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Comparative haematology of Vanaraja, Nicobari fowls and their various F_1 crosses under hot humid climate of Andaman and Nicobar Islands, India

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Abstract

Aim: In the present experiment, the haematological parameters of Vanaraja, Nicobari fowls (Black, Brown and White) and their six F_1 crosses were evaluated. Four erythrocyte traits, six leukocyte traits and one platelet trait were assessed.

Materials and Methods: Blood samples (1 ml) were collected from the wing vein of each adult bird using 2 ml disposable syringe and then directly transferred to labeled test tube containing anticoagulant EDTA (2 mg EDTA/ml of blood). All haematological parameters were measured using by an instrument named Cell Counter Analyzer MS9-5V (Melet Schloesing Laboratories).

Results: Variations among different genetic groups and sex were found in respect to different haematological parameters studied. Red blood cell (RBC) concentration of Vanaraja female was found to be very high. White blood cell (WBC) concentration of Black Nicobari X Vanaraja female was significantly lower than all the other groups except Brown Nicobari female. Platelet count of Vanaraja X White Nicobari male was significantly higher than all the other groups except White Nicobari male, Vanaraja X Black Nicobari male, male and female of Brown Nicobari X Vanaraja, male and female of Vanaraja X Brown Nicobari and White Nicobari X Vanaraja male.

Conclusions: The haematological parameters of Vanaraja, Nicobari fowls and their F_1 crosses were investigated and compared. The results of the study will be helpful for accurate interpretation of haematological tests of the poultry genotypes of Andaman and Nicobar Islands.

Keywords: Andaman and Nicobar Islands, blood parameters, Nicobari fowl, Vanaraja

Introduction

Analysis of blood profile has been used routinely as a guide in the diagnosis of diseases in both human being and animals [1]. Change in haematological parameters is an important tool to access the level of stresses due to environment and nutritional factors [2] and provide useful information on the immune status of animals [3]. Certain haematological parameters are well established markers of certain production traits in poultry, such as high packed cell volume (PCV) and high Hb (HGB) are associated with high feed conversion ration (FCR) and high serum protein indicates good feathering ability and tissue growth in poultry [4]. High level of circulating lymphocytes is an indicator of the ability of the birds to survive in stressful conditions. Such information, apart from being useful for diagnostic purposes, could equally be incorporated into breeding programs for genetic up gradation of indigenous poultry.

Nicobari fowl is an indigenous and endemic breed of poultry of Andaman and Nicobar Islands and produces highest number of eggs among all the indigenous chicken breeds of India [5]. They are resistant to some of the deadliest diseases of poultry and very much adaptable to the local conditions of these Islands [6-7]. Three varieties of Nicobari fowl are generally found i.e. White, Black and Brown. Vanaraja is another very good dual purpose breed recently introduced in these Islands. Recent study also suggests that adaptability of Vanaraja to the local environment of Andaman and Nicobar Islands are less compared to Nicobari fowls [7].

Blood profiles of Vanaraja and Nicobari fowls under the worm humid tropical condition of Andaman and Nicobar islands are very essential for accurate interpretation of haematological tests. As no information on these aspects was available, the present study was designed to determine haematological parameters of the Vanaraja, Nicobari fowls and their various F_1 crosses under the local environment of Andaman and Nicobar Islands.

Materials and Methods

Ethical approval: All the present experiments comply with all relevant institutional and national animal welfare guidelines and policies. Blood samples from birds were collected aseptically following standard national welfare guidelines.

Table-1. Comparative haematological parameters (Erythrocytes) of Vanaraja, Nicobari fowls and their various F_1 crosses

Species	Sex	RBC	MCV	HCT	HGB
Van	M	0.84±0.23^{CDEF}	104.93±0.59^{AB}	8.83±2.40^{BCDEF}	16.17±2.19^{ABC}
	F	1.53±0.22^{A}	101.17±1.71^{AB}	15.28±2.07^{A}	12.98±0.94^{BCD}
WN	M	1.47±0.01^{AB}	103.03±0.84^{AB}	15.13±0.09^{A}	16.80±0.76^{AB}
	F	1.10±0.01^{ABCDE}	104.73±0.09^{AB}	11.47±0.15^{ABCDE}	12.33±0.63^{BCD}
BN	M	1.13±0.01^{ABCDE}	106.33±0.88^{A}	12.4±0.95^{ABCD}	15.47±0.44^{ABCD}
	F	1.33±0.06^{ABC}	100.74±1.44^{AB}	13.4±0.51^{ABC}	11.56±0.69^{CD}
BrN	M	0.95±0.02^{ABCDEF}	103.47±0.64^{AB}	9.97±0.19^{ABCDEF}	14.37±1.42^{ABCD}
	F	1.25±0.06^{ABCD}	103.73±0.99^{AB}	12.9±0.69^{ABCD}	11.73±0.15^{CD}
V an X WN	M	0.85±0.09 ^{BCDEF}	102.93±1.05^{AB}	8.7±0.99^{BCDEF}	17.88±1.53^{A}
	F	1.44±0.02^{ABC}	103.47±1.15^{AB}	14.57±0.49^{AB}	12.87±0.96^{BCD}
N X Van	M	1.22±0.22^{ABCD}	102.87±0.75^{AB}	12.53±2.27^{ABCD}	18.92±0.48^{A}
	F	1.01±0.19^{ABCDEF}	103.43±0.68^{AB}	10.45±1.92^{ABCDEF}	10.88±1.29^{D}
Van X BN	M	0.56 ±0.04^{EF}	104.57±0.87^{AB}	5.83±0.41^{EF}	18.73±0.59^{A}
	F	1.24±0.18^{ABCD}	103.4±0.67^{AB}	12.73±1.74^{ABCD}	15.2±1.76^{ABCD}
BN X Van	M	0.64±0.07^{DEF}	103.35±2.86^{AB}	6.7±0.85^{DEF}	14.78±2.32^{ABCD}
	F	0.43±0.07^{F}	104.20±0.55^{AB}	4.5±0.58^{F}	15.1±0.46^{ABCD}
Van X BrN	M	1.06±0.16 ^{ABCDE}	101.16±1.19^{AB}	10.74±1.72^{ABCDE}	16.60±0.53^{AB}
	F	1.18±0.27 ^{ABCD}	102.93±1.08^{AB}	12.05±2.64^{ABCD}	12.43±1.78^{BCD}
BrN X Van	M	0.83±0.24 ^{CDEF}	99.87±1.82^{B}	8.17±2.29^{CDEF}	14.23±1.27^{ABCD}
	F	0.85±0.34 ^{BCDEF}	101.2±1.2^{AB}	8.65±3.55^{BCDEF}	12.45±0.25^{BCD}

Values are expressed as Mean±S.E.M, MCV: Mean corpuscular volume; HCT: Hematocrit, HGB: Hemoglobin concentration
^{ABCDEF}Values in different superscripts in the same column differ significantly ($p<0.05$)

Birds: Haematological parameters were studied and compared among ten varieties of chicken i.e. Vanaraja (Van), White Nicobari (WN), Black Nicobari (BN), Brown Nicobari (BrN), F_1 cross of Vanaraja and White Nicobari (Van X WN), F_1 cross of White Nicobari and Vanaraja (WN X Van), F_1 cross of Vanaraja and Black Nicobari (Van X BN), F_1 cross of Black Nicobari and Vanaraja (BN X Van), F_1 cross of Vanaraja and Brown Nicobari (Van X BrN) and F_1 cross of Brown Nicobari and Vanaraja (BrN X Van). 20 birds from each group (10 male and 10 female) were taken for the present study. The birds were reared in deep litter system, fed *ad libitum* and kept in separate rooms. Ambient temperature, lighting, ventilation and other environmental conditions were provided according to the recommended standards.

Sampling procedures and measurement of haematological traits: Blood samples were collected from the wing vein of each adult bird using 2 ml disposable syringe and then directly transferred to labeled test tube containing anticoagulant EDTA (2mg/ml of blood). Blood samples from birds were collected in the early morning. The blood samples were used for measuring the haematological values within 1 hour of collection. Haematological parameters such as total red blood cells (RBC), white blood cell (WBC), packed cell volume (PCV) or haematocrit (HCT), mean corpuscular volume (MCV), differential leukocyte count and thrombocyte count were determined using Cell Counter MS9-5V-Melet Schloesing laboratories.

Statistical analysis: All the collected data were analyzed with the SAS Software Release 8.2 with the Proc GLM and Proc CORR procedures [8]. The GLM procedure uses the method of least squares to fit general linear models. PROC GLM analyzes data within the framework of General linear models. PROC GLM handles models relating one or several continuous dependent variables to one or several independent variables. Proc CORR is generally used to determine correlation among different variables. The differences between treatments were analyzed using a one way analysis of variance (ANOVA). Differences with a confidence level of 0.05 or less were considered to be significant.

Results

Erythrocytic values: Mean values of different haematological parameters differed among different groups. Comparative erythrocytic parameters of Vanaraja, Nicobari fowls and their various F_1 crosses are presented in Table-1. The RBC concentration of BN X Van female was significantly lower in comparison to all the other groups except Van male, BrN male, Van X WN male, WN X Van female, Van X BN male, BN X Van male and male and female of BrN X Van. MCV of BrN X Van was significantly lower than BN male but did not vary significantly with any other groups and no significant variations were found among any other groups in respect to MCV. HCT values of Van X BN male and BN X Van female were significantly lower in comparison to the values of Van female, WN male, BN male and female, BrN female, Van X WN female, WN X Van male, Van X BN female and Van X BrN female. HGB values of Van X WN male, WN X Van male and Van X BN male were significantly higher in comparison to Van female, WN female, BN female, BrN female, Van X WN female, WN X Van female, Van X BrN female, BrN X Van female but did not vary significantly with the values of any other groups.

Leukocytic and thrombocytic values: Comparative leukocytic and Thrombocytic parameters of Vanaraja, Nicobari fowls and their various F_1 crosses are presented in Table-2. WBC concentration of BN X Van female was significantly lower than all the other groups except BrN female. The Lumphocyte % of BN X Van

Table-2. Comparative haematological parameters (Leukocytes and Thrombocytes) of Vanaraja, Nicobari fowls and their various F_1 crosses

Breed	Sex	WBC (10 3/µl)	L%	M%	H%	E%	B%	PLT (10 3/µl)
Van	M	158.02±8.02^{A}	49.83±6.92^{BCD}	11.27±0.64^{AB}	23.73±5.42^{AB}	1.73±0.49^{c}	4.33±0.32^{A}	16.33±1.67^{B}
	F	138.18±25.54^{A}	47.37±9.80^{BCD}	8.90±1.51^{AB}	32.02±12.64^{A}	1.00±0.29^{c}	3.63±0.71^{A}	13.67±0.92^{B}
WN	M	149.65±7.86^{A}	43.67±2.80^{BCD}	11.17±0.29^{AB}	28.07±1.80^{AB}	3.10±0.85^{BC}	3.83±0.03^{A}	23.00±2.00^{AB}
	F	166.93±0.70^{A}	62.93±1.44^{ABC}	10.17±0.18^{AB}	15.30±1.17^{AB}	0.30±0.058^{c}	4.30±0.10^{A}	16.00±3.46^{B}
BN	M	166.20±0.61^{A}	54.70±0.68^{ABCD}	11.80±0.76^{A}	20.60±1.15^{AB}	1.50±0.12^{c}	4.20±0.06^{A}	14.00±1.15^{B}
	F	165.72±0.62^{A}	61.86±1.58^{ABC}	9.86±0.41^{AB}	16.24±0.83^{AB}	0.26±0.075^{c}	4.44±0.11^{A}	14.80±1.02^{B}
BrN	M	163.32±4.19^{A}	51.15±6.65^{BCD}	11.10±0.20^{AB}	23.65±5.75^{AB}	1.00±0.80^{c}	4.35±0.35^{A}	16.00±6.00^{B}
	F	118.43±50.69^{AB}	42.00±19.80^{BCD}	8.30±2.31^{B}	35.40±19.65^{A}	2.90±2.55^{BC}	2.90±1.40^{A}	13.33±1.33^{B}
BN X Van	M	138.66±5.19^{A}	46.75±5.66^{BCD}	10.43±0.54^{AB}	26.62±3.96^{AB}	2.77±0.79^{BC}	2.92±0.60^{A}	27.00±8.29^{AB}
	F	76.96±11.95^{B}	76.13±3.07^{A}	2.60±0.58^{C}	3.53±0.29^{B}	0.50±0.36^{c}	1.00±0.58^{B}	19.33±0.88^{B}
Van X BN	M	138.62±2.41^{A}	39.27±3.01^{CD}	10.63±0.13^{AB}	34.03±2.43^{A}	2.27±0.48^{BC}	3.47±0.22^{A}	23.33±2.03^{AB}
	F	144.46±9.89^{A}	44.77±4.45^{BCD}	10.93±0.12^{AB}	17.37±5.83^{AB}	13.63±6.62^{A}	3.97±0.58^{A}	20.67±0.88^{B}
BrN X Van	M	165.25±2.74^{A}	49.93±2.71^{BCD}	10.83±0.50^{AB}	22.90±1.40^{AB}	2.93±1.90^{BC}	4.33±0.19^{A}	22.33±6.98^{AB}
	F	162.82±0.48^{A}	49.10±6.30^{BCD}	10.60±0.30^{AB}	11.90±5.10^{AB}	15.35±10.15^{A}	3.95±0.15^{A}	30.00±10.00^{AB}
Van X BrN	M	153.02±5.76^{A}	47.12±3.59^{BCD}	11.02±0.18^{AB}	17.72±4.29^{AB}	11.98±5.07^{AB}	3.48±0.14^{A}	31.80±7.81^{AB}
	F	139.86±1.75^{A}	57.13±8.19^{ABCD}	9.50±0.35^{AB}	18.48±4.73^{AB}	3.98±3.07^{BC}	2.63±0.88^{AB}	23.50±4.67^{AB}
WN X Van	M	134.70±2.60^{A}	36.70±1.34^{D}	10.80±0.25^{AB}	30.63±3.69^{A}	8.45±3.58^{ABC}	3.02±0.16^{A}	24.17±3.53^{AB}
	F	156.26±8.81^{A}	66.33±5.59^{AB}	8.95±1.02^{AB}	13.45±3.31^{AB}	0.33±0.11^{c}	4.33±0.35^{A}	15.25±0.85^{B}
Van X WN	M	135.26±2.80^{A}	42.50±6.91^{BCD}	10.00±0.31^{AB}	31.68±4.59^{A}	3.38±1.50BC	2.50±0.89^{AB}	46.75±21.11^{A}
	F	145.09±2.75^{A}	46.23±0.64^{BCD}	11.03±0.58^{AB}	27.00±1.73^{AB}	1.53±0.18^{c}	4.50±0.29^{A}	19.00±0.58^{B}

Values are expressed as Mean±S.E.M, L: Lymphocyte, M: Monocyte, H:Heterophil, E: Eosinophil, B: Basophil, PLT: Platelete

^{ABCDEF}Values in different superscripts in the same column differ significantly ($p<0.05$)

was significantly higher in comparison to all the other groups except WN female, male and female of BN, Van X BrN female, and WN X Van female. Mon % of BN male was significantly higher in comparison to BrN female, BN X Van female but did not vary significantly with that of all other groups. Het % of Van female, BrN feale, Van X BN male, WN X Van male, Van X WN male were significantly higher than BN X Van female but did not vary significantly with other groups. Eos % of Van X BN female and BrN X Van female were significantly higher in comparison to all ther other groups except Van X BrN male and WN X Van male. Bas % of BN X Van female was significantly lower in comparison to all the groups except Van X WN male and Van X BrN female. Platelet count of Van X WN male was significantly higher than all the other groups except WN male, Van X BN male, male and female of BrN X Van, male and female of Van X Br N and WN X Van male.

Discussion

In the present study, significant variations in haematological parameters were found among different genetic groups of chickens. Variation in haematological parameters of Nigerian native chicken varieties i.e. normal frizzle-feathered, naked-neck, and normal feathered native chickens was reported by Peters et al. [9]. It was found that male birds generally had higher mean values of all the haematological parameters than their female counterparts across all genotypes [9]. In a study on comparative haematology of different species of poultry by Pandian et al. [10] highest haemoglobin and PCV was reported in Aseel (12.90 and 30.16 respectively) and highest RBC concentration was found in Kadakanath (2.96). HGB and PCV were not significantly different among three ecotypes of chicken of Sudan (Betwil, Bare Neck and Large Beladi) whereas RBC and MCV varied significantly [11]. In the present study, significant variation between male and female was found in respect to different haematological parameters which is consistent with the result reported in three ecotypes of chicken of Sudan [11]. MCV values in male broilers were found higher than that in females and eosinophiles content was higher in females [12]. Mmereole [2] reported that among the four broiler breeds (Arbor-Acre, Ross, Marshal and Cobb), Ross was significantly superior to the other breeds in terms of RBC, PCV, HGB, and MCHC values while Marshal had significantly higher values of MCV and MCH than the other breeds. Hematological parameters in Fayoumi, Assil and Local Chickens of different ages reared in Sylhet region of Bangladesh were estimated and comapred which relealed that the RBC concentration was higher in Fayoumi, the hemoglobin concentration was high in Assil and the PCV was slightly different or similar in all three breeds [13]. Comparative Studies on haematological values of broiler Strains (Ross, Cobb, Arbor-acres and Arian) was conducted by Talebi et al. [1] in which he they reported that as age of birds increases. increasing of age, the erythrocytic parameters (except MCV, MCH, and MCHC) and leukocytic parameters (except heterophils and H/L ratio) were significantly increased ($P<0.01$). However. , but MCV, MCH and absolute count of heterophils as well as H/L ratio were significantly decreased with the age ($P<0.01$).

Conclusion

In conclusion, significant variations in blood parameters were found among different genetic groups of chickens viz. Vanaraja, Nicobari fowls and their

various F_1 crosses. The results of the study will be helpful for accurate interpretation of haematological tests of the poultry genotypes of Andaman and Nicobar Islands.

Authors' contributions

AK and AKDe were involved in the design of the experiment. The experiment was done by AKDe and JS. MSK and SJ helped in data analysis. AK revised the final draft of manuscript. All the authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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