

# Comparative Haematology And Biochemical Parametr Of Indigenous And Broiler Chicken

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**Abstract:** This study focuses on analysing comparative haematology and serum-biochemical parameters of indigenous Vanaraja and broiler chicken. For this investigation two different breeds of chicken such as; Indigenous Vanaraja chicken and broiler chicken were used as the experimental birds. The haematological parameters includes White Blood Cell (WBC), Red Blood Cell (RBC), Haemoglobin (Hb), Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), Erythrocyte Sedimentation Rate (ESR) and Differential Leukocyte Count (DLC) whereas the biochemical parameters includes albumin, globulin, cholesterol, glucose etc. The WBC value of both the species was statistically different from each other and was significant at  $p < 0.01$ . The RBC value was statistically non-significant in the breeds. The Hb concentration, PCV, MCV and MCH value was higher in case of Indigenous Vanaraja chicken than the broiler chicken and was statistically significant at  $p < 0.001$ . However the MCHC value was non-significant for both the breeds. The Lymphocyte count was higher in Broiler chicken than the Indigenous Vanaraja chicken and was significant at  $p < 0.01$ , the Heterophil count was non-significant, Monocyte count was non-significant at  $p > 0.05$ , Eosinophil count was statistically significant at  $p < 0.01$  and the Basophil count was non-significant at  $p > 0.05$ . There was no significant difference seen in between both indigenous and broiler for the Total protein concentration. The serum albumin concentration was significant at ( $P = 0.05$ ). The concentration of different serum constituents of broiler and indigenous chickens was significant at ( $P = 0.001$ ). Cholesterol content in broiler was significantly higher than indigenous chickens at ( $P < 0.001$ ). Serum globulin concentration in the broiler and indigenous was non-significant at ( $P > 0.05$ ). Ratio of concentration of serum albumin/globulin in broiler and indigenous was non-significant at ( $P > 0.05$ ). The above study suggested the highest rank of Haemoglobin concentration in Vanaraja chicken, because it is more active than Broiler chicken and the oxygen consumption rate is more. The haematological parameters differs from each other in both the breeds due to the several factors such as; low immunity, environmental factors, change in number, size and shape of blood cell. The genetic traits also have effect on the haematological parameters of both the types of birds. High serum albumin was caused by dehydration. The high or low glucose level was due to may be due to the consumption of diet rich in grain.

**Keywords:** Haematological parameter, Indigenous, Broiler, Haemoglobin, WBC

## 1. INTRODUCTION

Poultry birds provide humans with companionship, food in the form egg, meat and feather. Poultry products such as egg and meat are major source of proteins in human diet as well as it have various effects on the national economy of many countries all over the world [1]. Poultry plays an important role to solve unemployment; it may act as a source of income, it used as a food source, helps to earn money. Chicken is the most domesticated poultry bird in the globe. As those poultry birds are found every region of world they may affected by various diseases according to change in climatic condition, altitude, hormonal changes, change in temperature; hence it is necessary to identify the diseases. Different breeds of chickens may vary from each other according to their haematological and biochemical values. The present experiment aimed to collect the information about the haemato-biochemical values of Indigenous Vanaraja and Broiler chicken. Vanaraja chicken is a type of Indigenous breed chicken found in most region of India. Blood plays major role in transporting nutrients, metabolic waste products and gases in all over the body [2]. Blood act as an indicator for clinical and nutritional health status of animals [3].

For studying the nutritional values, the haemato-biochemical profiles are most commonly used for chickens [4]. Blood parameters are helpful to provide the normal values for haematological and biochemical factors of domestic birds [5]. Those values were measured and a broad data base was presented according to their blood profiles. The analysis of blood parameters can be done based upon these normal values, which can evaluate the immune status of poultry birds [6] and diagnosis of disease [7]. Haematological values have values of birds can be affected by several factors such as age, gender, hormones and environmental conditions [8]. This study is planned to evaluate differences in the haematological and sero-biochemical profiles of the indigenous Vanaraja chicken breeds and broiler.

## 2. MATERIALS AND METHODS

### EXPERIMENTAL SITE

This experiment was carried out from January to March 2019 at Centurion University of Technology and Management, Bhubaneswar, Odisha.

### EXPERIMENTAL BIRDS AND MANAGEMENT

A mature indigenous chickens i.e., Vanaraja was selected for this study, which was kept in the poultry farm of Centurion University, Bhubaneswar campus and a broiler chicken was collected from a nearby located poultry farm. The birds were obtained with their normal diet and environmental conditions.

### DATA COLLECTION

Blood samples for the all the experimental analysis were collected from the two different species of chickens (Vanaraja and Broiler). Blood samples were collected from the respective chickens by venipuncture of right side jugular

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vein by the help of a veterinary doctor. Blood samples were drawn by a gauge needle being fixed with 2ml syringe (Dispo van, 26x1/2, 0.45x13mm, manufactured by: Hindustan syringe and medical devices Ltd., Ballabgarh, Faridabad, India-121004). The samples were immediately transferred in to a 2ml vials contained Ethylene diaminetetra acetic acid (EDTA anti-coagulant) and then thoroughly shaking to mix the blood sample with the EDTA for the haematological test. Blood samples were marked according to types of species (2ml, XLNCA-E3K2,). As well as for biochemical test blood sample was collected and placed in an appendorf tube.

### HAEMATOLOGICAL ANALYSIS

The haematological analysis was done to know the blood cell characteristics and to determine all the haematological values. Blood samples were collected by the EDTA. Neubauer's haemocytometer was used for counting Red Blood Cell (RBC) and White Blood Cell (WBC). Haemoglobin (Hb) concentration was estimated by the haemometer and Packed Cell Volume (PCV) was determined using the microhaematocrit method [9]. Differential leukocyte count and RBC, WBC counting was done by the compound microscope. The Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated as per the formula.

### SERUM BIOCHEMICAL ANALYSIS

For biochemical analyses, serum was utilized which was collected immediately after the collection of blood by centrifuging the blood at 5,000 rpm for five minutes. From the obtained serum, biochemical parameters like protein, albumin, glucose and cholesterol were estimated using commercial kits (Coral Clinical Systems, Verna Industrial Estate, Verna, and Goa, India). The concentration of albumin was assayed spectrophotometrically at 630 nm and was calculated by using the formula; Albumin in g/dl = Absorbance of test sample / Absorbance of standard x4 [10]. The concentration of glucose was determined by Glucose oxidase peroxidase (GOD/POD) method by using the formula; Glucose in mg/dl = Absorbance of test sample / Absorbance of standard x100 [11]. The amount of cholesterol is determined by the Cholesterol oxidase and Phenol4-aminoantipyrine (CHOD/PAP) method by using the formula Cholesterol in mg/dl = Absorbance of test sample / Absorbance of standard x200 [12]. The concentration of protein was determined by mixing 1.0 ml of biuret reagent with 0.02 ml of serum sample followed by incubation for 10 minutes by using the equation; Proteins in g/dl = Absorbance of test sample / Absorbance of standard x8 [13].

### STATISTICAL ANALYSIS

The given results were obtained by statistically analysis of the data. The haematological parameters were expressed as mean  $\pm$  SE in both the breed chicken i.e., Vanaraja and broiler using the Microsoft Office Excel 2010. Comparison of Haematological parameters of Vanaraja and broiler chicken was performed in excel sheet by using t-test: Two-Sample Assuming Equal Variances. Differences were classified as significant at  $p < 0.05$ ,  $p < 0.01$ ,  $p < 0.001$ .

### RESULT AND DISCUSSION

The haematological and biochemical parameters of indigenous chicken i.e., Vanaraja and broiler were tested to know the differences between the haematological parameters and the biochemical parameters of the two different species.

### HAEMATOLOGICAL ANALYSIS

The table obtained all the blood related parameters such as; Total RBC counting, Total WBC counting, haemoglobin test, PCV, MCV, MCH, MCHC, ESR etc. (Table 1).

### TWBC (TOTAL WHITE BLOOD CELLS)

The result indicates that Total White Blood Cells (TWBCs) ranges from  $20657.8 \pm 1317.382$  to  $25554.7 \pm 1599.756$  for indigenous breed of chicken and broiler chicken respectively which was significantly differs from each other ( $p < 0.01$ ) (Table 1). The TWBCs of broiler was significantly higher than the TWBCs of indigenous Vanarajachicken. The white blood cell has an important role in immune system. When any bacteria, virus, fungi or any kind of foreign particle enters to body WBC can recognise it and protects body by fighting against it. WBC can destroy the foreign particle before it causes any disease. As infection-causing bacteria or viruses multiply in the blood; bone marrow produces more white blood cells to fight off the infection. Any type of emotional or physical stress can also cause increase the number of white blood cell counts.

### TRBC (TOTAL RED BLOOD CELLS)

The total Red Blood Cell values were not statistically different from each other. The TRBC values differs from  $2.04 \pm 0.045216$  to  $2.19 \pm 0.113969$  for indigenous Vanaraja and broiler chicken respectively which was not significantly differs from each other ( $p > 0.05$ ). The TRBCs were higher in case of Broiler than the indigenous chicken breed (Table 1).

### HAEMOGLOBIN ESTIMATION

The haemoglobin concentration of both the species was significantly different from each other at p value ( $p < 0.001$ ). The haemoglobin value ranges from  $8.3 \pm 0.265832$  to  $5.38 \pm 0.145144$  for indigenous Vanaraja and broiler chicken respectively which also statistically differs from each other (Table 1). The haemoglobin concentration was higher in indigenous Vanaraja chicken than the broiler chicken. The result suggested that the different types of breeds in accordance with the oxygen consumption rate have various effects on the haemoglobin concentration of Vanaraja and broiler respectively than other factors.

### PCV (PACKED CELL VOLUME)

For PCV value with respect to different breeds, the result indicated significant difference at p value of ( $p < 0.001$ ). The value of PCV for the two different breeds ranges from  $24.93 \pm 0.81922$  to  $16.19 \pm 0.442832$  for indigenous Vanaraja chicken and Broiler chicken respectively (Table 1). The PCV values were higher in Vanaraja chicken than the broiler chicken. The difference was very large and was statistical different from each other. The different birds have different PCV value which is due to several variables such as; difference in age, reproductive status, geographical elevation, season, parasitism and nutritional status. It is

difficult to consider any single parameter which may change the PCV value.

### MCV (MEAN CORPUSCULAR VOLUME)

The MCV value for the two different breeds was ranges from  $122.8715 \pm 5.064627$  to  $76.37782 \pm 5.863983$  for indigenous Vanaraja and broiler chicken respectively. The MCV values were significantly different from each other with the p value ( $P < 0.001$ ) which was statistically differ from each other. MCV value was higher in Vanaraja than Broiler (Table 1).

### MCH (MEAN CORPUSCULAR HAEMOGLOBIN)

The result showed that the Mean Corpuscular Volume was varies from  $40.88051 \pm 1.578331$  to  $25.37155 \pm 1.934761$  for the indigenous Vanaraja and broiler chicken respectively. The MCH value was significantly differ from each other with having p value ( $p < 0.001$ ) (Table 1).

### MCHC (MEAN CORPUSCULAR HAEMOGLOBIN CONCENTRATION)

For mean corpuscular haemoglobin concentration (MCHC), the values are non-significant at p value of ( $p > 0.5$ ). The MCHC value ranges from  $33.30568 \pm 0.119948$  to  $33.23529 \pm 0.098039$  for indigenous Vanaraja and broiler chicken respectively which is statistically non-significant (Table 1).

### ESR (ERYTHROCYTE SEDIMENTATION RATE)

The ESR value ranges from  $2.64 \pm 0.265916$  to  $2.45 \pm 0.292973$  for Vanaraja and Broiler chicken respectively. The value was statistically non-significant at  $p > 0.01$  (Table 1).

### DLC (DIFFERENTIAL LEUKOCYTE TEST)

The value of lymphocyte were varies from  $68.4 \pm 1.351542$  to  $72.6 \pm 0.805536$  for indigenous Vanaraja and broiler chicken breeds. The lymphocyte value was higher in broiler than the Indigenous Vanaraja chicken breed. The Value was significantly different from each other with p value of ( $p < 0.1$ ) (Table 2). For the number heterophil of different breeds there was a non-significant value with p value of ( $p < 0.05$ ). The value of heterophil was ranges from  $15.3 \pm 1.106044$  to  $15.7 \pm 1.145523$  for Vanarajand broiler respectively which was not statistical different from each other. The value of monocyte was ranges from  $10 \pm 1.619328$  to  $6.7 \pm 1.535144$  for indigenous Vanaraja and broiler chicken breeds. The value was not statistically significant at  $p > 0.05$ . For the value of eosinophil of different breeds there was significant different values with p value of ( $p < 0.001$ ). The value of eosinophil ranges from  $4.2 \pm 0.2$  to  $3.2 \pm 0.133333$  for the indigenous Vanaraja chicken and broiler chicken respectively. The value of basophil for two species of chicken were varies from  $2.1 \pm 0.179505$  to  $1.8 \pm 0.133333$  which was not statistically significant (Table 2) (Fig.1).

### SERUM BIOCHEMICAL ANALYSIS

All the biochemical parameters are albumin, globulin, cholesterol, glucose etc. (Table 3).

### PROTEIN

Total protein concentration in the broiler was found that ( $3.806 \pm 0.196611$ ) g/dl and concentration in indigenous chickens had ( $4.14 \pm 0.2502$ ) g/dl (Table 3). There was no significant difference seen in between both indigenous and broiler.

As ( $P > 0.05$ ), so here no significant value seen in between broiler and indigenous. But High protein foods can help to reach at fitness goals. Protein is much required for a healthy body. Serum proteins are divided into two groups, albumin and globulin [14]. Proteins act as a transporter of hormones, vitamins, minerals, lipids and other materials. In addition proteins help to balance the osmotic pressure of the blood tissue. Most of the circulating cholesterol is carried in birds by high density lipoprotein cholesterol ( $\alpha$ -2globulin fraction) and LDL ( $\beta$ -globulin fraction) [15].

### ALBUMIN

The serum albumin concentration is significant ( $P = 0.05$ ) and serum albumin concentration in indigenous was found ( $2.168 \pm 0.1549$ g/dl) and in broiler it was ( $1.74 \pm 0.188679623$ g/dl) (Table 3). Here significant value was found. Albumin is may influenced by environment, breed, age, physiological state, and antigen exposure. When protein intake exceeds the amount required for growth and maintenance serum albumin is also increase. Albumin is an important protein in blood. Storage of protein in the white material of egg is also a type of albumin. [16]. It helps to repair body tissue, builds enzymes and hormones and assists in clotting blood. By the consumption of more amount of protein increases the amount of albumin levels. Serum albumin produced from liver and forms a proportion of plasma protein. Even human serum albumin normally constitutes about 50% of plasma protein. Low albumin may be caused by liver disease, malnutrition, late pregnancy, genetic variations. High is caused by dehydration [16].

### 3. III.3 GLUCOSE

The concentration of different serum constituents (Mean  $\pm$  SE) is presented in Table Broiler chickens had a significant value ( $P = 0.001$ ) glucose content ( $247.244 \pm 3.03768596$ mg/dl) than that of indigenous chickens ( $210.102 \pm 3.461288$ mg/dl) (Table 3). Here there was significant difference was seen in between broiler and indigenous chickens. It may be due to the consumption of diet rich in grain. Mainly glucose comes from food rich in carbohydrates. After consumption of tis it travels from esophagus to stomach and breakdown occurs by the help of acids and enzymes. During this process glucose is released [17]. Glucose production is more during the time of fasting and if during the time of blood puncturing from the chicken occurred during this period of time so a high rate of glucose production was seen. Blood glucose level may vary according to season [18]. High blood glucose level causes hyperglycemia. Low blood glucose level causes hypoglycemia. Diabetic patient should avoid meat in their plate as it contains sugar (Economic costs of diabetes in the U.S., 2007).

### CHOLESTEROL

Cholesterol content in broiler ( $170.626 \pm 3.018158$ mg/dl) was significantly ( $P < 0.001$ ) higher than indigenous chickens ( $146.444 \pm 2.284981$ mg/dl) (Table 3) So significant difference was seen in between both the chickens. Lower content of

cholesterol in indigenous chickens might be due to their high body activity. Cholesterol value differs significantly among breeds. Animal products also contain saturated fat which causes livers to manufacture even more cholesterol. Unsaturated fats do not have this effect. A vegetarian diet is the best way to avoid highcholesterol levels. Blood cholesterol is related to the fertilization as the body uses. Cholesterol to manufacture sex hormones like testosterone, estrogen etc. so if the collection of blood will happen at that time then it must show the high level of cholesterol. In animal cells manufacture cholesterol helps for both membrane structure and other uses, with relative production rates varying by cell type and organ function. About 80% of total cholesterol produces from liver and intestine and also includes adrenal glands and reproductive organs [19].

#### GLOBULIN

Serum globulin concentration in the broiler and indigenous was  $(1.994 \pm 0.300925 \text{g/dl})$  and  $(1.984 \pm 0.314461 \text{g/dl})$  respectively (Table 3). Here ( $P > 0.05$ ) so no significant difference was seen. Globulin percentage is high when it was made sure that the chicken is getting proper nutrition [17]. These are otherwise known as globular proteins. Globulins are produced in the liver. Globulins, albumins, and fibrinogen are major blood proteins. Low globulin can be a sign of liver or kidney disease. High level may indicate infection, inflammatory disease or immune disorders. High levels of globulin may cause such type of cancers like multiple myeloma, malignant lymphoma [20]. Also Globulin level has been used as indicator of immune responses and sources of antibody production. They also help during the time of fight infection and transport of nutrients [17]. The increase level of globulin concentration might confer higher disease resistance capacity of chicken.

#### ALBUMIN/GLOBULIN

Ratio of concentration of serum albumin/globulin in broiler was  $(0.970743 \pm 0.170835)$  and in indigenous it was  $(1.255146 \pm 0.298389)$  (Table 3). Here ( $P > 0.05$ ), so there is no significance was seen in between the broiler chickens and indigenous chickens. Low albumin/globulin ratio might be a sign towards autoimmune disorder, where immune system attacks healthy cells. It shows kidney disease, which is inflammation and scarring of the liver. In some [1] Orawan C and Aengwanich W (2007) Blood cell characteristics, haematological values and average daily gained weight of Thai Indigenous, Thai Indigenous crossbred and broiler chickens. *Pakistan Journal of Biological Sciences*, 10 (2): 302-309.

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cases low albumin/globulin ratio may be a sign of tumor in bone marrow [17]. High albumin/globulin ratio might be cause disease in liver, kidney, or intestine. It also causes low thyroid and leukemia (DerSarkissian, 2017).

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#### 5. ACKNOWLEDGEMENTS

The authors would like to express their thanks to the School of Applied sciences, Department of Zoology, Centurion University of Technology and Management, BBSR, Odisha, for providing facilities for carrying of current research.

#### 6. CONCLUSION

The comparative haematology and biochemical analysis of Indigenous Vanaraja chicken and Broiler chicken concluded that the Haematological parameters and the blood profiles can be consulting as the health indicator [21]. The haematological and biochemical parameters of different breeds of chickens differ from each other in various areas of world. Therefore it is important to know the blood and serum profiles of different breeds of chicken for the exact exposition of the health status [22],[23]. This information related to the blood profile of chickens will not only be useful for diagnosis and well management of birds but also can help to improve several new strains of broiler which are genetically resistance to poultry disease [24]. That can also be useful for genetic improvement of industrial and indigenous poultry birds [25]. The result on comparative haematological values of two different breeds of chicken i.e. Indigenous Vanaraja chicken and Broiler chicken indicates that there were some significant differences found in two different breeds whereas some were non-significant. The overall results of tested chicken breeds displayed that all the mean values for each haematological parameters possessed normal values for normal growth of both the breeds of chicken's assembles with the value as reported [26],[27]. The result implies the normal health condition for the two different species. By improving the hematological and serum characteristics of broiler birds the improvement of the quality and the general health of broiler chickens.

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Table1 Average value of haematological parameters of blood cell of different blood samples with respect to the different breeds of Indigenous chicken i.e. Vanaraja and Broiler chicken

Haematological Parameters	Unit	Vanaraja	Range (Min-Max)	Broiler	Range (Min-Max)	P Value
WBC	10 <sup>3</sup> /mm <sup>3</sup>	20657.8 ± 1317.382	17934 - 28560	25554.7± 1599.756	18963-29700	0.014794 S
RBC	10 <sup>6</sup> /mm <sup>3</sup>	2.04± 0.045216	1.7-2.2	2.19± 0.113969	2.19± 0.113969	0.118479
Haemoglobin	Grams/dl	8.3± 0.265832	6.9-9.2	5.38± 0.145144	4.9-6.1	7.82E-09 S

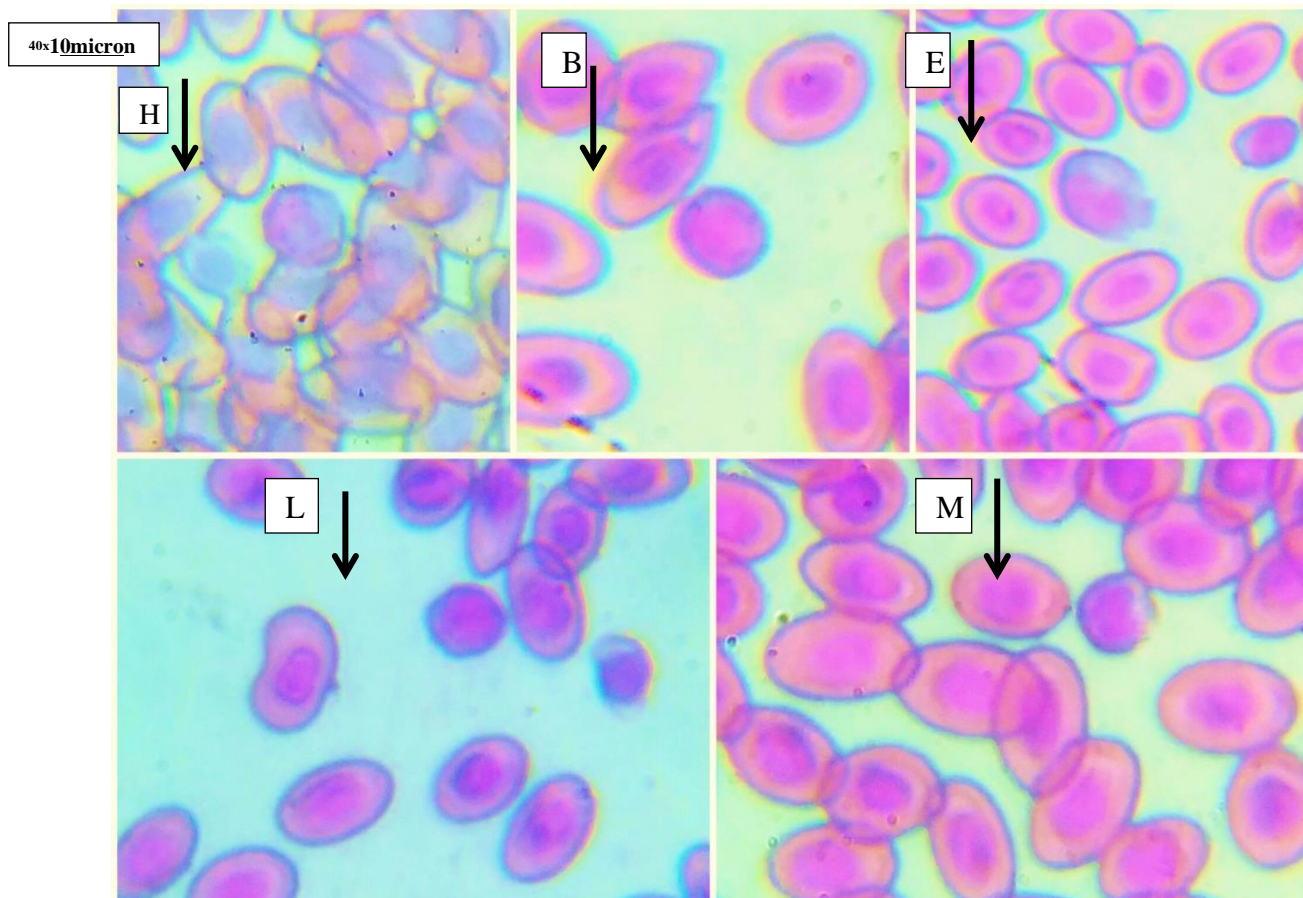
PCV	%	24.93± 0.81922	20.3-27.6	16.19± 0.442832	14.7-18.3	1.17E-08 S
MCV	FL	122.8715± 5.064627	92.27273- 147.0588	76.37782± 5.863983	58.8-122	5.63E-06 S
MCH	pg	40.88051± 1.578331	31.36364- 47.64706	25.37155± 1.934761	19.6-40.66667	3.67E-06 S
MCHC	%	33.30568 ± 0.119948	32.4- 33.99015	33.23529± 0.098039	32.35294- 33.33333	0.327502 NS
ESR	%	2.64± 0.265916	1-4	2.45± 0.292973	1-1	0.455942

**Table2** Average value of different types of leucocytes in relation to Vanaraja and Broiler chicken

Types of Leukocyte	Unit	Vanaraja	Range (Min-Max)	Broiler	Range(Min-Max)	P Value
Lymphocyte	%	68.4± 1.351542	60-73	72.6± 0.805536	69-75	0.007817 S
Heterophil	%	15.3± 1.106044	9-19	15.7± 1.145523	6-19	0.402252 NS
Monocyte	%	10± 1.619328	5-21	6.7± 1.535144	4-20	0.078223 NS
Eosinophil	%	4.2±0.2	3-5	3.2± 0.133333	3-4	0.000294 S
Basophil	%	2.1± 0.179505	1-3	1.8± 0.133333	1-2	0.098197 NS

**Table3** The biochemical parameters comparison between Broiler and Indigenous

Biochemical parameters	Unit	Broiler	Range	Vanaraja	Range	P value
Protein	g/dl	3.806±0.196611	3.12-4.22	4.14±0.2502	3.4-4.9	0.162279845
Albumin	g/dl	1.74±0.188679623	1.1-2.2	2.168±0.1549	1.85-2.75	0.058825259
Glucose	mg/dl	247.244±3.03768596	239-256	210.102±3.461288	201.2-220.46	2.0594E-05
Cholesterol	mg/dl	170.626±3.018158	164-182	146.444±2.284981	140.22-152	0.000105916
Globulin	g/dl	1.994±0.300925	1.32-3.12	1.984±0.314461	1.15-2.98	0.491116339
Albumin/ Globulin	g/dl	0.970743±0.170835	0.35256-1.363636	1.2551460.298389	0.66443-2.391304	0.216063788



**Fig.1 Differential Leukocyte Test (H=Heterophil, B=Basophil, E=Eosinophil, L=Lymphocyte, M=Monocyte). (Scale:40x10 $\mu$ m, Figures are captured at 40x with scale length 10 $\mu$ m)**