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Original Research Article

Comparative Evaluation of Blood Biochemical and Haematological Parameters Along With Immune Status of Vanaraja Birds under Different Systems of Rearing

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A B S T R A C T

Day old Vanaraja chicks (n=150) were selected and reared for a period of 8 weeks to assess the effect of concentrate mixture supplementation on blood picture and immunity status in different system of rearing. Birds were divided into three groups (I, II and III) having 50 birds in each group. Group I was kept in intensive system, with supplementation of concentrate mixture as per the per BIS specifications (1992) for broilers throughout the experiment. Group II was reared under semi-intensive system, where birds are provided with 50% of concentrate mixture, with small house and also they were left open for scavenging. Group III birds were kept in backyard system where the birds are kept in farmer's home left open whole day without concentrate mixture. Blood collection was done at the end of the experiment for assessment of blood biochemical constituents (Glucose, cholesterol, total protein, albumin, globulin) and the haematological parameters (Hb, TEC, TLC, PCV, MCV and MCH). Cell mediated Immunity and humoral immunity of the supplemented birds were studied at the end of the experiment. The haematology value (Hb, TEC, PCV) of the birds were found to be significantly ($p<0.05$) higher) in group III. Among blood biochemicals, serum cholesterol and glucose concentration were significantly ($P<0.05$) lower in extensive system of rearing i.e. group III than other groups. The immunity status of the birds were found to increased significantly ($P<0.05$) with respect to humoral immunity and cell mediated immunity in group II and group III. From the results it can be concluded that extensive system of rearing produced low cholesterol meat with high immune response.

Keywords

Vanaraja, immunity, haematology, blood biochemical, rearing systems

Introduction

Poultry production has been traditionally practiced in many developing countries for many generations as an important source of nutrition and sustainable income (Anderson, 2011).

Poultry kept on different rearing and management systems contribute to the cash income of the rural families. Increasing the genetic potential of the local native chicken varieties greatly helps in increasing the

availability of poultry meat and eggs in rural areas. Therefore, now a days rural poultry farming involves rearing of improved chicken varieties under free range, semi intensive or intensive conditions (Buragohain *et al.,* 2007), which encourages rearing of low input technology birds like Vanaraja, Giriraja, Girirani, Atulya, Gramalaxmi, Krishilayer, Gramapria, CARI Gold, Kalinga Brown and many more.

Vanaraja chicken was developed by crossing random bred meat control population as the female line and Red Cornish population as the male line at Project Directorate on Poultry, Hyderabad (Rao *et al.,* 2006). It is characterized by attractive-multicolour feather pattern with better immune competence. It grows faster, produces tender meat and gives brown shell eggs which are more desirable, therefore, it is better preferred in rural areas. Gyenis *et al.,* (2006) observed decreasing cholesterol levels in colored birds in backyard system of rearing. It shows different blood pictures and immunity status when they are reared with concentrate mixture in different systems, according to the specific demand of the today's life style and human needs. By simple interventions such as supplementation of concentrate mixture in indeginous birds can significantly enhance the survival, growth and production of chicken (Sarkar and Bell, 2006). Therefore keeping this in mind the experiment was designed to study the effect of different systems of rearing with concentrate feeding on blood biochemicals, haematological parameters and immunity status of Vanaraja birds.

Materials and Methods

A total 150 number of day old Vanaraja chicks were taken as experimental birds and divided in to 3 groups viz. I, II and III and randomly divided withb50 birds in each group. Initial body weight of chicks were recorded and group I birds were transferred to experimental shed of KVK, Shamakhunta, Mayurbhanj while group II and III chicks were distributed among the schedule tribe families for extensive and semi-intensive system of rearing. Intensive system of rearing was practised in the poultry farm of KVK itself with standard management and health care practices. The chicks were maintained in deep litter system of rearing. Experimental diets were offered as per the per BIS (1992) specification broilers from day old up to the end of experimental feeding period. In the back yard system the birds are kept in farmer's home left open whole day and in the semi intensive birds were provided with 50% of concentrate mixture, with small house and they were left open to scavenge for half of day. The ingredient and chemical composition of the experimental concentrate mixture for the birds is presented in the Table1. 5ml of Blood samples were collected from 10 birds of each treatment on 56^{th} day of the experiment by puncturing the wing vein with sterile syringes and needles (24-gauge). The blood samples after collection were transferred into sterile tubes, 2ml with anticoagulant for haematological parameters analysis and 3ml without any anticoagulant for biochemical parameter which are kept for 3 hours in slanting position. Samples were centrifuged at 5000 rpm for 10 minutes at 4ºC. Sera were collected by 1 ml auto-pipette. The collected sera samples were stored in deep freeze at -20°C in properly capped and labelled tubes for serum biochemical and immunological studies. The serum glucose, cholesterol, total protein, albumin, globulin were determined by following the procedures described in the respective reagent kits supplied by Crest Biosystem (Goa, India).

At the end of the experiment, three birds

from each replicate in each dietary treatment were injected intra-dermally in the comb with 100 micro gram of Phytohaemaglutinin-P (PHAP) in 0.1 ml of normal saline to measure the cellular immune response by Cutaneous Basophillc Hyper Sensitivity (CBH) test (Edelman *et al.,* 1986). The normal thickness of the comb and thickness 12 hrs, 24 hrs, 36 hrs of post injection were measured by using a digital slide caliper (Mitituyo, Japan) to estimate the cellular immunity. The measure of humoral immunity was carried out as per the method described by Abdallah *et al.,* (2009). Sheep red blood cells (SRBC) were used as test antigens to quantitatively analyse specific antibody response as measure of humoral immunity. Weight of the lymphoid organs has also recorded by sacrificing the above birds. Data were statistically analysed in SPSS (version 20.0) computer program using one-way ANOVA for more than 2 groups of observations. Multiple comparisons were also made by Duncan's Multiple Range Tests (Duncan 1955).

Results and Discussion

Serum biochemical parameters of Vanaraja birds in different system of rearing at 8th week of age are presented in Table 2. The average levels of serum total protein (g/dl) ranged from 3.13±0.39 to 4.10±0.24, serum albumin (g/dl) ranged from 2.04±0.16 to 2.26±0.16 and serum globulin (g/dl) ranged from 1.09±0.15 to 1.84±0.12 in different rearing system showing highest value in group III, followed by group II and group I birds. The average levels of serum glucose (mg/dl) and serum cholesterol (mg/dl) in group III birds were significantly lower (161.44±1.56 and 172.14±3.39, respectively) as compared to birds of in group I (169.96±0.43 and 196.78±0.59, respectively). These results were in accordance to the findings of Panigrahy *et al.,* (2017) who reported similar trends on glucose, total protein, albumin, globulin, cholesterol of Vanaraja birds in intensive rearing system. Similarly, Abdi-hachesoo *et al.,* (2013) also studied the he blood biochemical parameters of indigenous local scavenging type breed of Iran. They found the parameters to be within the following range; total protein (g/dl) 3.87 ±.70 to 5.22 ± 0.46, albumin (g/dl) 2.77±.70 to 4.12 ± 0.46, triglyceride (mg/dl) 79.20 ± 14.57 to 64.80 ± 13.28 and cholesterol (mg/dl) 167.60 ± 35.68 to 152.60 ± 28.11, but they found higher level of Glucose (mg/dl) 260.60 ± 35.68 to 245.60 ± 28.11.which are in accordance with present results. Albokhadaim *et al.,* (2012) also reported similar results in local chickens for triglyceride and cholesterol concentrations of 79.2 mg/dl and 167.6 mg/dl in males 64.8 mg/dl and 152.6 mg/dl in females respectively, However, they found contradicted our results by presenting glucose 260.6 mg/dl for males, and 245.6 mg/dl for females in local Saudi chickens, with no significant difference between male and females. This might be due to difference in species and local environmental conditions. Present findings are in agreement with results of Kaneko (2008) who reported glucose and cholesterol in chicken to be 167.8 mg/dl and 183.8 mg/dl respectively in intensive conditions. All these variations in serum parameters may be due to the effect of exercise in different rearing systems.

Among haematological parameters which are presented in Table 3. The packed cell volume (%) of groups were found to be vary in between 36.81±1.36 to. 38.53±1.35, the mean haemoglobin (g/dl) of all the treatment groups ranged from 9.40±0.23 to 12.78±0.21with significantly higher in group III.

Table.1 Ingredient (%) and chemical composition of starter and finisher diets for Vanaraja birds

Ingredient	**Starter (%)**	**Finisher (%)**
Maize	52.0	59.00
Soya bean meal	41.0	33.00
DORB	4.0	5.00
Mineral mixture	2.70	2.70
Common salt	0.30	0.30
Components		
Moisture	9.74	10.10
CP	22.75	20.09
Ether extract	2.10	2.17
Crude fibre	4.20	3.93
Total ash	9.40	9.55
Acid insoluble ash	2.50	2.67
Nitrogen free extract*	61.55	64.26
Metabolisable energy*(kcal/kg)	2790	2895

*Calculated value

Table.2 Serum biochemical parameters of Vanaraja birds in different treatment groups

Parameters	**Group**			**P value**
	I	**II**	**III**	
Total protein(g/dl)	3.13^{a}±0.39	3.88^{b}±0.14	4.10^{c}±0.24	0.012
Albumin(g/dl)	2.04±0.16	2.14±0.07	2.26±0.16	0.070
Globulin (g/dl)	1.09^{a}±0.15	1.74^{b}±0.15	1.84^{b}±0.12	0.042
A/G ratio*	1.65±0.25	1.74±0.14	1.86±0.12	0.012
Glucose(mg/dl)	169.96^{b}±0.43	168.48^{b}±0.58	161.44^{a}±1.56	0.037
Cholesterol(mg/dl)	196.78^{b}±0.59	191.61^{b}±1.79	172.14^{a}±3.39	0.008

^{abc} Means with different superscripts in a row differ significantly (P<0.05)
*Calculated value

Table.3 Average hematological values of Vanaraja birds in different dietary treatments

Parameters	**Group**			**P value**
	I	**II**	**III**	
PCV (%)	36.81±1.36	37.86±1.32	38.53±1.35	0.110
Hemoglobin (g/dl)	9.40^{a}±0.23	11.20^{b}±0.22	12.78^{c}±0.21	0.040
TEC (X 10^{6}/ mm^{3})	2.16^{a}±0.03	2.28^{a}±0.01	2.45^{b}±0.05	0.007
TLC (X 10^{3}/ mm^{3}	53.34±0.47	52.71±0.40	54.34±0.50	0.072
MCV* (fl)	133.41±2.14	136.07±1.40	130.65±3.40	0.325
MCH* (%)	45.05^{a}±0.40	47.51^{b}±0.66	50.14^{c}±1.44	0.006

^{abc} Means with different superscripts in a row differ significantly (P<0.05)
* calculated value

Table.4 SRBC and CBH response of Vanaraja birds at 8th week of age in different treatment groups

Parameters	Group			P value
	I	II	III	
CBH	216.18[a]±12.75	284.07[b]±14.04	315.28[c]±16.51	0.021
SRBC	5.67[a]±0.88	8.33[b]±0.64	9.50[c]±0.84	<0.01

[abc] Values bearing different superscripts in a row differ significantly (P<0.05)

Table.5 Weight of lymphoid organs (percentage of live weight) under different rearing system

Organs	Group			P value
	I	II	III	
Spleen	0.23[a]±0.02	0.25[a]±0.01	0.32[b]±0.01	0.040
Bursa	0.15± 0.01	0.16±0.02	0.18±0.01	0.155
Thymus	0.44[a]±0.03	0.55[b]±0.05	0.58[b]±0.06	0.039

[abc] Values bearing different superscripts in a row differ significantly (P<0.05)

The TEC and MCH values were significantly higher in group III than group I and II birds. Though TLC and MCV values do not vary significantly, but numerically in group III highest value was observed. In accordance to our findings, Panigrahy *et al.*, (2017) in a study on haematological parameters of Vanaraja birds in different seasons they found that TEC ($\times 10^6$/mm^3) in male and female birds were 2.96±0.13 and 1.62±0.12, 2.59±0.09 and 1.29±0.06, respectively in summer and winter season. All other parameters like Hb (g/dl), TLC ($\times 10^3$/mm^3), MCH% and MCV (fl) in summer were similar to our findings, it might be due the seasonal and health conditions of the bird. Similarly Kundu *et al.*, (2013) reported the RBC ($\times 10^6$/mm^3), PCV (%) and Hb (g/dl) concentration of Vanaraja birds in the tropical climate were in range of 0.84±0.23 to 1.53±0.22, 101.17±1.71 to 104.93±0.59 and 16.17±2.19 to 12.98±0.94, respectively. The WBC count was found to be in higher a range of (138.18±25.54 to 158.02±8.02) x 10^3/microliter for Vanaraja birds in hot humid tropical climate of Andaman and nicobar island. Prahsanth *et al.*, (2012) and Biswas *et al.*, (2011) found that the haematological parameters like TEC ($\times 10^6$/mm^3), TLC ($\times 10^3$/mm^3), Hb(g/dl), and PCV(%) values of domestic birds were 2.68±0.06 to 3.01±0.08, 13.58±1.98 to 14.33±1.75, 11.46±0.47 to 11.75±0.95 and 34.05±1.11 to 35.61±1.13 respectively at 5 weeks of age which corresponds to our findings. Ipek and Sahan (2006) also found that at 5 week of age, cold stress caused significant changes in PCV, Hb, RBC concentrations in broiler birds. The variation in the haematological parameters findings were might be due to the physiological conditions and housing of birds or seasonal effect.

Immunity

SRBC and CBH response of Vanaraja birds at 8th week of age are presented in table 4. The antibody titres (log_2) against SRBC inoculation of 8th week Vanaraja birds were 5.67±0.88 in group I, 8.33±0.88 in group II and 9.50±0.84 in group III birds. CBH response was calculated by thickness index which were 216.18±2.75 in group I, 284.07±14.04 in group II and 315.28±16.51in group III birds. It is evident from the results that the group III birds

exhibited significantly higher immune response then other birds. All these findings were in accordance to the findings of Reddy *et al.,* (2002), where antibody titres in response to SRBC inoculation and thickness index in response to PHA-P inoculation was done in three ages of Vanaraja birds and result were found to be 9.33 ± 0.66 in 28 days, 8.50 ± 0.22 in 42 days and 9.66 ± 0.42 in 56 days response to SRBC inoculation, while 312.11±35.76 in 28 days, 326.06 ± 17.69 in 42 days and 327.33 ± 2 I.89 towards response PHA-P inoculation. And they again reported that Vanaraja had the highest antibody titres than those of genotype Gramapriya and Krishibro. Vanaraja birds can be used for family poultry production as these birds can survive better in adverse environmental conditions because of their inherent qualities for better resistance against *E.coli*, higher humoral response against SRBC and higher CBH response to PHA-P.

The average weights of lymphoid organs viz., spleen, bursa and thymus of Vanaraja birds are presented in table 5. Which are expressed as percentage of their live weight of 8th week old Vanaraja birds ranged from 0.23±0.02 to 0.32±0.01, 0.15±0.01 to 0.18±0.01 and 0.44±0.03 to 0.58±0.06, respectively under different rearing conditions. Similar findings were reported by Kumar *et al.,* (2012) in intensive rearing of Vanaraja birds. The relative weight of spleen and thymus of Vanaraja birds in group III were significantly ($P<0.05$) higher as compared to other treatments. These all higher immunity responses may be due to adaptation and exposure to the outer environment through extensive rearing system.

From the present experiment, it can be concluded that extensive system of rearing have upper hand over semi intensive and intensive with respect to meat quality as significantly lower blood glucose and cholesterol concentration, along with significantly higher total protein and globulin concentration in serum of birds were observed in extensive system of rearing. Apart from that there was significantly higher immune response of birds reared in extensive system of rearing with respect to both cellular and humoral immunity.

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