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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

Effect of Coriander Seeds as Diet Ingredient on Blood Parameters of Broiler Chicks Raised under High Ambient Temperature

Farah K. Al-Jaff

Department of Animal Resources, College of Agriculture, University of Baghdad, Baghdad, Iraq

Abstract: This Study was conducted to investigate the potential effect of coriander seeds on physiological traits. One hundred and eighty day-old Arbor Acer broiler chick were randomly assigned to four dietary treatments with three replicate pens (15 birds/pen). Birds were fed experimental diets containing 0% (T1), 1% (T2), 2% (T3) and 3% (T4) coriander seed. Feed and water were provided *ad libitum* during the experiment. Performance and physiological parameters were monitored at the end of the study (6 weeks of age) which includes live body weight, feed conversion ratio (g. Feed gain/g. Gain) total protein, albumin, globulin, A/G ratio, GTP, GOT, Alkaline phosphatase, glucose, cholesterol, LDL, HDL, Triglycerides, phospholipids, uric acid, creatinine and antibody titer (ND). Results showed that final body weight was ($p < 0.01$) higher in 2% coriander seed (T3) than all other groups and feed conversion ratio was significantly ($p < 0.05$) better for birds that were fed 2% (T3) and (T4) coriander seed than all other groups. Serum protein and albumin were ($p < 0.05$) higher in 2% (T3), While serum globulin ($p < 0.05$) lower in 2% coriander seed (T3) when compared with other groups. GOT and GPT were ($p < 0.05$) lower for 2% (T3) and 3% (T4) coriander seed, while alkaline phosphatase was ($p < 0.05$) lower in 2% (T3) group. Serum glucose ($p < 0.05$) lower in 2% (T3) coriander seed than all other group, Serum cholesterol was ($p < 0.05$) lower in 2% (T3) and 3% (T4) compared with other groups. LDL was ($p < 0.05$) lower in (T3) group, while HDL was ($p < 0.05$) lower in T3 and T4 groups when compared with the control. Serum triglycerides and antibody titers were ($p < 0.05$) higher in 2% and 3% coriander seed when compared with other groups. It could be concluded from this study that the inclusion of coriander seeds at levels of 2% have a positive effect on blood pictures, broiler performance and immune system during heat stress (high ambient temperature).

Key words: Broiler performance, physiological parameters, immune response, heat stress

INTRODUCTION

Herbs and spices are known for their preservation and medical value (De Souza *et al.*, 2005; Saeed and Tariq, 2006), *Coriandrum sativum* (Coriander) is considered both as an herb and a spice.

It has been referred to as antidiabetic (Gray and Flatt, 1999) and hypocholesterolemic (Chithra and Leelamma, 1997; Dhanapakiam *et al.*, 2008) The seed of coriander sativum contain 0.5-1% essential oil which is rich in beneficial phytonutrients including carvone, geraniol, limonene, borneol, camphor, elemol and linalool. Flavonoides compound in coriander include phenolic acid. Isao *et al.* (2004) suggested that the volatile oils have antimicrobial properties against food borne pathogen such as Salmonella species. Aromatic plants and essential oils extracted from these plants have become more important due to their potential antimicrobial and stimulating effects on digestive system (Lee *et al.*, 2004). They have a stimulating effect on the digestive enzyme and by improving the utilization of digestive products through enhanced liver function (Langhout, 2000; Williams and Losa, 2001; Hernandez *et al.*, 2004). Aromatic plant, coriander is an annual species of parsley family, native of eastern Mediterranean region. Coriander has been used as a

medicine. As a medical plant, coriander has been used to manage diabetes (Swantson-Flatt *et al.*, 1990; Graig, 1999), used as antifungal (Bacilico and Basilico, 1999), antioxidant (Chithra and Leelamma, 1997), antimicrobial (Delaquis *et al.*, 2002; Singh *et al.*, 2002; Egayyar *et al.*, 2001), It has also appetizing and stimulatory effects in the digestion progress (Cabuk *et al.*, 2003). However, tow reports are available on the effect of coriander oil or seed on broiler performance under heat stress by (Al-Mashhadani *et al.*, 2011; Hamodi *et al.*, 2010).

Thus the objective of this study is to investigate the effect of coriander seed on performance, blood parameters and immune response of broiler chickens under high ambient temperature (32-36).

MATERIALS AND METHODS

This study was conducted at the Poultry Farm, Animal Resource Department, University of Baghdad, Collage of Agriculture, during summer months to study the effect of inclusion different levels of coriander seed (*Coriandrum sativum* L.) as diet ingredient on broiler performance, blood parameters and immune response. A total of 180 day-old broiler chicks (Arbor Acers) were allocated randomly (utilizing a Complete Randomize Design (CRD) to four dietary treatment from 1-6 weeks

Table 1: Composition of the experimental diets

Ingredient	Coriander seed							
	Starter (1-4 weeks)				Grower (4-6 weeks)			
	Cont.	1%	2%	3%	Cont.	1%	2%	3%
Yellow corn	45.00	45.00	50.00	54.00	50.00	49.00	50.00	51.00
Wheat	20.00	19.00	12.00	7.00	19.50	19.50	18.25	15.00
SBM (48%)	25.00	25.00	26.00	26.00	20.00	20.00	19.00	20.00
Protein con. ¹ (40%)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Coriander ² seed	-	1.00	2.00	3.00	-	1.00	2.00	3.00
Corn oil	-	-	-	-	0.50	0.50	0.75	1.00
Calculated composition according to NRC (1994)								
CP (%)	22.12	22.10	22.17	21.91	20.19	20.10	19.56	19.73
Kcal (ME/kg)	2965.00	2961.10	2961.00	2967.10	3050.00	3044.00	3066.00	3070.00
Ca (%)	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
P ava. (%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Lysine (%)	1.12	1.11	1.13	1.13	0.99	0.99	0.96	0.98
Meth. + Cys. (%)	0.82	0.82	0.92	0.82	0.76	0.79	0.74	0.74

¹Protein concentrate provided per kg: 40% crude protein; 2800 Kcal. ME/kg; 2.7% lysine; 1.7% methionine; 2.4% methionine+cystine; 8% calcium; 3% available phosphorus; 12% crude fat; 25% ash and vitamin and minerals which meet NRC (1994) Requirement.

²Coriander seed 2710 Kcal. ME/kg; 0.5% protein; 5.5% moisture; 0.2% volatile oil; 19.6% ether extract; 31% crude fiber; 1.2% potassium; 0.02% sodium; 20% carbohydrates; 12 mg/100 mg ascorbic acid; 0.26 mg/100 g B1 and 0.23 mg/100 g B2

of age with three replicate pens (15 birds/pen). The experimental diets were control (T1), 1% coriander seed (T2), 2% coriander seed (T3) and 3% coriander seed (T4). The experimental diets were formulated to be isocaloric and isonitrogenic according to NRC (1994). The ingredient and chemical composition of the experimental diets are presented in Table 1.

Feed and water were provided *ad libitum* through out the experimental period, Birds were vaccinated against new castle and Gumboro diseases according to their age. Performance criteria include final body weight, weight gain, feed consumption and feed conversion ratio. At the end of the experimental period, blood samples were taken from 6 birds/treatment. Separation of serum was carried out by centrifugation of the blood at 3000 rpm for 10 min. The clear serum was transferred carefully to clean and dry vials and kept in deep freezer until analysis for determination of total serum protein, GPT, GOT, Alkaline phosphatase, total cholesterol (LDL) and (HDL) were determined also, triglycerides, phospholipids, uric acid according to Doumas *et al.* (1981); Reinhold (1953); Zake *et al.* (1954); Sidney and Barnard (1973); Giorgio (1974); Patton and Crouch (1977) and Fossati and Principe (1980), respectively. And antibody titer for New Castle disease were measured by Elisa, Dates were subjected to analysis of variance (SAS, 2001 and significant treatment means were separated by Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

The effect of including different levels of coriander seeds as diet ingredient on body weight, feed conversion ratio (g. feed/g. gain), serum protein, albumin, globulin levels and Albumin/Globulin (A/G) ratio of broiler chicken at 6 weeks of age are illustrated in Table 2.

The effect of inclusion different levels of coriander seed in the diet on 6 weeks live body weight (g) are presented in Table 2. There were no difference in average final body weight between the control group (T1) and 1% (T2) coriander seed diet. While, birds consuming 2% had a significantly ($p<0.01$) body weight as compared to T1, T2 and T3. The birds consuming the diets containing 2% coriander seed (T3) had significantly ($p<0.01$) higher final body weight than those on the other experimental diets (T1, T2 and T4 respectively). The inclusion 2% coriander seed to the diets improved final body weight by 14% over the control group (T1). The inclusion 2% coriander seed resulted in significant ($p<0.05$) better feed conversion ratio as compared with other group. While, feed conversion ratio on average for treatment 0% (T1) and 2% (T2) coriander seed were significantly lower ($p<0.05$) as compared to 2% (T3) and 3% (T4) coriander seed. For blood protein, result revealed that inclusion of coriander seed at level 2% (T3) had a significantly higher ($p<0.05$) total serum protein when compared with the other groups. While, the levels of 1% (T2) and 3% (T4) coriander seed were not significantly different than the control, even though total serum protein concentration was numerically higher in T2 and T4 than the control.

Data illustrated that albumin serum concentration were significantly ($p<0.05$) higher in groups 2% (T3) and 3% (T4) by about 7.32% and 6.11% respectively. While chicks that were fed 1% (T2) coriander seed exhibit numerically increase in serum albumin concentration by about 3.15% as compared to the control group. Furthermore, serum globulin concentration in 2% (T3) group was significantly ($p<0.05$) higher than the control group (T1) by 6.08%. There were no significant differences between 1% (T2) and 3% (T4) coriander seed in serum globulin concentration as compared with

Table 2: The effect of coriander seeds on body weight (g) feed conversion (g feed/g gain), serum protein, albumin, globulin, albumin/globulin ration of broiler chicks at 6 weeks of age

Parameters	Coriander seed (% in diet)				Levels of significance
	Control (T1)	1 (T2)	2 (T3)	3 (T4)	
Live weight (g)	1609.38±43.87 ^b	1555.55±20.74 ^b	1876.81±28.24 ^a	1694.44±33.79 ^b	**
g feed/g gain	1.99±0.11 ^a	2.06±0.31 ^a	1.93±0.10 ^b	1.91±0.11 ^b	*
Total protein (g/dl)	4.31±0.18 ^b	4.42±0.22 ^b	4.62±0.18 ^a	4.44±0.31 ^b	*
Albumin (g/dl)	2.15±0.01 ^c	2.22±0.23 ^c	2.32±0.12 ^a	2.29±0.01 ^b	*
Globulin (g/dl)	2.16±0.02 ^a	2.20±0.01 ^a	2.30±0.01 ^a	2.15±0.16 ^a	*
A/G ratio	1.02±0.01	1.00±0.03	1.00±0.02	1.03±0.03	NS

^{a, b, c}Means in the same raw with different superscripts are significantly different. **($p < 0.01$); *($p < 0.05$). Mean±Std. error.

T1: Control; T2: 1% coriander seed; T3: 2% coriander seed; T4: 3% coriander seed. NS: Not Significant

Table 3: Effect of different levels of coriander seeds as diet ingredient on alkaline phosphatase, GOT and GPT

Parameters	Coriander seed (% in diet)				Levels of significance
	Control (T1)	1 (T2)	2 (T3)	3 (T4)	
GOT (U/100 ml)	69.50±1.01 ^a	68.70±2.31 ^a	65.40±0.21 ^b	66.40±1.22 ^b	*
GPT (U/100 ml)	75.33±1.01 ^a	73.45±2.23 ^a	67.25±0.21 ^b	65.50±2.41 ^b	*
Alkaline phosphatase (mg/dl)	12.50±1.41 ^a	11.63±2.11 ^a	10.40±0.21 ^b	10.65±2.65 ^a	*

^{a, b, c}Means in the same raw with different superscripts are significantly different ($p < 0.05$). Mean±Std. error.

T1: Control; T2: 1% coriander seed; T3: 2% coriander seed; T4: 3% coriander seed

the control group. The increase in serum globulin concentration lowers albumin/globulin ratio. The highest value of globulin concentration maybe attributed to enhance resistance of the chicks against different stress factor (high ambient temperature 32-36°C in this study). The effect of inclusion of coriander seed on GOT, GPT and Alkaline phosphatase of broiler chicks at 6 weeks of age are presented in Table 3. It can be noticed from Table 3 that broiler chicks that fed 2% and 3% coriander seed had significantly ($p < 0.05$) lower serum GOT by about 4.66% and 6.29% for 2% (T3) and 3% (T4) respectively as compared with the control group. While 1% (T2) coriander seed cause a non significant reduction in GOT as compared with the control group (1.16%). GPT serum concentration were significantly ($p < 0.05$) lower for 2% (T3) and 3% (T4) groups by about 12.01% and 15.00% respectively when compared with the control (T1) group, While 1% (T2) coriander seed had non significant values on GOT and GPT serum concentration as compared with the control group (T1). In general GOT and GPT considered as liver enzymes which increase liver damage (hepatocellular degeneration), Thus the decrease in serum concentration of GOT and GPT may provide evidence for occurrence of hepatoprotective effect of coriander seeds and its essential oil (Langhout, 2000; Williams and Losa, 2001; Hernandez *et al.*, 2004). Alkaline phosphatase was significantly ($p < 0.05$) lower in chicks that fed 2% (T3) coriander seeds compared with other groups.

Serum glucose significantly ($p < 0.05$) decreased in broiler chicks that fed 2% (T3) and 3% (T4) coriander seed by about 7.88% and 4.72% respectively when compared with the control group (T1). Furthermore, coriander seed at level of 1% (T2) numerically lower

serum glucose than the control group (T1). These data were supported by Lemhadri (2004) who reported that an aqueous oregano extract exhibit an anti-hyperglycemia in rats without effecting basal plasma insulin concentration. Furthermore, these results were supported by Al-Mashhadani *et al.* (2011) who reported that the inclusion of coriander oil at levels of 0.5% and 1% as a diet ingredient resulted in a significant ($p < 0.05$) decrease in serum glucose and cholesterol in broiler chicken raised under summer months in Iraq (32-36°C). Serum cholesterol concentration of broiler chickens were raised during summer month (32-36°C) is presented in Table 4. The inclusion of coriander seed as diet ingredient at levels of 2% (T3) and 3% (T4) resulted in a significant ($p < 0.05$) decreased in serum concentration of cholesterol by about 8.27 and 7.01% respectively. These results are in agreement with (Graig, 1999). Serum cholesterol LDL (low density lipoprotein) showed a significant ($p < 0.05$) decline in the groups that were fed 2% (T3) coriander seeds by about 3.05. While, cholesterol HDL (High density lipoprotein) increased significantly ($p < 0.05$) in T3 and T4 groups by about 10.95 and 8.11% when compared with the control group (T1). These results could be explained according to Dhanapakiam *et al.* (2008), who illustrated that the concentration of LDL was decreased. While, the HDL cholesterol was increased ($p < 0.05$) in animal fed coriander seed. This could be due to the inhibition in the enzyme activity maybe due to that this is the key enzyme in pathway of cholesterol biosynthesis in the liver is 3-enzyme-3-methylglutaryl CoA (HMG-CoA) reductase activity (Crowell, 1999). Since the coriander oil reduces the activity of this enzyme HMG-CoA which is the regulatory enzyme in cholesterol synthesis. As a result, a hypocholesteremic effect of coriander oil can be

Table 4: Effect of inclusion different levels of coriander seeds as diet ingredient on glucose, cholesterol, HDL, LDL, triglyceride, phospholipids, uric acid and antibody titer (ND) of broiler chicks at 6 weeks of age during summer condition

Parameters	Coriander seed (% in diet)				Levels of significance
	Control (T1)	1 (T2)	2 (T3)	3 (T4)	
Glucose (mg/dl)	187.66±0.46 ^a	185.62±0.82 ^a	175.00±0.32 ^c	178.56±0.21 ^b	*
Cholesterol (mg/dl)	210.62±0.12 ^a	208.50±0.14 ^a	194.52±0.16 ^b	196.82±0.17 ^b	*
LDL (mg/dl)	104.40±2.80 ^a	103.50±2.61 ^b	101.31±1.20 ^c	103.40±0.62 ^b	*
HDL (mg/dl)	40.66±0.65 ^c	40.72±0.67 ^c	45.66±0.44 ^a	44.25±0.87 ^b	*
Triglyceride (mg/dl)	196.22±2.14 ^a	195.46±1.60 ^a	185.01±0.10 ^b	184.11±1.22 ^b	*
Phospholipids (mg/dl)	106.24±2.12	103.00±3.04	102.50±3.30	104.26±2.14	NS
Uric acids (mg/dl)	2.33±0.35	3.30±0.21	2.60±0.22	3.34±0.14	NS
Antibody titer	54.00±0.33 ^b	56.00±0.41 ^b	88.00±0.11 ^a	87.00±0.14 ^a	*

^{a, b, c}Means in the same row with different superscript are significantly different ($p < 0.05$). Mean±Std. error.

T1: Control; T2: 1% coriander seed; T3: 2% coriander seed; T4: 3% coriander seed. NS: Not Significant

expected. Case *et al.* (1995) illustrated that a 5% inhibition of HMG-CoA reductase lowered serum cholesterol by 2% in poultry. Chithra and Leelamma (1997) reported that coriander enhance bile acid synthesis and increase degradation of cholesterol to fecal bile acid and natural sterols which resulted in lowering serum cholesterol. The data revealed that coriander seeds as diet ingredient had no significant effect on serum phospholipids and uric acid of broiler chicken when compared with the control in this study. But generally the triglycerides was significantly ($p < 0.05$) lower in T3 and T4 groups by about 6.05% and 6.58% respectively when compared with the control group.

Al-Harhi (2004) conducted an experiment to evaluate the efficiency of utilizing some herbs with and without antibiotic supplementation on broiler performance and he reported that plasma cholesterol and triglyceride were significantly decreased by the addition of herbs or/and antibiotics to broiler chicken diets. The noticeable improvement of antibody titer against ND in the present study might be due to the effects of active components of coriander seed. As a medical plant, coriander had antimicrobial effects (Tabance *et al.*, 2003; Cabuk *et al.*, 2003) and antifungal effect (Soliman and Badea, 2002). This could be one more reason for improving the immune status of the chicks. It could be concluded from the results of this study that coriander seed at 2% (T3) supplementation as diet ingredient may improve hepatoprotective effect, immune status, performance and blood picture of chicks raised under high summer condition (32-36°C) in Iraq.

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