry matter (DM), crude protein (CP) and energy as per the procedures described by AOAC (1997).

The humoral immunity was estimated in birds by measuring antibody titer to Newcastle disease (ND) vaccine (antibody production against ND virus). Broilers were vaccinated against ND by ocular route at 7th and 28th day of age with LaSota strain (ND Lasota Vac-500; Indovax Pvt. Ltd. Hyderabad, India). At 42nd day of age, blood was collected, and serum was separated. Haemagglutination inhibition (HI) activity of serum was estimated, and the antibody titers (log 2) were measured by following the standard procedure (Wegmann and Smithies 1966).

On 42nd day, blood sample were collected aseptically from wing vein (one bird from each replicate) in vacutainers and kept in incubator at room temperature for serum collection. The serum is used for estimation of cholesterol, total protein, albumen globulin and antioxidant activity by using spectrophotometer with commercially available kits (ERBA diagnostic Mannheim-Trans Asia Bio-medicals Limited).

Data were analyzed for mean, standard errors, and analysis of variance using the Snedecor and Cochran (1989) method, and means were compared using Duncan test (1955) using the Statistical Package for Social Sciences (SPSS) 20.0 version software, with significance set at P<0.05.

Table 1. Ingredient composition of basal diets (in kg) fed to the commercial broilers from 0–42 days

Ingredient	Pre-starter (0–14 d)	Starter (15–28 d)	Finisher (29–42 d)
Maize	56.09	56.4	59.8
Oil	2.04	4.0	5.0
Soybean meal	37.1	34.6	30.1
Stone grit	1.58	1.83	1.88
Dicalcium phosphate	1.85	1.90	1.96
Salt	0.46	0.46	0.48
DL-Methionine	0.22	0.18	0.16
L-Lysine HCl	0.17	0.15	0.13
Trace mineral mixture*	0.10	0.10	0.10
Vitamin $AB_2D\backslash K$**	0.020	0.020	0.020
Vitamin B-Complex**	0.025	0.025	0.025
Herabal Coccidiostat (Coxynil)	0.05	0.05	0.00
Choline chloride (50%)	0.15	0.15	0.15
Toxin binder	0.10	0.10	0.10
Total	100	100	100
Nutrient composition (*calculated values*)			
ME (kcal/kg)	2958	3074	3163
Crude protein (%)	22.76	21.58	19.68
Lysine (%)	1.30	1.21	1.08
Methionine (%)	0.55	0.49	0.45
Calcium (%)	0.97	1.04	1.06
Available phosphorous (%)	0.45	0.45	0.45

*Trace mineral provided per kg diet: Manganese, 120 mg; Zinc, 80 mg; Iron, 25 mg; Copper, 10 mg; Iodine, 1 mg and Selenium, 0.1 mg. **Vitamin premix provided per kg diet: Vitamin A, 200000 IU; Vitamin D_3, 3000 IU; Vitamin E, 10 mg; Vitamin K, 2 mg; Riboflavin, 25 mg; Vitamin B_1, 1 mg; Vitamin; B_6, 2 mg; Vitamin B_{12}, 40 mg and Niacin, 15 mg.

RESULTS AND DISCUSSION

Body weight gain: Supplementation of different dietary treatments did not show any significant difference on body weight gain of broilers during pre-starter phase (Table 2). During starter (15–28 d) phase, significantly (P<0.05) higher body weight gain was recorded in birds fed diets supplemented with coriander seed powder (CSP)1.5% followed by CSP 0.5% and antibiotic groups compared to control and CSP 1.0% groups. During finisher phase, the body weight gain increased linearly with increasing levels of CSP in broilers and the differences among the treatment groups were significant (P<0.05). The highest weight gain was recorded in CSP 1.5% , followed by CSP 1.0% and antibiotic groups. However, birds supplemented with CSP 0.5% level and control group recorded the lowest mean weight gain among all the treatment groups.

Similarly, Guler *et al*. (2005) reported that birds fed with diet containing 2% coriander seed showed significantly (P<0.05) higher weight gain followed by 1% coriander, antibiotic, 4% and 0.5% coriander seed in Japanese quails. Significantly (P<0.005) improved live body weight of broilers was also reported by Rashid *et al*. (2014) with supplementation of coriander powder @ 1.0% and 1.5%. Similar result was also reported by Taha *et al*. (2019) in

which body weight gain was significantly (P<0.05) higher at 0.4% coriander level followed by 0.2% level of coriander compared to control and 0.1% level in broilers. The increased body weight gain observed in broilers upon feeding coriander seed powder might be attributed to the antioxidant properties of coriander seeds which act as natural growth promoter (Taha *et al*. 2019); or due to enhanced liver function (Reddy *et al*. 2019) or due to appetizing and stimulatory effects in digestion process (Rajeshwari and Andallu 2011).

Feed intake: Feed intake (FI) was not significantly influenced by different dietary treatments during prestarter (0–14 d) and starter (15–28 d) phases (Table 2). However, significantly (P<0.05) higher feed intake was observed in CSP 1.5%, CSP 1.0% and antibiotic groups, whereas lower feed intake was noticed in CSP 0.5% and control groups during finisher phase. Increased feed consumption in 1.5% CSP supplemented group is in line with the findings of Naeemasa *et al*. (2015), who reported that supplementation of coriander powder at 1.5% maximized feed intake of broiler chicken compared to other groups (2.0% and 2.5%) and control. Guler *et al*. (2005) observed significantly (P<0.05) higher feed intake in coriander seed powder supplemented groups (1.0, 2.0 and 4.0%), except for the 0.5% coriander group where the intake did not differ (P>0.05) from the control. A similar result was also reported by Reddy *et al*. (2019) in which feed intake was significantly (P<0.05) better in coriander seed meal group (1.0, 1.5 and 2.0%) compared to control group in Japanese quails. The improvement in the feed intake observed with the addition of coriander seed powder could be attributed to the presence of essential oils and their main component, linalool, in coriander seeds. It has been reported that linalool has an appetizing effect in diets and stimulates the digestive process in animals (Cabuk *et al*. 2003). On the contrary, coriander seed powder added to the diet did not result in significant (P>0.05) effect on feed intake of broilers (Rashid *et al*. 2014).

Feed conversion ratio (FCR): During pre-starter phase, no significant (P>0.05) difference was recorded among different dietary treatments (Table 2). During the starter phase, significantly (P<0.05) better feed efficiency was recorded in CSP (0.5%), CSP (1.5%) and antibiotic groups compared control and CSP (1.0%) groups. During the finisher (29–42 d) phase, significantly (P<0.05) better FCR was recorded in CSP (1.5%) and antibiotic groups compared to CSP (0.5% and 1.0%) and control groups. The improved feed utilization upon feeding coriander seed as observed in the present study could be attributed to the stimulating effect of coriander powder in improving the flavour and palatability of feed through their active compound (linalool), which enhances the activity of digestive enzymes resulting in higher nutrient absorption, thus improving the feed intake, which in turn can enhance the FCR and improve growth performance parameters (Rajeshwari and Andallu 2011). Similarly, supplementation of CSP significantly (P<0.05) improved the FCR as reported by Maroof *et al*. (2016), Reddy *et al*. (2019) and Taha *et al*. (2019). On the contrary, some researchers reported that feeding coriander seed in the diet had no effect (P>0.05) on FCR (Rashid *et al*. 2014, Naeemasa *et al*. 2015, Maha *et al*. 2016) in broiler chicken.

Mortality: Mortality was not influenced by supplementation of CSP at 42 d of age. However, mortality rate was within the acceptable range.

Nutrient utilization: Among all the treatments, significantly better energy retention was recorded in 1.5% CSP group at 42 d of age (Table 3). However, the energy retention in 1.0% and 0.5% CSP was comparable to the antibiotic group and higher than control. Supplementation of CSP (0.5, 1.0 and 1.5%) significantly (P<0.05) improved the protein utilization and dry matter digestibility compared to antibiotic and control groups. The enhanced dry matter digestibility and nutrient utilization may be attributed to the essential oils, which not only act as antibacterial and antioxidant properties, but also as stimulant of digestive enzymes in the intestinal mucosa, which might have improved the utilization of nutrients (Rajeshwari and

Table 2. Effect of coriander seed powder (CSP) on phase wise body weight gain (BWG), feed intake (FI) and FCR of broiler chicken

Treatment	Diet	Pre-starter (0–14 d)			Starter (15–28 d)			Finisher (29–42 d)		
		BWG (g)	FI (g)	FCR	BWG (g)	FI (g)	FCR	BWG (g)	FI (g)	FCR
T_1	Basal (BD)	289	264	0.916	758^{b}	1193	1.575^{c}	1093^{c}	2197^{b}	2.010^{d}
T_2	BD + Antibiotic (@ 500 g/t)	296	264	0.894	772^{ab}	1185	1.535^{b}	1146^{b}	2228^{ab}	1.948^{ab}
T_3	BD + Coriander (0.5%)	297	266	0.898	765^{ab}	1146	1.498^{a}	1081^{c}	2114^{c}	1.958^{c}
T_4	BD + Coriander (1.0%)	290	261	0.900	760^{b}	1182	1.556^{c}	1156^{b}	2230^{ab}	1.928^{b}
T_5	BD + Coriander (1.5%)	296	268	0.903	781^{a}	1190	1.524^{b}	1205^{a}	2260^{a}	1.876^{a}
SEM		1.625	2.437	0.0080	2.756	4.992	0.0052	7.656	9.876	0.0081
N		10	10	10	10	10	10	10	10	10
P value		0.360	0.949	0.930	0.042	0.114	0.001	0.001	0.001	0.001

Value bearing different superscripts within a column differ significantly (P<0.05).

Table 3. Effect of coriander seed powder (CSP) on nutrient utilization, antioxidant enzyme activity and immunity of broiler chicken

Treatment	Diet	Energy %	Protein %	Dry matter %	GSHPx (Units/ml)	GSHRx (Units/ml)	SOD (Units/mg protein)	Bursa	Spleen	Thymus	NDV titers (log_2)
T_1	Basal (BD)	69.75^c	81.49^c	70.16^c	228^e	1647^b	6.26^c	0.090^b	0131^c	0.318^b	2.89^c
T_2	BD + Antibiotic (@ 500 g/t)	74.11^b	82.10^b	72.14^b	303^c	1671^b	5.71^c	0.091^b	0.160^b	0.321^b	3.28^b
T_3	BD + Coriander (0.5%)	73.98^b	84.98^a	75.99^a	356^b	1869^a	7.24^b	0.110^b	0.165^b	0.258^b	3.24^b
T_4	BD + Coriander (1.0%)	74.03^b	84.75^a	76.10^a	288^d	1789^a	6.26^c	0.081^b	0.162^b	0.250^b	3.22^b
T_5	BD + Coriander (1.5%)	75.12^a	84.21^a	76.22^a	530^a	1850^a	7.96^a	0.176^a	0.210^a	0.491^a	3.44^a
SEM		0.402	0.401	0.399	16.538	18.871	0.141	0.0068	0.0074	0.0224	0.033
N		10	10	10	10	10	10	10	10	10	10
P value		0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.009	0.001	0.001

Value bearing different superscripts within a column differ significantly (P<0.05).

Andallu 2011). Similar results were also reported by Barad *et al*. (2017) and Reddy *et al*. (2019).

Carcass parameters: The dietary treatments did not show any significant (P>0.05) difference in slaughter parameters at 42 d of age (Table 4). Similarly, addition of coriander seed powder (Rashid *et al*. 2014, Naeemasa *et al*. 2015, Maha *et al*. 2016, Reddy *et al*. 2019) did not show any significant (P>0.05) influence on carcass parameters of broilers.

Antioxidant activity: The serum glutathione peroxidase (GSHPx) enzyme activity was significantly (P<0.05) increased in various levels of coriander seed powder (CSP) fed groups compared to control (Table 3). Among all the treatments, birds supplemented with CSP 1.5% recorded significantly (P<0.05) higher GSHPx enzyme activity followed by CSP 0.5%, antibiotic and CRP 1.0% groups. Supplementation of CSP at various levels significantly (P<0.05) increased the glutathione reductase enzyme (GSHRx) and superoxide dismutase (SOD) enzyme activity compared to control and antibiotic groups. Among all the treatments, birds supplemented with CSP at 1.5% level showed significantly (P<0.05) higher SOD enzyme activity. Similar findings were reported by Chitra and Leelamma (1999) who demonstrated that coriander fed groups had a better antioxidative effect by increasing the activity of GSHPx, GSHRx and SOD enzyme compared to control. Hosseini *et al*. (2011) reported that turmeric powder enhanced the activity of GSHPx and SOD enzymes compared to control in broilers. Coriander is an egregious source of phyto-chemicals and functional compounds namely polyphenols, flavonoids and ascorbic acid which ultimately constitute for its high antioxidant activity. Darughe *et al*. (2012) demonstrated that essential oil of coriander (CEO) contains camphor (44.99%), cyclohexanol acetate (14.45%), limonene (7.17%), α-pinene (6.37%) and inhibited the rate of primary and secondary oxidation

Table 4. Effect of different levels of coriander seed powder on serum biochemical parameters and carcass parameters (% live weight) of broilers

Treatment	Diet	Total cholesterol (mg/dL)	Total protein (g/dL)	Albumin (g/dL)	Globulin (g/dL)	A/G ratio	Eviscerated Yield	Carcass yield	Abdominal fat	Liver	Heart	Gizzard	Giblets yield
T_1	Basal (BD)	231^a	4.91^c	2.78^c	2.13^c	1.35	61.38	65.84	1.26	2.32	0.52	1.62	4.46
T_2	BD + Antibiotic (@500g/t)	166^b	5.34^b	2.96^b	2.41^{ab}	1.22	61.99	66.23	1.27	2.06	0.53	1.65	4.23
T_3	BD + Coriander (0.5%)	172^b	5.51^{ab}	3.02^{ab}	2.49^a	1.23	60.01	64.44	1.14	2.08	0.54	1.82	4.44
T_4	BD + Coriander (1.0%)	166^b	5.71^a	3.13^a	2.57^a	1.23	61.26	66.23	1.08	2.55	0.59	1.84	4.98
T_5	BD + Coriander (1.5%)	133^c	5.69^a	3.03^{ab}	2.66^a	1.16	60.99	65.68	1.38	2.41	0.57	1.72	4.70
SEM		5.663	0.066	0.025	0.055	0.031	0.488	0.507	0.043	0.054	0.013	0.039	0.072
N		10	10	10	10	10	10	10	10	10	10	10	10
P value		0.001	0.001	0.001	0.025	0.399	0.797	0.812	0.179	0.108	0.490	0.285	0.118

Value bearing different superscripts within a column differ significantly (P<0.05).

products formation and their effects were almost equal to BHA at 0.02%. The improvement in the antioxidant enzyme activity observed with the addition of coriander seed powder could be attributed to the presence of essential oils and their main components, linalool, trepene and terpenoid (Zlatanov and Ivanov 1995).

Immunity: Significant difference (P<0.05) was observed in the relative weights of bursa, spleen and thymus at 42 d of age (Table 3). Supplementation of CSP at 1.5% level significantly increased the relative weights of bursa, spleen, thymus and the antibody response to ND vaccine (HI activity) compared to CSP 0.5%, CSP 1.0%, control and antibiotic groups. In agreement with the positive results of coriander powder on immunity, Rashid *et al*. (2014) reported that supplementation of coriander at 1.0 and 1.5% levels significantly increased spleen weight compared to control. Similarly, Taha *et al*. (2019) recorded significantly higher immune organ weights in coriander supplemented groups. Farah and Jaff (2011) also recorded increased (P<0.05) antibody titers against ND in coriander supplemented diets compared to control. Similarly, Hesam *et al*. (2014) observed increased antibody titers against newcastle, infectious bronchitis, and infectious bursal disease with coriander extract supplementation in water for broilers. The increased antibody production against NDV because of coriander powder might be due to enhanced macrophage activity and increased local antibodies (IgA) at mucosal surfaces (Huang *et al*. 2004). The weight of spleen, thymus and bursa is directly proportional to immune response in broilers (Kabir *et al*. 2004). The higher lymphoid organs weight (bursa, spleen and thymus) also supports the increased immune response in coriander supplemented groups.

Sero-biochemicals: Supplementation of CSP (0.5, 1.0 and 1.5%) and antibiotic significantly (P<0.05) lowered the total serum cholesterol (mg/dL) levels compared to control (Table 4). The lowest cholesterol levels were recorded in CSP 1.5% followed by CSP 1.0%, CSP 0.5% and antibiotic groups. Similarly, Farah and Jaff (2011) reported that addition of coriander seed (@ 2.0 and 3.0% level) lowered the serum cholesterol concentration in broilers under high ambient temperature. The decrease in the serum cholesterol levels observed in the present study could be attributed to the incorporation of coriander seed powder in the diet which might reduce the activity of beta-hydroxy, beta-methyl glutaryl CoA reductase (HMG CoA) and plasma lecithin cholesterol acyl transferase activity (LCAT) in the liver. HMG CoA reductase is the key enzyme in the pathway of cholesterol biosynthesis in liver (Chithra and leelamma1997). Further, it is concluded that increased activity of these enzymes enhanced the degradation of cholesterol to faecal bile acids and neutral sterols, thus lowering the cholesterol levels in serum (Dhanapakiam *et al*. 2008). Similar results were also reported by Abadi and Andi (2014) and Hesam *et al*. (2014). On the contrary, no effect (P>0.05) of feeding coriander seed powder in the diet on serum cholesterol concentration was reported by Jafar (2011) and Ghazanfari *et al*. (2015) in broiler chicken. The decreased serum cholesterol levels in antibiotic group might be due to decreased pathogenic population of *Clostridium* and *Escherichia coli* counts and increased *Lactobacillus* count in intestines. These lactobacilli cells utilize cholesterol for their own metabolism and reduces the circulatory cholesterol (Ahmed and Said 2020).

The serum total protein (g/dL), albumin (g/dL) and globulin (g/dL) concentration increased significantly (P<0.05) in all CSP (0.5, 1.0 and 1.5%) supplemented groups compared to control and antibiotic groups at 42 d of age. The increased serum protein and globulin in CSP groups might be attributed to increased protein digestibility and enhancement of immune system. Similarly, Farah and Jaff (2011) noticed higher serum total protein and albumin levels with coriander seed powder in broilers. On the contrary, Farag (2013) and Ghazanfari *et al*. (2015) did not find significant (P>0.05) effect on serum total protein and albumin levels in broiler chicken.

Economics: Significantly (P<0.05) higher returns over feed cost were recorded in 1.5% CSP group followed by antibiotic group (Supplementary Tables 1, 2). Although, all the test groups obtained profits and lower returns were recorded in CSP (0.5%) and CSP (1.0%) groups compared to control group.

Farag (2013) recorded highest net revenue in 0.6% coriander seed supplemented group, followed by 0.4% and 0.2% coriander seed levels compared to the control. Similarly, increased profits upon feeding coriander seed powder were also reported by Rashid *et al*. (2014) and Taha *et al*. (2019) in broiler chicken. The increased profits in 1.5% CSP group might be attributed to the better efficiency of feed utilization and greater body weight which ultimately results in higher selling price of broilers and more returns.

Inclusion of 1.5% coriander seed powder was more effective in terms of higher weight gain, better FCR, nutrient utilization and higher returns over feed cost compared to control and antibiotic groups. Supplementation of coriander seed powder at 1.5% level significantly increased the immune organ weight, antibody response to ND vaccine, serum antioxidants activity and decreased the serum total cholesterol levels of broilers. Therefore, it could be concluded that supplementation of coriander seed powder at 1.5% level can be used in place of antibiotic growth promoter in broilers.

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