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Full Length Research Paper

Hematological and serum biochemical parameters of broilers fed with *Andrographis paniculata* as an alternative to antibiotic growth promoter

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An experiment was conducted to study the effect of *Andrographis paniculata* on hematological and serum biochemical parameters of broilers as an alternative to antibiotic growth promoter with one hundred and fifty commercial, one day-old broiler chicks. The chicks were fed basal diet (T_1), basal diet with 20 mg/kg virginiamycin (T_2), basal diet containing *A.paniculata*-1.0 g/kg (T_3), basal diet containing *A.paniculata*-2.0 g/kg (T_4) and basal diet containing *A.paniculata* - 3.0 g/kg (T_5) and were maintained for six weeks period. The result revealed that the packed cell volume were ranged from 29.66 to 32.83% and hemoglobin levels ranged from 12.16 to 13.06 g/dl which did not vary significantly between treatment groups. The total leukocyte count was significantly higher in T_5 compared to control group with no difference between the levels of *A. paniculata.* The serum total cholesterol and high-density lipoprotein (HDL) cholesterol levels in *A. paniculata* fed group did not vary significantly from virginiamycin and control groups. *A. paniculata* fed group had significantly higher serum total protein, albumin and globulin than virginiamycin and control diet fed groups. The serum glucose level did not vary between treatment groups than antibiotic and control diet fed groups. Serum aspartate transaminase, alkaline transaminase and alkaline phosphatase were significantly lower in *A. paniculata* fed groups. It was concluded that feeding *A. paniculata* improved the immune status and hepatoprotective activity in broilers.

Key words: *Andrographis paniculata*, hematology, serum bio-chemicals, broilers.

INTRODUCTION

Antimicrobials have been used as feed supplement for more than 50 years in poultry feed to enhance the growth performance and to prevent diseases in poultry. However, in recent years great concern has arisen about the use of antibiotics as supplement at sub-therapeutic level in poultry feed due to emergence of multiple drug resistant bacteria (Wray and Davies, 2000). Antibiotics can be replaced by alternatives such as prebiotics, probiotics and botanicals. Commercial additives of plant origin like herbs, spices and various plant extracts are also considered to be natural products that consumers would have received an increased attention. *Andrographis paniculata* (AP) is one of such plant having antimicrobial and growth promoting activity and hence may be used as alternative to antibiotics and tonic (Chopra et al., 1992; Valdiani et al., 2012).

AP is an erect annual herb extremely bitter in taste in all parts of the plant body. AP is distributed in tropical Asian countries, often in isolated patches. Native populations of AP are spread throughout south India and Sri Lanka. AP is used in traditional Siddha and Ayurvedic systems of medicine in India as well as in tribal medicine in China, Hong Kong, Philippines, Malaysia, Indonesia, and Thailand (Akbar, 2011). AP is reported to possess antihepatotoxic, antibiotic, antimalarial, antihepatitic, anti-thrombogenic, anti-inflammatory (Thiyagarajan et al., 2011), anti-snake venom and antipyretic properties

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Table 1. Mean hematological parameters of broilers as influenced by dietary inclusion of *A. paniculata* at 6 weeks of age.

Treatment groups	PCV (%)	Hb (g/dl)	Total leukocytes (x 10^3/µl of blood)
T_1 - Basal diet	30.50 ± 0.88	12.50 ± 0.44	24.34^{c} ± 0.38
T_2 - Basal diet + 20 mg Virginiamycin/kg	30.16 ± 1.19	12.16 ± 0.45	25.02^{bc} ± 0.34
T_3 - Basal diet + 1.00 g *A. paniculata*/kg	30.83 ± 0.98	13.06 ± 0.37	25.08^{b} ± 0.18
T_4 - Basal diet + 2.00 g *A. paniculata*/kg	29.66 ± 0.91	13.00 ± 0.47	25.25^{ab} ± 0.36
T_5 - Basal diet + 3.00 g *A. paniculata*/kg	32.83 ± 0.70	12.96 ± 0.33	25.35^{a} ± 0.42

Value in each cell is the mean of six observations. $^{a-c}$ Means within a column with no common superscript differ significantly ($P<0.05$).

besides its general use as an immunostimulant agent (Burgos et al., 2009). However, its role on hematological, serum biochemical characteristics are not still clear in broilers even though already some works have been carried out in rats and other species. Hence, the present study was carried out to evaluate the effect of AP on hematological and serum biochemical parameters of broilers.

MATERIALS AND METHODS

The whole plants of AP were collected from Namakkal, Tamil Nadu, India after ascertaining their identity. The leaves of AP were collected and shade dried, powdered and kept ready for experimental use.

Biological experiment

One hundred and fifty commercial, straight run one day-old broiler chicks belonging to a single hatch were purchased from a local hatchery, wing banded, weighed and randomly allotted into five treatment groups with three replicates of ten chicks each. The chicks were fed basal diet (T_1), basal diet with virginiamycin - 20 mg/kg (T_2), AP - 1.0 g/kg (T_3), AP - 2.0 g/kg (T_4) and AP - 3.0 g/kg (T_5). The chicks were reared in broiler cages in a gable roofed, open sided house. All the chicks were provided with uniform floor, feeder and waterer space and were reared under standard management conditions throughout the experimental period of six weeks. The experimental diet was formulated according to the standards prescribed in Bureau of Indian Standards (B.I.S, 1992). The broiler starter and finisher diets were fed *ad libitum* to the birds from 1 to 28 and 29 to 42 days of age, respectively.

Collection of data

At the end of the experiment, one male and one female from each replicate, totally six birds per treatment were randomly picked up, blood samples were collected for hematological and serum biochemical characteristics. Blood samples were collected from the birds and immediately assessed for its packed cell volume, hemoglobin and total leukocyte count as per the standard procedure.

Serum biochemistry

Blood samples were allowed to clot and centrifuged at 1500 rpm for 20 min to separate the sera. The sera samples were stored at –20°C for the analyses of serum glucose, total protein, albumin, cholesterol, high density lipoprotein (HDL)-cholesterol, aspartate transaminase (AST), alkaline transaminase (ALT) and alkaline phosphatase (ALP). The serum globulin was calculated by subtracting serum albumin from serum total protein levels.

Data analysis

The data collected on various parameters were subjected to statistical analysis as per the methods suggested by Snedecor and Cochran (1989) using completely randomized design.

RESULTS AND DISCUSSION

Hematological parameters

Mean hematological parameters of broilers as influenced by dietary inclusion of AP is presented in Table 1. The packed cell volume (PCV) and hemoglobin (Hb) levels did not vary significantly between treatment groups and varied from 29.66 to 32.83% and 12.16 to 13.06 g/dl, respectively. These values concur with values of 32.0% PCV and slightly lower than 14.11 g/dl Hb in Cobb broilers at 42 days of age (Talebi et al., 2005). Similar reports was made by Venkataranganna et al. (2008) who reported that feeding of herbal product, “Partsmart” containing dried aqueous extracts of *Phoenix dactylifera* (fruit:188 mg), *Cichorium intybus* (seeds:188 mg), AP (aerial part:188 mg), *Vitis vinifera* (fruit:188 mg), *Phyllanthus amarus* (aerial part:124 mg) and *Emblica officinalis* (fruit:124 mg) did not have any significant effect on PCV and Hb in Wistar rats.

However, Dhenge et al. (2009) reported that feeding of AP leaves powder significantly increased haemoglobin concentration in broilers. Similarly, Ravikumar et al. (2010) also reported that oral administration of AP (100 and 200 mg/kg body weight) for 21 days significantly restored the hemoglobin in diabetic albino rats. Sapcota et al. (2006) found that feeding of AP to aflatoxicosis induced broilers for six weeks period partially restored the PCV level in a dose dependent manner.

The total leukocyte count was significantly ($P<0.05$) higher in T_5 compared to control group with no difference between the levels of AP. Similar reports were also made by Dhenge et al. (2009) who have reported that feeding

Table 2. Mean serum biochemical characteristics of broilers as influenced by dietary inclusion of *A. paniculata* at 6 weeks of age.

Treatment groups	Total cholesterol (mg/dl)	HDL cholesterol (mg/dl)	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Glucose (mg/dl)
T_1 - Basal diet	154.30 ± 5.59	70.20 ± 1.82	3.88^{B} ± 0.11	1.60^{b} ± 0.02	2.28^{cd} ± 0.13	181.16 ± 3.14
T_2 - Basal diet + 20 mg Virginiamycin/kg	159.60 ± 5.59	69.18 ± 1.21	3.82^{B} ± 0.25	1.76^{b} ± 0.03	2.06^{d} ± 0.13	178.33 ± 5.78
T_3 - Basal diet + 1.00 g *A. paniculata*/kg	158.33 ± 4.16	69.69 ± 0.78	4.96^{A} ± 0.16	1.90^{a} ± 0.07	3.05^{a} ± 0.17	178.167 ± 4.26
T_4 - Basal diet + 2.00 g *A. paniculata*/kg	158.33 ± 5.27	69.65 ± 1.27	4.51^{A} ± 0.26	1.82^{a} ± 0.07	2.68^{abc} ± 0.18	176.83 ± 5.25
T_5 - Basal diet + 3.00 g *A. paniculata*/kg	156.70 ± 6.45	68.24 ± 1.69	4.60^{A} ± 0.30	1.82^{a} ± 0.05	2.77^{ab} ± 0.19	177.00 ± 6.79

Value in each cell is the mean of six observations. $^{a-d}$ Means within a column with no common superscript differ significantly ($P<0.05$). $^{A-C}$ Means within a column with no common superscript differ significantly ($P<0.01$).

of AP leaves powder significantly increased the total leukocyte count as compared with control in broilers.

Serum biochemistry

Mean serum biochemical parameters of broilers as influenced by dietary inclusion of AP are presented in Table 2. The serum total cholesterol and HDL cholesterol levels in AP fed group did not vary significantly from virginiamycin and control groups. This finding is in agreement with the results of Eugine and Manavalan (2011) who reported that feeding of AP to swiss albino mice did not alter the serum total cholesterol. Similar observation was also made by Dwivedi et al. (1987) and Zhang and Tan (2000) who reported that feeding of dried leaf powder of AP did not reduce the serum cholesterol level in rabbit and rat, respectively. However, Bharathi et al. (2011) reported that feeding of AP at 0.05% in the feed from 29 to 45 days of age after chloripyrifos induced changes in cob broilers significantly reduced the serum total cholesterol and increased HDL cholesterol. Similarly, Sivaraj et al. (2011) reported that feeding of AP aqueous leaf extract significantly restored the serum total cholesterol in ethanol induced liver toxicity in *albino* rats. The decreased serum cholesterol in the plant extract administrated rat might be due to increased activity of enzyme catalase involved in esterification of cholesterol in the plasma.

AP fed group had significantly higher total protein content of 4.96, 4.60 and 4.51 g/dl in T_3, T_5 and T_4, respectively than virginiamycin (T_2 -3.82 g/dl) and control (3.88 g/dl). This finding concurs with the earlier report of increased serum total protein level due to AP in beta-Hexachlorocyclohexane treated mice (Trivedi and Rawal, 1998) and restored total protein in diabetic albino rats (Ravikumar et al., 2010).

However, Venkataranganna et al. (2008) reported that feeding of herbal product; 'Partsmart' containing AP did not have any significant effect on total protein in Wistar rats. The serum albumin level was significantly ($P<0.05$) higher in all the supplemented groups than control. However, serum globulin level was significantly ($P<0.05$) higher in T_3, which did not differ significantly from T_4 and T_5. The virginiamycin fed group (T_2) recorded the lower globulin level of 2.06 g/dl at 6 weeks of age. Ravikumar et al. (2010) reported that oral administration of AP (100 and 200 mg/kg body weight) for 21 days significantly restored albumin in diabetic albino rats.

However, Venkataranganna et al. (2008) reported that feeding of herbal product; 'Partsmart' containing AP did not have any significant effect on serum albumin and globulin in Wistar rats. The serum glucose level did not vary between treatment groups. Similar observation was made by Dwivedi et al. (1987) while feeding AP leaf powder to New Zealand White rabbits and Asmah et al. (2006) in normal rats. However, it significantly reduced the blood glucose in hyperglycemic rats. This hypoglycemic effect may be due to the possible compounds namely diterpenoids (Jain et al., 2000) as well as flavonoids (Gupta et al., 1983). Similarly, Ravikumar et al. (2010) also reported that oral administration of AP (100 and 200 mg/kg body weight) for 21 days significantly reduced the blood glucose level compared to untreated diabetic rats.

Hepatic enzymes

Mean serum hepatic enzymes of broilers as influenced by dietary inclusion of AP are presented in Table 3. Analysis of serum AST, ALT and ALP level revealed that T_3, T_4 and T_5 recorded significantly ($P<0.01$) lower enzyme activity than other treatment groups. The significant decrease

Table 3. Mean serum hepatic enzymes (U/l) of broilers as influenced by dietary inclusion of *A. paniculata* at 6 weeks of age.

Treatment groups	AST	ALT	ALP
T_1 - Basal diet	$186.00^{B} \pm 4.00$	$47.00^{B} \pm 1.94$	$186.65^{B} \pm 6.47$
T_2 - Basal diet + 20 mg Virginiamycin/kg	$172.00^{B} \pm 3.22$	$44.33^{B} \pm 1.72$	$213.84^{B} \pm 6.81$
T_3 - Basal diet + 1.00 g *A. paniculata*/kg	$139.66^{A} \pm 3.20$	$35.16^{A} \pm 1.16$	$190.17^{B} \pm 10.01$
T_4 - Basal diet + 2.00 g *A. paniculata*/kg	$135.00^{A} \pm 1.84$	$33.33^{A} \pm 1.42$	$139.33^{A} \pm 5.56$
T_5 - Basal diet + 3.00 g *A. paniculata*/kg	$133.00^{A} \pm 1.84$	$34.16^{A} \pm 1.65$	$150.75^{A} \pm 2.59$

Value in each cell is the mean of six observations. ^{A,B} Means within a column with no common superscript differ significantly ($P<0.01$).

in the levels of biochemical marker enzymes like ALT, AST and ALP in plant extract administered animals might be due to decreased leakage of the enzymes in liver cells. This suggests that the AP plant extract could repair the hepatic injury and/or restore the cellular permeability, thus educing the toxic effect of liver toxicity and preventing enzymes leakage into the blood circulation (Sivaraj et al., 2011). Dwivedi et al. (1987), Trivedi and Rawal (1998) and Bhattacharyya et al. (2003) also reported a similar finding that AP feeding significantly prevented the elevation of serum ALT, AST and ALP in drug induced hepatotoxicity, which reflected the hepatoprotective role of AP in rats and mice. From the results, it was concluded that supplementation of AP to broiler diet enhanced the immunoprotective and hepato protective nature of broilers.

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