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Effect of ginger on blood chemistry and immunity status of black rock broiler chicken

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Abstract
The present experiment was conducted to assess the effect of ginger supplementation on the blood Haemato-biochemical and immuno response of black rock broiler chicken. One hundred twenty numbers of day old black rock broiler chicks were distributed to 04 groups having 30 birds in each. Each group consists of three replicates with 10 birds in each replicate. Ginger was supplemented at the label of 0, 0.5, 1.0 and 1.5% in four groups respectively through the feed. The experiment continued for 42 days. The mean Hb(%), PCV(%), TEC($\times 10^6$/µl), TLC($\times 10^3$/µl), MCV(fl), MCHC(%) at 6th week of Black rock broiler birds in all the groups ranged from 9.44±0.06 to 9.8±0.21, 28.36±1.10 to 30.68±1.57, 2.72±0.12 to 2.90±0.24, 19.53±1.67 to 20.05±1.96,102.96±7.35 to 109.52±12.34 and 32.40±2.35 to 33.88±0.63 showing non-significant difference among the treatments. Serum biochemicals like glucose, total protein, albumin, globulin, urea, creatinine, uric acid did not differ significantly (P>0.05), but serum cholesterol and triglycerides decreased significantly (P<0.05) in treatment birds than control. The present research result has shown conspicuous enhancement in immunity status when tested with foot pad infusion of PHA-P and antibody production against sheep red blood cells. It may be concluded that supplementation of ginger powder enhanced the immunity and decreased the total cholesterol in black rock bird.

Keywords: ginger, blood chemistry, immunity, lipid profile, chicken

Introduction
Poultry industry in India has always been an integral component of the livestocks production system which represents the major success story. This industry has become the means of livelihood of the almost major workforce in the country. This industry has grown from grass root level backyard to higher level commercial industry within a short time period. This transformation occurred due to scientific breeding, hatching, rearing and processing activities in the poultry industry. In our country this industry is now fully grown up because of higher returns, short time intervals and small scale land. Changing lifestyle in human race has increased the level of acceptance of poultry products. In the recent livestock census the total poultry population increased by 16.8% over previous census. Now India is the 3rd largest producer of eggs and 4th largest producer of chicken in the world (FAO, 2016) [13]. Poultry products are not only a good source of protein in the diet of human being but also have a good income augmenting power because of lower expenses in rearing (Demeke, 2003) [10]. The feed cost accounts for an expensive input of 70-80 per cent of broiler production cost (Akdeniz *et al.*, 2006) [2]. For smooth feeding management poultry nutritionist formulating a high standard feed ration along with some changes which will improve the feed efficiency of bird.The aim of use of various feed additives is to advance the growth cycle, improve production capacity, resistant to fatal disease and economical feed utilization. Better metabolism of nutrient, streamlined feed utilization and advanced growth are the characteristics of good feed additive (Church and Pond, 1988) [9]. Ginger (*Zingiber officinale*) is famous as folk medicine and the properties present in ginger have antimicrobial, antioxidative and pharmacological effects (Ali *et al.*, 2008) [3]. Ginger can be anticipated as the best potential alternate to synthetic antibiotic growth promoter (Karangiya *et al.*, 2016) [15]. Glucosinolate, sterols and triterpenes found in ginger have carminative and diuretic properties (Al-Yahya, 1986) [5]. Improved histological gut health and antilipidemic properties were shown in the bird with ginger inclusion @ 6 g/kg diet (Shewita and Taha, 2018) [18]. Powdered form of ginger inclusion in diet@ 0.5% showed a significant decrease in serum cholesterol in broiler (Zhang *et al.*, 2009) [20].

Materials and Methods

The present research was conducted in college of veterinary science and animal husbandry, OUAT, Bhubaneswar, Odisha, India between February 1 and March 14, 2020 by taking one hundred twenty numbers of day old black rock broiler chicks were distributed to 04 groups having 30 birds in each. Each group consists of three replicates with 10 birds in each replicate. Feeding regiments were presented in Table 1.

Table 1: Dietary treatments of the experimental birds

Group	Dietary treatments
T_1	Basal Diet
T_2	Standard broiler ration+ginger powder @ 0.5%
T_3	Standard broiler ration+ ginger powder@ 1%
T_4	Standard broiler ration+ ginger powder@1.5%

*The required ginger was supplemented to the birds through feed.

The basal diets were prepared as per the BIS (2007) standards [8]. The freshly purchased ginger was washed and sliced. The sliced form of ginger was sun dried ground and stored in poly bags. The gingers offered to the birds wereanalysed for proximate principles as per A.O.A.C (1995) [6]. The chemical composition of the ginger was presented in Table 2.

Table 2: Composition of ginger (% DM basis)

Sl no.	Attributes	Ginger
1	Moisture	73.82
2	Dry Matter	26.18
3	Crude Fat	5.03
4	Crude Protein	8.16
5	Total Ash	2.91
6	Crude Fibre	2.88
7	Nitrogen free Extract*	81.02

* Calculated value

At the initiation of the trial, the experimental shed was cleaned and disinfected. The pathogenic organisms present in the experimental shed were destroyed by using the flame gun. Malathion (1%), formalin (10%) was sprayed outside the poultry house. Feeders and waterers were thoroughly washed with the help of potassium permanganate. Chicks procured from Central Poultry Development Organisation (CPDO) were weighed and wing banded on the first day of the experiment. By adopting a deep litter system of housing litter materials, feeding and watering facility were kept ready before the arrival of chicks. Clean drinking water was provided throughout the day. From 0-2 weeks, an electric bulb was provided in sufficient quantity to maintain brooding temperature. The feeding schedule was categorized into three phases: prestarter phase (1^{st}-14^{th}day), starter phase (15^{th}-24^{th}day) and finisher phase (25^{th}-42^{nd}day).

Estimation of hemoglobin was carried out as per Schalm *et al.* (1975) by using Hellige and Sahli's haemoglobinometer. PCV was estimated by using microhaematocrit method [17]. Proper mixing blood was filled in the thin capillary tube followed by centrifugation with help of microhaematocrit centrifuge machine at 1200 Rpm for 2-3 minutes. Reading of the tube was done by observing the height of red cell layer. Total red blood cell was estimated by using a hemocytometer. With the help of an RBC pipette, blood was drawn up to 0.5 marks followed by RBC diluting fluid up to 101 marks. After proper rotating by keeping it between the fingers, the solution was charged in the counting chamber. After properly settled down, erythrocyte were counted in five squares. The counted number multiplied by 50 gave the TLC (10^6 cells/ mm^3).

MCV is expressed as femtoliters and calculated as follows:

MCV = (PCV ÷ TEC) x 10

MCHC is calculated as follows:

MCHC = (Haemoglobin÷ PCV) X100

Cellular immunity was measured as Cutaneous Basophillc Hyper Sensitivity (CBH) test as per Edelman *et al*. (1986) [12]. Six birds from each group were injected intradermally into the foot web with 100 microgram of Phytohaemaglutinin-P (PHAP) on 42^{nd}day of the experiment. Thickness of foot web before and 24hr after injection was measured with help of digital slide calliper.

$$\text{CBH response} = \frac{\text{Post injection skin thickness}}{\text{Pre-injection thickness}} \text{ X } 100$$

Humoral immunity was measured as per Abdallah *et al.* (2009) following hemagluttination test [1]. Birds were immunized with sheep red blood cells on 42^{nd} day for measurement of primary response. Blood collected after seven days were analysed to measure the antibody titre by using microtiter plate U shape of 96 wells. All HA antibody titres were expressed as $\log_2$ of the reciprocal of the highest serum dilution causing agglutination of sheep RBC.IBM SPSS software (version 22.0) was used to analyze the data by using ANOVA [19].

Results and Discussion

The haematological parameters like Hb, PCV, TEC, TLC, MCV and MCHC at 6^{th} week of age of birds are presented in Table 3.No significant difference between the groups for any of the parameters was noticed. The present result was similar to those of Zomrawi *et al.* (2012) and Zomrawi *et al.* (2013) who detected blood parameters remaining unaffected in ginger supplementation to Hb, RBC and PCV percentages [21, 22]. However contradictory results were revealed by Moramadhi *et al.* (2010) who observed a significant increase (P<0.05) in haemoglobin concentration and packed cell volume in the treatment group as compared to the control [4].

Table 3: Hematological parameters of broiler birds (42^{nd} day)

Parameters	Treatments				p value
	T_1	T_2	T_3	T_4	
Hb (%)	9.80±0.21	9.44±0.06	9.50±0.17	9.68±0.17	0.424
PCV (%)	30.68±1.57	28.36±1.10	28.42±1.70	28.61±0.80	0.575
TEC ($\times 10^6$ /µl)	2.90±0.24	2.72±0.12	2.80±0.22	2.82±0.16	0.931
TLC ($\times 10^3$ /µl)	19.53±1.67	20.05±1.96	19.90±1.94	19.55±1.92	0.251
MCV (fl)	109.52±12.34	104.26±1.67	105.47±13.57	102.96±7.35	0.969
MCHC %	32.40±2.35	33.51±1.36	33.79±1.61	33.88±0.63	0.91

Serum biochemical parameters viz., glucose, total protein, albumin, globulin, A/G ratio, urea, creatinine, cholesterol, triglycerides, ALT, AST, HDL, LDL at 6th week of Black rock broiler birds are depicted in Table 4. The mean serum glucose, total protein, albumin and globulin levels remain unaffected in ginger treatments. The present study is in correlation with the findings of Ebrahimnezhad *et al.* (2014) [11]. Similarly, Jamel *et al.* (2010) found a non-significant difference in serum total protein, globulin, and albumin in broilers supplemented with ginger [14]. The cholesterol and triglyceride values varied significantly (p<0.05) among the treatments. This finding was in accordance with the results of Bhandari *et al.* (2005) who found that ethanolic extract of ginger not only significantly reduced the serum cholesterol and triglycerides but also shot up the high density lipid (HDL) cholesterol with a dynamic protective effect on lipid peroxidation of the tissue in diabetic rats [7].

Table 4: Serum biochemical profile of broiler birds (42nd Day)

Parameters	Treatments				p value
	T_1	T_2	T_3	T_4	
Glucose (mg/dl)	180.42±6.69	176.66±7.61	182.05±7.97	176.22±6.24	0.922
Total protein (g/dl)	3.55±0.29	3.61±0.22	3.42±0.13	4.07±0.38	0.405
Albumin (g/dl)	1.79±0.01	1.98±0.05	1.78±0.05	2.04±0.21	0.310
Globulin (g/dl)	1.75±0.28	1.62±0.19	1.64±0.10	2.03±0.31	0.614
A:G	1.21±0.30	1.29±0.15	1.09±0.06	1.07±0.16	0.845
Urea (mg/dl)	21.78±1.91	20.12±2.12	18.67±3.79	19.23±3.56	0.889
Creatinine (mg/dl)	0.38±0.06	0.39±0.03	0.33±0.10	0.39±0.09	0.944
Uric acid(mg/dl)	4.94±0.90	4.37±0.71	4.60±0.57	3.74±0.48	0.657
Cholesterol (mg/dl)	163.83^{b}±3.43	144.18^{ab}±5.05	137.26^{a}±4.27	129.43^{a}±2.87	<0.01**
Triglyceride (mg/dl)	54.73^{d}±2.85	46.99^{c}±2.61	41.34^{b}±1.04	35.18^{a}±1.18	<0.01**

^{abc}Values showing different superscripts in a row differ significantly (P<0.05)
*p<0.05, **p<0.01

The antibody titres (log_2) against SRBC inoculation and CBH response at 42nd day of age of experimented birds are depicted in Table 5. The present research result has shown conspicuous enhancement in immunity status in 1% treated birds, when tested with foot pad infusion of PHA-P and subsequent swelling thickness estimation. The antibody production against sheep RBC was significantly higher in treated birds than in control. The significant response to foreign antigen might be attributable to the T lymphocyte increase and antigen representing cell helper -T cells. Contents of ginger might be responsible for foreign antigen attack and significant response upon injection of the agent. Establishment of stable intestinal ecosystem of micro-flora in the intestine might be responsible for the CBH response so intense and significant. Similarly, antibody titre finding showed that supplementation of ginger in the diet of birds enhanced the humoral immunity of birds. Pathogens induce restraint to low gastric pH and rapid transit out of the digestive tract were the cause behind establishment of infection through colonization, and additives like herbal extracts of ginger intensified the host cell mediated immune system (Patterson and Burkholder, 2003) [16].

Table 5: Immunity status of broiler birds (6th week)

Parameters	Treatments				P value
	T_1	T_2	T_3	T_4	
SRBC	0.81^{a}±0.04	1.47^{b}±0.07	1.68^{c}±0.21	1.53^{c}±0.05	<0.01**
CBH	133.32^{a}±11.09	181.96^{b}±4.79	186.90^{c}±4.18	185.86^{c}±5.24	<0.01**

^{abc}Values bearing different superscripts in a row differ significantly (P<0.05)
*p<0.05, **p<0.01

Conclusion

The results of the research signify that supplementation of ginger @ 1% in the diet enhanced the immunity and decreased the total cholesterol and triglycerides in Black rock bird.

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