

Effect of ginger (*Zingiber officinale*) and cardamom (*Elettaria cardamomum*) on physiological and haemato-biochemical parameters of broiler

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ABSTRACT

One hundred and sixty eight (168) 'Vencob' day-old broiler chicks were used in an experiment to determine the effects of ginger (*Zingiber officinale*) and cardamom (*Elettaria cardamomum*) powder on the physiological and haemato-biochemical parameters of broilers. The birds were randomly assigned to seven dietary treatments in a Factorial Randomized Block Design (FRBD) consisting of 24 birds per treatment with 6 birds per replicate in a feeding trial that lasted for a period of 42 days. *Zingiber officinale* and *Elettaria cardamomum* at 0%, 1%, 2% and 3% were added to the basal diet and their effects determined on physiological and haemato-biochemical parameters. At the end of the experiment, 1 birds were randomly picked from each replication and their blood samples were collected for haematological assay and serum analysis. Results showed that haematological parameters were significantly influenced by the treatment. Serum components such as haemoglobin (Hb), serum triglyceride, serum HDL cholesterol, serum LDL cholesterol, serum protein, serum glucose, total cholesterol, body temperature and respiration rate of broilers were significantly influenced by 1 per cent ginger powder. The results of this investigation therefore, demonstrate that the inclusion of ginger at 1 per cent level reduced serum cholesterol, triglyceride, sugar and increased protein and HDL level when compared to the control diet and normal anatomical and physiological function of birds was not disrupted.

Key Words: Broiler chicks, haemato-biochemical, physiological parameters.

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INTRODUCTION

Ginger is the rhizome of the plant *Zingiber officinale*, consumed as a delicacy, medicine, or spice. The use of ginger and cardamom as substitute for antibiotic growth promoters is desirable for greater productivity of poultry, increased palatability of feed, nutrient utilization, appetite stimulation, increase in the flow of gastric juice and piquancy to tasteless food (Owen and Amakiri, 2012). Herbs, plant extracts and species can be valuable alternatives for the health and nutrition of the chicken. They have a wide range of activities such as stimulation of feed intake and endogenous secretions or have antimicrobial, coccdiostatic or anathematic activity. The blood constituent of an animal reflects the physical responsiveness of the animal to its internal and external environment (Esonu et al. 2001), they are very essential in diagnosing pathogenic and metabolic disorders and are vital tools to assessing the health status of an individual or flock. The changes in haemato-biochemical parameters are often used to determine the effects of stress or toxic condition due to environmental, nutritional or other factors. Normal ranges of haematological parameters can be altered by the ingestion of plant constituents such as Ginger (Ajagbonna et al. 1999). The use of feed additives such as Ginger which is a substitute for antibiotic growth promoters is desirable for greater productivity in poultry, increased palatability of feed, nutrient utilization, appetite stimulation, increased gastric juice flow *etc.* (Owen and Amakiri, 2012), it is therefore necessary to investigate the

feed additives in animal feed which justifies the study of the feed additive effects of graded levels of Ginger and Cardamom on haematology, serum chemistry and performance of broiler.

MATERIALS AND METHODS

168 day-old broiler chick (Vencob) were purchased from a Venketshwra hatchery Pune, weighed (43±0.35 g) and randomly allocated into seven treatment groups with four replicates of six chickens based on a completely randomized design. The concentrations of the administered supplements in the seven experimental diets were as follows: control diet (no additive) T₀; basal diet supplemented 1% cardamom (T₁), 2% cardamom (T₂), 3% cardamom (T₃), 1 % ginger (T₄), 2% ginger (T₅) and 3% ginger (T₆). Proximate analysis of Ginger and Cardamom powder were performed for the components of dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF) and ash, according to AOAC (1990) procedures (Table 1). Birds were vaccinated routinely against infectious *Ranikhet* (lasota), Infectious Bursal Disease at 8 and 18 days, respectively through the eye drop and drinking water. In addition all the birds were given medicine Groviplex for three days from 2nd day and on 20th day onward for 3rd days through fresh water at the 1ml/lit of water. Blood samples were collected at end of experiment from the wing vein with syringe from one bird in each replication for blood haemato-biochemical study *viz.*, haemoglobin, Serum glucose, total plasma cholesterol

(TC), triglycerides (TG), low density lipoprotein (LDL) and high density lipoprotein (HDL). The blood collected in sterilized glass test tube keeping in a slant position and serum was separated. All the serum samples were stored in a deep freeze at -20 °C until it processed. Blood cholesterol and serum triglyceride were estimated by Godkar (1994), serum HDL cholesterol by Richmond (1973), LDL cholesterol by Friedwald et al. (1972). Physiological parameters i.e. respiration rate was recorded at weekly interval by holding the birds in hands with counting the breath rate per bird per minute and body temperature inserting the mercury thermometer into the anus in morning. Data were subjected to statistical analysis using randomized block design and Duncan's multiple range test procedures within (Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

Chemical composition of experimental diets

The result of chemical composition of cardamom and ginger powder and broiler and finisher feed are presented in table 1 and Table 2. The values for dry matter, ether extract, crude protein, crude fiber, ash and nitrogen free extract were 77.19, 10.87, 13.83, 17.65, 15.50 and 42.15 per cent, respectively in cardamom powder. Composition of cardamom powder observed in the present investigation was in agreement with that reported by Elamin et al. (2008) and while the 79.30, 1.12, 4.33, 3.41, 4.78 and 86.36 per cent of dry matter, ether extract, crude protein, crude fiber, total ash and NFE, respectively in ginger powder. These values were closely similar to the values reported by Ademola et al. (2009) for ginger powder.

Haemato-biochemistry of broilers

The results on haematology and Serum chemistry of birds are presented in Table 2. Haemato-biochemical parameters studied include haemoglobin, Serum glucose, total plasma cholesterol (TC), total triglycerides (TG), low density lipoprotein (LDL), high density lipoprotein (HDL).

The average serum haemoglobin value of group T₂L₂ (11.68 mg/dl) was significantly higher than control groups. While T₀ (10.03 mg/dl) had lowest serum haemoglobin value. The present findings were in agreement with Najafi and Taherpour (2014) who

reported that increment in the serum haemoglobin with supplementation of ginger in broiler diets of 0.4 (9.45 mg/dl) and 0.8 per cent (9.16 mg/dl) level, respectively. Kausar et al. (1999) also recorded the supplementation of cardamom had non-significant effect on haemoglobin concentration than control level.

The overall glucose level highly significant was found in T₀ (188.50 mg/dl) as compared to others treatment groups. Thus, there was significant reduction (P<0.05) in serum glucose values in treatment T₂L₁ (145 mg/dl) as compared to T₀, T₁L₁, T₁L₂, T₁L₃, T₂L₂ and T₂L₃. The present findings were in agreement with Mohamed et al. (2012) who showed reduction of serum glucose at 0.1 (153.56 ± 1.090 mg/dl) and 0.2 (150.21 ± 1.070 mg/dl) per cent of ginger than control (164.21 ± 1.040 mg/dl). Similar findings were also reported by Zomrawi et al. (2013) showed reduction in serum glucose when supplemented with 1 (168.25 mg/dl), 1.5 (176.0 mg/dl) and 2 (144.50 mg/dl) per cent ginger powder as compared to control (183.5 mg/dl).

The overall mean of serum total protein was higher in T₂L₁ (2.92mg/dl) followed by T₂L₂ (2.65 mg/dl), T₁L₂ (2.48mg/dl), T₁L₁ (2.33mg/dl), T₁L₃ (2.28mg/dl), T₂L₃ (2.18mg/dl) and T₀ 1.93mg/dl), respectively. Thus, there was significant increase (P<0.05) in serum total protein values in treatment T₂L₁ (2.92 mg/dl) than to other treatments and control group. The present findings were in agreement with Elamin et al. (2011) who showed dietary cardamom had no effect on total serum protein at 0 (3.17 mg/dl), 0.15 (2.93 mg/dl), 0.30 (3.30 mg/dl) and 0.45 (3.27 mg/dl) per cent of cardamom powder.

The average total serum cholesterol were 169.35, 149.63, 139.43, 151.83, 120.08, 151.33 and 135.2 mg/dl for the treatment T₀, T₁L₁, T₁L₂, T₁L₃, T₂L₁, T₂L₂ and T₂L₃, respectively. Thus, there was significant reduction (P<0.05) in serum total cholesterol values in treatment T₂L₁ (120.08 mg/dl) as compared to other treatments. Treatment T₀ (169.35 mg/dl) showed highest cholesterol level as compared to all others treated groups. Our results were almost similar with Mohamed et al. (2012) who reported that total serum cholesterol was decreased in 0.1 per cent (119.30 mg/dl) and 0.2 per cent (115.89 mg/dl) ginger than control (126.40 mg/dl) group. Higher value of total serum cholesterol was observed by Najafi and

Table 1. Chemical composition of experimental feed ingredients (DM basis)

| Items | DM | CP | NFE | Fat | CF | Ash |
|----------------------------|-------|-------|-------|-------|-------|-------|
| Proximate principle | | | | | | |
| Broiler starter | 91.24 | 21.28 | 65.65 | 4.56 | 6.59 | 1.92 |
| Broiler finisher | 88.96 | 19.34 | 68.55 | 4.73 | 5.63 | 1.75 |
| Feed additive | | | | | | |
| Ginger | 79.30 | 1.12 | 4.33 | 3.41 | 4.78 | 86.36 |
| Cardamom | 77.19 | 10.87 | 13.83 | 17.65 | 15.50 | 42.15 |

DM= dry matter, CP=crude protein, EE=ether extract, CF= crude fibre; Nitrogen free extract (NFE) = 100-(moisture + CP +EE +CF + Ash)

Table 2. Effect of feed additives on haemato-biochemical parameters of broilers

| Treatment | Haemoglobin (Hb)(mg/dl) | Serum glucose (mg/dl) | Serum protein (mg/dl) | LDL cholesterol (mg/dl) | HDL Cholesterol (mg/dl) | Triglyceride (mg/dl) | Total Cholesterol (mg/dl) |
|--------------|-------------------------|-----------------------|-----------------------|-------------------------|-------------------------|----------------------|---------------------------|
| T0 | 10.03 ^{defg} | 188.50 ^a | 1.93 ^g | 57.47 ^a | 74.50 ^f | 88.60 ^a | 169.35 ^a |
| T1L1 | 10.73 ^c | 155.00 ^{cde} | 2.33 ^{cd} | 43.82 ^{bc} | 80.00 ^{cde} | 79.03 ^b | 149.63 ^{bc} |
| T1L2 | 10.18 ^{cdef} | 145.25 ^{def} | 2.48 ^{bc} | 52.78 ^{ab} | 89.75 ^b | 55.68 ^{ef} | 139.43 ^{bcd} |
| T1L3 | 10.53 ^{cd} | 173.75 ^{abc} | 2.28 ^{cde} | 39.94 ^{cde} | 82.50 ^{bcd} | 69.43 ^{cd} | 151.83 ^b |
| T2L1 | 11.60 ^{ab} | 145.00 ^{efg} | 2.92 ^a | 28.62 ^g | 96.50 ^a | 47.76 ^{fg} | 120.08 ^f |
| T2L2 | 11.68 ^a | 163.50 ^{bcd} | 2.65 ^b | 30.81 ^{def} | 82.50 ^{bcd} | 60.63 ^{de} | 151.33 ^b |
| T2L3 | 10.48 ^{cde} | 185.50 ^{ab} | 2.18 ^{def} | 40.86 ^{cd} | 83.00 ^{bc} | 72.50 ^{bc} | 135.20 ^{de} |
| ±SEm | 0.23 | 8.27 | 0.08 | 3.66 | 2.76 | 3.19 | 4.75 |
| C. D. at 5 % | 0.69 | 24.82 | 0.25 | 10.98 | 8.27 | 9.56 | 14.24 |

(Value with different superscripts in a row differ significantly $P < 0.05$).

Taherpour (2014) supplemented by 0.4 per cent ginger. While lowest value also reported by Najafi and Taherpour (2014) who reported that the serum total cholesterol (107.26 mg/dl) with supplementation of 0.8 per cent ginger.

The overall serum triglyceride were 88.60, 79.03, 55.68, 69.43, 47.76, 60.63 and 72.50 (mg/dl) for the groups T₀, T₁L₁, T₁L₂, T₁L₃, T₂L₁, T₂L₂ and T₂L₃, respectively. Thus, there was significant decrease in serum triglyceride values in all groups as compared to control group (T₀). The average serum triglyceride value of group T₂L₁ (47.76 mg/dl) was significantly lower than all groups. Hence, treatment T₂L₁ was significant over other treatments. The present findings were in agreement with Mohamed et al. (2012) who reported the reduction in the serum triglyceride with supplementation of ginger powder in broiler diets 116.10, 108.20 and 107.42 for the levels of 0, 1 and 1.5 per cent, respectively. Elamin et al. (2011) and Rafiee et al. (2014) also reported the decrease in the serum triglyceride with supplementation of cardamom and ginger, respectively in broilers.

The average serum HDL cholesterol values (mg/dl) in different groups are presented in Table 2. The high density lipoprotein (HDL) were 74.50, 80.00, 89.75, 82.50, 96.50, 82.50 and 83.00 (mg/dl) for the groups T₀, T₁L₁, T₁L₂, T₁L₃, T₂L₁, T₂L₂ and T₂L₃, respectively. The average HDL cholesterol value of group T₂L₁ (96.50 mg/dl) was significantly higher ($P < 0.05$) than T₀ treatment after supplemented with 1.0 per cent ginger. Our results were agree with Najafi and Taherpour (2014) who reported that the HDL value highest in 0.4 per cent (43.58 mg/dl) ginger than 0.8 per cent (34.50 mg/dl) ginger and control group (31.31 mg/dl). Ademola et al. (2009) also reported the significant increase in high density lipoprotein cholesterol in broiler with supplementation 1.0 (71.79 mg/dl), 1.5 (79.19 mg/dl) and 2 (73.12 mg/dl) per cent of ginger powder than control (66.10 mg/dl).

The overall highest low density lipoprotein content was in control group (57.47 mg/dl), followed by T₁L₂ (52.78mg/dl), T₁L₁ (43.82mg/dl), T₂L₃ (40.86mg/dl), T₁L₃ (39.94mg/dl), T₂L₂ (30.81 mg/dl) and T₂L₁ (28.62mg/dl), respectively. The average LDL cholesterol value of group T2L1 (28.62 mg/dl) was significantly decreased ($P < 0.05$) than control (57.47 mg/dl) group and there was a significant reduction in serum LDL cholesterol values in T₂L₂ (30.81 mg/dl), T₁L₃ (39.94 mg/dl) and T₂L₃ (38.62 mg/dl) when compared with control. Ademola et al. (2009) recorded the reduction in serum LDL cholesterol values in 1.5 per cent (26.83 mg/dl) followed by 2 per cent (32.78 mg/dl), 1 per cent (42.78 mg/dl) and 0 per cent (86.95 mg/dl) of ginger in diet. Barazesh et al. (2013) and Najafi and Taherpour (2014) also reported that low density lipoprotein was reduced in ginger supplemented broiler diet. Our findings of present study were in accordance with results of Omidi et al. (2014) who reported decreased low density lipoprotein when supplementation of cardamom essential oil (CEO) 50 or 100 mg/kg in the broiler diet as compared to control.

Body temperatures

The average body temperature values (°C) in different groups are presented in Table 3. The highest body temperature of broilers was found in T₂L₂ (41.16°C) and T₂L₃ (41.16 °C) by supplemented 2 and 3 per cent of ginger as compared to control and other treated groups, respectively. Hence, treatment T₂L₂ (41.16 °C) and T₂L₃ (41.16°C) were at par with each other. Almost similar findings were reported by Hermes et al. (2011). The results of present were in agreement with Ali et al. (2010) who reported that increment in the body temperature with supplementation of turmeric (41.74±0.28°C) in broiler diets at five weeks than control (40.37±0.01°C).

Respiration rate

The overall mean of respiration rate values were 44.00, 43.21, 44.04, 41.08, 44.29, 41.42 and 43.21 for the groups

T₀, T_{1L₁}, T_{1L₂}, T_{1L₃}, T_{2L₁}, T_{2L₂} and T_{2L₃}, respectively. The average respiration rate value of group T_{2L₁} (44.29 breath/min) was significantly higher than all groups. Hence, treatment T₀ (44.00 breath/min) and T_{1L₂} (44.04 breath/min) were at par with each other. The results of present finding almost similar to Hermes et al. (2011). The present findings were in agreement with Ali et al. (2010) who reported that the increment in the body temperature with supplementation of *Curcuma longa* (55.00±0.57 breath/min) in broiler diets at five weeks than control (66.00±1.00 breath/min).

It can be concluded that feeding of 1 per cent ginger powder significantly improved performance and reduced serum cholesterol, triglyceride, sugar and increased protein and HDL level with economic production of broilers. More studies required in this field to confirm the mechanism and mode of action of active ingredients of ginger powder. It may be suggested that the 1 per cent ginger powder is more beneficial for broilers because after supplementation by 1 per cent ginger, farmers gain more profits.

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