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Breed and gender effects on blood profile of Muturu and Bunaji cattle in Benue and Ogun State, Nigeria

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Target Audience: *Researchers, Cattle farmers*

Abstract

This research was conducted to study the blood profile of Bunaji and Muturu cattle in Benue and Ogun States. Four hundred and eighty cattle comprising 240 of each breed and 120 of either gender at each location were sampled. The experiment was set in a 2×2×2 factorial format in a CRD with location, breed and gender as factors. Samples were collected five times at each location. Blood parameters analyzed were PCV, Haemoglobin (Hb), Red Blood Cell Count (RBC), Lymphocytes, Granulocytes and Monocytes. The results showed that Muturu cattle presented significantly ($p<0.05$) higher mean PCV, Hb, WBC, percent Lymphocyte and Monocytes. It was also observed that Muturu cattle at Benue State showed higher ($p<0.05$) mean PCV, RBC and percent granulocyte while the Bunaji presented higher ($p<0.05$) mean MCHC, with the bulls presenting significantly ($p<0.05$) higher mean MCHC (39.45g/dl) than the cows (36.38g/dl). Similarly, higher mean MCHC were observed in Muturu bulls (31.02g/dl) compared to the cows (28.90g/dl) of Benue State. These variations in mean MCHC were not observed among cattle in Ogun State. Mean lymphocytes and granulocytes varied significantly ($p<0.05$) with Bunaji gender in Ogun State. The study concluded that location and breed affected haematological parameters of the cattle breed investigated.

Key words: *Blood; Breed; Bunaji; Gender; Muturu*

Description of Problem

The functions of blood have been documented (1; 2; 3; 4 and 5). Haematological values during different physiological situations could be used for the diagnosis of various pathological and metabolic disorders, which can adversely affect the productive and reproductive performance of cattle, leading to heavy economic losses (6). In addition, habitat quality and adaptability to environmental conditions can be assessed by haematologic parameters (7). The Bunaji breed makes up higher percentage of cattle and they are found in the drier north and sub-humid zones of Nigeria while the Muturu are the main indigenous breed (8). A detailed appraisal of the nutrition and health status of beef cattle in extensive management condition is a prerequisite for effective production of quality beef. In addition, variations in environmental factors and/or nutrition are known to influence diseases prevalence and productivity of the animal (9). The study of blood parameters is more economical compared to the traditional measures of effect such as reduction of mortality. It serves also as an excellent medium for the measurement of potential biomarkers, because its collection is relatively non-invasive, and it encompasses an enormous range of physiological process in the body at any given time (10). Apart from veterinary uses of blood picture, it enables one to see

weak points on the farm and it is a useful tool to improve the health, welfare and productivity of the animal (7). Currently in Nigeria, the available information on the haematology and serum chemistry of indigenous cattle with reference to seasonal influence is inadequate or tending to be obsolete. This study was designed to evaluate the effects of location, breed and gender on blood profile of Muturu and Bunaji breeds of cattle.

Materials and Methods

The experiment was carried out in Ogun and Benue States of Nigeria. Farmers' animals were used for the experiment. A total of four hundred and eighty (480) apparently healthy animals were used for the experiment. Two hundred forty (240) mature cattle comprising of Muturu and Bunaji were sampled. This is made up of one hundred and twenty (120) of male and female cattle in Benue and Ogun States. The experiment is a symmetrical factorial (2×2×2) arrangement in a complete randomized design (CRD). The factors include two breed of cattle (Muturu and Bunaji), two locations (Benue and Ogun States) and two genders (Bulls and Cows). Five millilitres of blood sample were collected from the jugular vein of each animal by venipuncture over ethylene-diamine-tetra-acetic acid (EDTA) in a haematological bottle for laboratory analysis of cellular components of the blood. Haematological analysis was carried out using Mindray® BC-2800Vet auto haematology analyzer. The parameter measured included values for red blood cell (RBC) count, white blood cell (WBC) count, haemoglobin (Hb), packed cell volume (PCV), mean cell haemoglobin concentration (MCHC) and leucocyte differential cell counts. Data collected were subjected to analysis of variance (ANOVA) using (11) version 4 statistical packages. Where significant differences occurred, the mean was subjected to Duncan Multiple Range Test (DMRT) using (12) version 9.2 statistical packages.

Results

Location and breed interaction effect on the haematological profile of cattle is presented in Table 1. The PCV of Muturu in both locations were higher ($p<0.05$) than observed values in Bunaji cattle. RBC counts in both breeds at Benue State were comparable and higher ($p<0.05$) than both breeds at Ogun State. The mean Hb concentration of both breeds at Benue State were similar ($p<0.05$) and compared with the mean obtained for Muturu cattle but differed ($p<0.05$) from the of Hb concentration of Bunaji at Ogun State. Mean MCHC concentration of Bunaji at Benue State was significantly ($p<0.05$) different from Muturu in Benue State and cattle in Ogun State. Mean WBC count showed that Muturu in both locations had higher ($p<0.05$) value than Bunaji cattle. Muturu cattle at Ogun State presented significantly ($p<0.05$) higher count than those at Benue State. Percent mean lymphocytes for Muturu in Ogun State was significantly ($p<0.05$) higher than observed in Bunaji in Ogun State and both breeds in Benue State. Bunaji at Ogun State showed higher ($p<0.05$) percentage than their counterpart at Benue State. Cattle in Benue presented lower ($p>0.05$) percent lymphocyte mean. Percent mean granulocyte count were comparable for both breeds at Benue State and were significantly ($p<0.05$) higher than values observed for both breeds at Ogun State. Bunaji at Ogun State had significantly ($p<0.05$) higher mean compared to Muturu in the same location. Percent mean monocyte value indicated that both breeds at Ogun State were similar and differed significantly ($p<0.05$) from their counterparts at Benue State. While Muturu at Benue State differed significantly ($p<0.05$) from the Bunaji breed.

Location and gender interaction effect on haematological profile of cattle is presented in Table 2. It was observed that percent mean

PCV for cows at Benue State were higher ($p<0.05$) than that observed in bulls. Mean RBC count of cattle at Benue State were significantly ($p<0.05$) higher than observed among the cattle at Ogun State. Bulls in Benue presented higher ($p<0.05$) mean MCHC concentration than cows and both sexes in Ogun State. Mean WBC count of cattle at Ogun State differed ($p<0.05$) from that of cattle at Benue State. It was observed that percent lymphocytes count of bulls at Ogun State differ significantly ($p<0.05$) from other means. Mean percent granulocyte was higher ($p<0.05$) for bulls at Benue State as compared to other means. And it was also observed that percent granulocyte for cattle in Benue were significantly ($p<0.05$) higher than in cattle at Ogun State. Percent monocyte mean was significantly ($p<0.05$) higher for both gender of cattle at Ogun State compared to the observation at Benue State. The effect of breed and gender interaction on haematological profile of cattle is presented in Table 3. Mean of the PCV, RBC, Hb, WBC, percent lymphocyte and monocyte in Muturu were observed to be significantly ($p<0.05$) higher those in Bunaji. But mean MCHC and granulocytes Bunaji genders presented higher ($p<0.05$) value than both gender of Muturu.

The effect of location, breed and gender interaction on haematological profile of cattle is presented in Table 4. Mean percent PCV showed significantly ($p<0.05$) higher values for both Muturu bulls and cows at Benue State than the values obtained for both sexes of Bunaji in Benue and both breeds and their sexes in Ogun State. The observed PCV results for Bunaji in both location were significantly ($p>0.05$) lower than in Muturu. Significant ($p<0.05$) gender variation in PCV values was not observed within breeds. Mean RBC count of cattle at Benue State had comparable values but been significantly ($p<0.05$) different from that observed at Ogun State. Muturu cattle were observed to have higher ($p<0.05$) Hb concentrations in both location than their Bunaji counterpart. Bunaji bulls in Benue presented significantly ($p<0.05$) higher mean than their counterpart in Ogun state. MCHC mean concentration showed that Bunaji bulls at Benue State differed significantly ($P<0.05$) from other treatment means. Significant ($p<0.05$) within breed and gender variations were not observed in mean WBC count. However, mean values obtained showed that Muturu cattle presented higher ($p<0.05$) values than Bunaji in both locations. In addition, higher ($p<0.05$) WBC count was observed in Muturu at Benue compared to other treatment means. Percent lymphocyte mean indicated that both gender of Muturu at Ogun State compared with each other but were significantly ($P<0.05$) higher than other treatment means. Bunaji bulls at Ogun State on the other hand varied significantly ($P<0.05$) higher than their female counterpart in the same location. Similar percent granulocyte means were observed for all treatments at Benue State which were higher significantly ($p<0.05$) than the mean values obtained for cattle in Ogun state. Percent monocyte means showed that Muturu cows at Ogun state varied significantly ($p<0.05$) higher than other treatment means but compared to Bunaji bulls in the same location. Percent mean monocyte values obtained for cattle at Ogun state were significantly ($p>0.05$) higher than for cattle at Benue state.

Table 1: Effect of location and breed interaction on haematological profile of cattle

	Benue		Ogun		
Parameters	Bunaji	Muturu	Bunaji	Muturu	SEM
PCV (%)	29.09^{d}	37.46^{a}	32.73^{c}	34.67^{b}	0.45
RBC (× 10^{6}/µl)	7.85^{a}	8.17^{a}	4.35^{c}	5.53^{b}	0.17
Hb (g/dl)	10.53^{a}	10.76^{a}	10.21^{b}	10.80^{a}	0.09
MCHC (g/dl)	37.91^{a}	29.96^{b}	31.46^{b}	31.43^{b}	0.59
WBC (×10^{3}/µ/l)	6.64^{c}	11.25^{b}	11.21^{b}	16.24^{a}	0.33
Lymphocytes (%)	31.09^{c}	31.35^{c}	41.37^{b}	54.19^{a}	1.11
Granulocytes (%)	55.87^{a}	58.53^{a}	47.79^{b}	33.26^{c}	1.19
Monocytes (%)	4.27^{c}	5.90^{b}	11.00^{a}	11.85^{a}	0.30

Key: PCV= Packed cell volume; RBC= Red blood cell; Hb = haemoglobin; WBC=White blood cell; MCHC= Mean corpuscular haemoglobin count; SEM= standard error of means. Means in the same row with different superscript(s) differed significantly (P<0.05).

Table 2: Effect of location and gender interaction on haematological profile of cattle

	Benue		Ogun		
Parameters	Bulls	Cows	Bulls	Cows	SEM
PCV (%)	32.65^{b}	33.90^{a}	33.87^{ab}	33.53^{ab}	0.45
RBC (× 10^{6}/µl)	8.04^{a}	7.99^{a}	5.02^{b}	4.86^{b}	0.17
Hb (g/dl)	10.71	10.58	10.49	10.51	0.09
WBC (×10^{3}/µ/l)	8.83^{b}	9.06^{b}	13.88^{a}	13.57^{a}	0.33
MCHC (g/dl)	35.53^{a}	32.64^{b}	31.35^{b}	31.54^{b}	0.59
Lymphocytes (%)	31.38^{c}	31.07^{c}	49.95^{a}	45.61^{b}	1.11
Granulocytes (%)	58.08^{a}	56.32^{b}	38.65^{d}	42.40^{c}	1.19
Monocytes (%)	5.15^{b}	5.03^{b}	11.40^{a}	11.45^{a}	0.30

Key: PCV= Packed cell volume; RBC= Red blood cell; Hb = haemoglobin; WBC=White blood cell; MCHC= Mean corpuscular haemoglobin count; SEM= standard error of means. Means in the same row with different superscript(s) differ significantly (P<0.05).

Table 3: Effect of breed and gender interaction on haematological profile of cattle in Benue and Ogun States

	Bunaji		Muturu		
Parameters	Bulls	Cows	Bulls	Cows	SEM
PCV (%)	30.52^{b}	31.30^{b}	36.00^{a}	36.12^{a}	0.45
RBC (× 10^{6}/µl)	6.03^{b}	6.17^{b}	7.02^{a}	6.68^{ab}	0.17
Hb (g/dl)	10.43^{b}	10.30^{b}	10.77^{a}	10.79^{a}	0.09
MCHC (g/dl)	35.50^{a}	33.88^{a}	31.09^{b}	30.30^{b}	0.59
WBC (×10^{3}/µ/l)	8.98^{b}	8.86^{b}	13.72^{a}	13.77^{a}	0.33
Lymphocytes (%)	38.00^{b}	34.47^{b}	43.33^{a}	42.21^{a}	1.11
Granulocytes (%)	49.90^{ab}	53.76^{a}	46.82^{bc}	44.96^{c}	1.19
Monocytes (%)	8.18^{ab}	7.10^{b}	8.38^{a}	9.38^{a}	0.30

Key: PCV= Packed cell volume; RBC= Red blood cell; Hb = haemoglobin; WBC=White blood cell; MCHC= Mean corpuscular haemoglobin count; SEM= standard error of means. Means in the same row with different superscript(s) differed significantly (P<0.05).

Table 4 Effect of location, breed and gender interaction on haematological profile of cattle

	Benue				Ogun				
	Bunaji		Muturu		Bunaji		Muturu		
Parameters	Bulls	Cows	Bulls	Cows	Bulls	Cows	Bulls	Cows	SEM
PCV (%)	28.29^{d}	29.89^{d}	37.02^{a}	37.90^{a}	32.75^{c}	32.72^{c}	34.99^{b}	34.35^{bc}	0.63
RBC (× 10^{6}/µl)	7.82^{a}	7.88^{a}	8.25^{a}	8.10^{a}	4.24^{c}	4.46^{c}	5.80^{b}	5.26^{b}	0.23
Hb (g/dl)	10.66^{ab}	10.40^{bc}	10.75^{ab}	10.76^{a}	10.21^{c}	10.21^{c}	10.78^{a}	10.81^{a}	0.13
MCHC (g/dl)	39.45^{a}	36.38^{b}	31.02^{c}	28.90^{d}	31.55^{c}	31.38^{c}	31.15^{c}	31.70^{c}	0.84
WBC (×10^{3}/µ/l)	6.52^{c}	6.76^{c}	11.14^{b}	11.36^{b}	11.45^{b}	10.96^{b}	16.30^{a}	16.18^{a}	0.46
Lymphocytes (%)	31.60^{d}	30.58^{d}	31.15^{d}	31.55^{d}	44.40^{b}	38.35^{c}	55.50^{a}	52.87^{a}	1.56
Granulocytes (%)	55.80^{ab}	55.95^{ab}	60.36^{a}	56.69^{ab}	44.01^{c}	51.57^{b}	33.28^{d}	33.23^{d}	1.69
Monocytes (%)	4.77^{cd}	3.78^{d}	5.53^{cd}	6.27^{c}	11.59^{ab}	10.42^{b}	11.22^{b}	12.48^{a}	0.43

Key: PCV= Packed cell volume; RBC= Red blood cell; Hb = haemoglobin; WBC=White blood cell; MCHC= Mean corpuscular haemoglobin count. SEM= standard error of mean Means in the same row with different superscript(s) differ significantly ($p<0.05$)

Discussion

Normal reference range of cattle blood indices were documented (13; 14). All blood indices examine in this study were affected by location. This corroborate the report of earlier workers that, generally blood parameters can be influenced by age, gender, breed, climate, geographical location, day length, nutritional and physiological status of the animal (15); stress, exercise, transport and disease condition (14). Breed effect were also observed in this study; gender effect were however limited, been noticed only if numerical variation is considered. The significance and non-significant effect of gender on haematological indices is species specific (14). Except Bunaji cows in Benue, percent mean PCV value observed in this study were higher than the values (31.5±1.0 for cows; 24.15±6.45 for bulls) reported (16). It could be inferred from values of mean percent PCV that serum total protein was higher in the cattle at Benue than Ogun State. (17) had noted that PCV is proportional to the level of total protein. Hence the serum total protein level can be assessed via percent PCV. The higher PCV could imply a response of the animal to abundant useful feed supply (18) Furthermore, high PCV in the face of adverse environmental condition is a sign of adaptability (19). The findings of this work agreed with (20) that gender does not have effect on PCV of cattle. RBC and WBC are listed amongst those that could indicate adaptability to adverse environmental condition (21). (22) stated that erythrocytes are an appropriate and sensitive model to study the oxidative status of transition dairy cows exposed to hot environments. Hence the observed RBC count in Benue could imply a better adaptability and oxidative in that milieus. (23) pointed out that Hb concentration correlated with nutritional status of animals. The result of this study imply that the Muturu are healthier; better adapted and nourished as compared to the Bunaji. Other disparities in the parameters due to gender observed in this experiment were numerical. Gender variation found with mean MCHC of cattle in Benue may not be unrelated with genetic and physiologic distinction between the genders of cattle (22). The WBC value observed in cattle at Benue State in this study could be compared to the value reported (23). However, the higher value of WBC of cattle at Ogun State may be a response to immune challenges. The number of circulating WBC corpuscles is contingent on

the demand and their development along different lineages is governed by external stimuli including cytokines, matrix proteins (24). Increment in monocytes and WBC (13.75 in Muturu as against 8.92 in Bunaji), count increment with low MCHC (30.89 in Muturu as against 34.69 in Bunaji) which is the situation observed in this study among the Muturu, is predictive of infection. A decrease in MCHC and an increase in WBC are mainly due to lymphocytosis (25; 26; 27). The relative increase in lymphocyte is suggestive of this assertion. The observation among the Bunaji which showed an increase in granulocyte over the lymphocyte may be as a result of stress due to constant exercise in the long distance treks, day by day, in search for pasture. This raises the glucocorticoid level which causes the lymphocyte to migrate thorough the endothelial layer of the vascular tissues to other tissues (lymph nodes, spleen, bone marrow and skin) where they sequestered. This mechanism of granulocytosis (or neutrophils increment in circulating fluid) is reported to also reduce lymphocyte concentration in circulation (26). Neutrophilia could also be cause by fear, excitement, exercise, corticosteroid induced stress, acute inflammatory response such as bacterial infection, necrosis and neoplasia (28). The decreased in percent lymphocytes count in cattle at Benue State may be due excitement-, fear- (21) or stress- (29) induced Neutrophilia.

Conclusions and Applications

The result of this study showed that:

1. Haematological parameters of Bunaji and Muturu cattle measured were influenced by location and breed, sex effects were not significant.
2. Muturu breed presented relatively better blood picture than Bunaji breed of cattle.
3. The leucocyte differential count of the cattle investigated showed signs of disease challenge to both breeds of animal and in both location.

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