THE EFFECT OF CATTLE BREEDS ON HAEMATOLOGICAL PARAMETERS AND POSSIBLE ASSOCIATION WITH TRYPANOTOLERANCE

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ABSTRACT

In order to investigate the trypanotolerant indices in cattle breeds, haematological parameters were determine in 12 N'Dama (ND), 13 Muturu (MUT), 11 White Fulani Cross (WFX) and 14 White Fulani cattle (WF). The packed cell volume (PCV), haemoglobin (Hb) and red blood cell (RBC) values of all the breeds of cattle were within the normal reference interval. MUT had significantly higher PCV, Hb and RBC values than the WFX. No significant difference (p>0.05) in the PCV, Hb and RBC was observed among the other breeds. No significant difference (p>0.05) in mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) was observed in all the breeds of cattle. However, ND had significantly higher (p<0.05) mean corpuscular haemoglobin concentration (MCHC) compared to MUT, WFX and WF. The trypanotolerant cattle (ND and MUT) had significantly higher (p<0.05) Hb and MCHC than the more trypanosusceptible cattle (WFX and WF). There was no significant difference (p>0.05) in the white blood cell (WBC) count among the breeds of cattle. However, WF cattle had significantly lower (p<0.05) lymphocyte count than WFX, MUT and ND. ND cattle had significantly higher (p<0.05) eosinophil count than WF, MUT and WFX. The results suggest that MCHC, lymphocytes and eosinophils are considered as possible trypanotolerant indices in the trypanotolerant breeds of cattle.

Keywords: Haematology, Trypanotolerant indices, N'Dama, Muturu, White Fulani, White Fulani cross

INTRODUCTION

Haematological parameter plays a vital role in ascertaining the physiological status of an animal (Etim *et al.*, 2013). Blood constituent changes in respect to the physiological state of an animal. Ecological and physiological characteristics of an animal can be investigated by haematological study, which helps in the selection of animals that are genetically resistant to certain diseases and environmental conditions (Etim *et al.*, 2014).

The use of trypanotolerant cattle has not been given adequate consideration in trypanosomosis control programmes (Hendrickx *et al.*, 2004; Agyemang, 2005). Trypanotolerant breeds, although equally susceptible to initial infection by trypanosomes, possess the ability to survive, reproduce and remain productive in areas of high tsetse challenge without the need for the use of chemicals to control the vector or drugs to control the parasite (Dayo *et al.*, 2009; Yaro *et al.*, 2016), while other breeds rapidly succumb to the disease (Berthier *et al.*, 2015). The trypanotolerant trait is generally attributed to the taurine breeds of cattle in West and Central Africa, namely, the N'Dama and the West

African shorthorn (WASH) (Maganga *et al.*, 2017). Studies have shown that the basis of this trait was associated with the capacity of these animals to develop less severe anaemia in the face of infection (Berthier *et al.*, 2015). Packed cell volume (PVC) in particular and parasitaemia the two principal indicators of trypanotolerance are strongly correlated with animal performance especially, post-weaning growth, reproductive performance, and overall cow productivity (Marcotty *et al.*, 2008). Therefore, this study investigates the haematological parameters of breeds of cattle known to be trypanotolerant and trypanosusceptible, with the view to ascertain any differences in their parameters as the possible association with trypanotolerance.

MATERIALS AND METHODS

Sampling: Apparently healthy animals were selected for this study. N'Dama (12), Muturu (13), White Fulani Cross (11) and White Fulani (14) were sourced from Ibadan (7^{O} 23'47"N 3^{O}55'0"E), Oyo State, during the rainy season (April – June 2017). The sampled animals were reared predominantly under the extensive system of management.

Sample Collection: Three milliliters each of blood was obtained aseptically by jugular venipuncture into lithium heparinized bottles for the haematological study. The collected blood samples were transferred into icepacks and transported to the laboratory for processing and analysis.

Parasitological Investigation: All the blood samples were examined for trypanosomes and other parasites using wet mount, buffy coat techniques and Giemsa thin blood smears as described by Herbert and Lumsden (1976).

Determination of Haematological Parameters

Red blood cell parameters: The red blood cell parameters considered for this study were red blood cell (RBC) counts, packed cell volume (PCV), haemoglobin concentration (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC). These were determined using the methods described by Weiss and Wardrop (2010).

White blood cell parameters: The white blood cell (WBC) parameters evaluated for this study included the total white blood cell count and the differential leucocyte counts. The absolute differential leucocyte counts were also determined using the appropriate computation from a Giemsa stained blood smear. These were determined using the methods described by Weiss and Wardrop (2010).

Platelet count: The platelet count was carried out by direct platelet count method using 1 % ammonium oxalate as the diluent solution. The diluted blood was then counted using the haemocytometer under the microscope and the value obtained was multiplied by 10^5 to give the total platelet count in platelets/microlitre using the method described by Weiss and Wardrop (2010).

Data Analysis: All data collected were analysed using the computer software (SAS, 2011) version 9.3. Descriptive statistics of the haematological parameters were presented as Mean ± SE. Comparison of the mean of the haematological parameters of the trypano-tolerant and susceptible breeds were also determined using Student t-test and ANOVA as appropriate. Evaluation of significant differences among the breeds of cattle was done using Fisher's exact test. A p-value <0.05 was considered statistically significant.

RESULTS

Parasites: None of the blood samples examined for trypanosomes and other parasites were positive for parasite.

Haematology

Erythrocytic values: The PCV, Hb and RBC values of all the breeds of cattle were within the normal reference interval. As shown in Table 1, Muturu had significantly higher ($p<0.05$) PCV (39.90 ± 4.84 %), Hb (13.14 ± 1.59 g/dL) and

Table 1: Effect of breed on the haematological values of cattle reared at Ibadan, Oyo State, during the wet season (April – June 2017)

Parameters	White Fulani	White Fulani X	Muturu	N'dama
	n=14	n =11	n =13	n = 12
PCV (%)	35.57 ± 5.63^{ab}	34.20 ± 4.18^{a}	39.90 ± 4.84^{b}	36.80 ± 7.58^{ab}
Hb (g/dL)	11.81 ± 1.81^{ab}	11.16 ± 1.53^{a}	13.14 ± 1.59^{b}	12.55 ± 2.43^{ab}
RBC (x10^3/µL)	5.89 ± 0.91^{ab}	5.57 ± 0.81^{a}	6.56 ± 0.9^{b}	6.15 ± 1.39^{ab}
Platelet (x10^5/µL)	1.73 ± 0.38^{b}	1.22 ± 0.20^{a}	1.30 ± 0.15^{a}	1.20 ± 0.35^{a}
MCV (fL)	60.33 ± 2.48	61.65 ± 2.91	61.03 ± 3.12	60.12 ± 3.31
MCH (pg)	20.06 ± 0.92	20.08 ± 0.99	20.09 ± 0.97	20.56 ± 1.24
MCHC (g/dL)	33.25 ± 0.69^{a}	32.58 ± 1.14^{a}	32.94 ± 0.47^{a}	34.21 ± 1.12^{b}
Total WBC (x10^3/µL)	5.45 ± 1.69	5.28 ± 0.87	5.18 ± 0.78	5.76 ± 1.33
Lymphocyte (x10^3/µL)	1.09 ± 0.16^{a}	3.83 ± 0.78^{b}	3.09 ± 0.56^{b}	3.99 ± 1.31^{b}
Neutrophil (x10^3/µL)	2.34 ± 0.58^{b}	1.32 ± 0.35^{a}	1.53 ± 0.29^{a}	1.08 ± 0.59^{a}
Monocyte (x10^3/µL)	0.29 ± 0.12^{b}	0.08 ± .0.09^{a}	0.25 ± 0.17^{b}	0.03 ± 0.034^{a}
Eosinophil (x10^3/µL)	0.25 ± 0.53^{a}	0.18 ± 0.37^{a}	0.25 ± 0.14^{a}	0.65 ± 0.35^{b}
Basophil (x10^3/µL)	0	0	0	0

n=number of animals; ^{a,b,c} Means with different superscripts letter within same rows are significantly different (p<0.05)

RBC (6.56 ± 0.9 x10^3/µL) than the White Fulani Cross (34.20 ± 4.18 %, 11.16 ± 1.53 g/dL and 5.57 ± 0.81 x10^3/µL) respectively. No significant difference (p>0.05) in the PCV, Hb and RBC was observed among the other breeds (Table 1). No significant difference (p>0.05) in MCV and MCH was observed in all the breeds of cattle (Table 1). However, N'Dama (ND) had significantly higher (p<0.05) MCHC compared to Muturu (MUT), White Fulani Cross (WFX) and White Fulani (WF) (34.21 ± 1.12, 32.94 ± 0.47, 32.58 ± 1.14 and 33.25 ± 0.69 g/dL) respectively. The trypanotolerant cattle had significantly ($p< 0.05$) higher Hb (12.84 ± 2.03 g/dL) and MCHC (33.57 ± 1.06 g/dL) than the more trypanosusceptible cattle (WFX and WF) (11.54 ± 1.70 g/dL and 32.37 ± 0.34 g/dL) respectively (Table 2).

Leucocytic values

White blood cell (WBC) count: There was no significant difference (p>0.05) in the WBC counts among the breeds of cattle (Table 1). No significant differences (p>0.05) in the WBC counts were observed between the trypanotolerant and trypanosusceptible cattle (Table 2).

Lymphocyte count: White Fulani cattle had significantly lower (p<0.05) lymphocyte count than White Fulani Cross, Muturu and N'Dama (1.09 ± 0.16 x10^3/µL, 3.83 ± 0.78 x10^3/µL, 3.09 ± 0.56 x10^3/µL and 3.99 ± 1.31 x10^3/µL) respectively (Table 1). Trypanotolerant cattle had significantly higher (p<0.05) lymphocyte count than the trypanosusceptible cattle (3.64 ± 0.14 x10^3/µL and 2.65 ± 0.12 x10^3/µL) respectively (Table 2).

Neutrophil count: White Fulani cattle had significantly higher (p<0.05) neutrophil count than White Fulani Cross, Muturu and N'Dama (2.34 ± 0.58 x10^3/µL, 1.32 ± 0.35 x10^3/µL, 1.53 ± 0.29 x10^3/µL and 1.08 ± 0.59 x10^3/µL) respectively (Table 1). Trypanotolerant cattle (ND and MUT) had significantly lower (p<0.05) neutrophil count than the trypanosusceptible cattle (WF and WFX) (1.26 ± 0.54 x10^3/µL and 2.76 ± 0.49 x10^3/µL) respectively (Table 2).

Eosinophil count: N'Dama cattle had significantly higher (p<0.05) eosinophil count than White Fulani, Muturu and White Fulani Cross (0.65 ± 0.35 x10^3/µL, 0.25 ± 0.53 x10^3/µL, 0.25 ± 0.14 x10^3/µL and 0.18 ± 0.37 x10^3/µL} respectively (Table 1). Trypanotolerant cattle had significantly higher (p<0.05) eosinophil count than the trypanosusceptible cattle (0.49 ± 0.34 x10^3/µL and 0.21 ± 0.12 x10^3/µL) respectively (Table 2).

Monocyte count: White Fulani (0.29 ± 0.0.12 x10^3/µL) and Muturu (0.25 ± 0.17 x10^3/µL) had significantly higher (p<0.05) monocyte count than White Fulani Cross (0.08 ± 0.09 x10^3/µL)

Table 2: Haematological values in trypanotolerant and susceptible cattle reared at Ibadan, Oyo State, during the wet season (April – June 2017)

Parameters	Trypanotolerant n =25	Susceptible n =25
PCV (%)	35.00 ± 5.02	30.35 ± 6.39
Hb (g/dL)	12.84 ± 2.03	11.54 ± 1.70*
RBC (x10^3/µL)	6.35 ± 1.16	5.76 ± 0.86
Platelet (x10^5/µL)	1.25 ± 0.27	1.52 ± 0.41*
MCV (fL)	60.58 ± 3.16	60.88 ± 2.69
MCH (pg)	20.33 ± 1.11	20.07 ± 0.94
MCHC (g/dL)	33.57 ± 1.06	32.37 ± 0.34*
Total WBC (x10^3/µL)	5.47 ± 1.10	5.38 ± 1.39
Lymphocyte (x10^3/µL)	3.64 ± 0.14	2.65 ± 0.12*
Neutrophil (x10^3/µL)	1.26 ± 0.54	1.76 ± 0.69*
Monocyte (x10^3/µL)	0.12 ± 0.16	0.17 ± 0.15
Eosinophil (x10^3/µL)	0.49 ± 0.34	0.21 ± 0.12*
Basophil (x10^3/µL)	0	0

*n=number of animals; *Values significantly different (p< 0.05). Trypanotolerant= N'Dama and Muturu Trypanosusceptible= White Fulani and White Fulani cross*

and N'Dama (0.03 ± 0.03 x10^3/µL) (Table 1). No significant difference (p>0.05) in the monocyte count was observed between the trypanotolerant and susceptible breeds of cattle (Table 2).

Basophil count: No basophil was seen among the breeds of cattle (Tables 1 and 2).

Platelets values: Significantly higher (p<0.05) platelet count was observed in the White Fulani compared to White Fulani Cross, Muturu and N'Dama (1.73 ± 0.38 x10^5/µL, 1.22 ± 0.20 x10^5/µL, 1.30 ± 0.15 x10^5/µL and 1.20 ± 0.35 x10^5/µL) respectively (Table 1). Trypanotolerant cattle (ND and MUT) had a significantly lower (p<0.05) platelet count than the trypanosusceptible cattle (WFX and WF) (1.25 ± 0.27 x10^5/µL and 1.52 ± 0.41 x10^5/µL) respectively (Table 2).

DISCUSSION

The PCV, Hb and RBC values observed in the present study were within the normal reference interval (Fielder, 2015) and there were no significant differences within the breeds of cattle. This indicated that the animals sampled for this study were healthy and eliminates the school of thought that variability in health status of the breeds of cattle might be responsible for the significant differences seen in haematological parameters.

This observation was in agreement with the findings in the N'Dama and White Fulani cattle reported by Ogunsanmi *et al.* (2000).

N'Dama breed of cattle had higher levels of MCHC when compared with the other breeds of cattle (White Fulani Cross, Muturu and N'dama). This observation was similar to the findings in Sokoto Gudali and White Fulani breed of cattle reported by Olayemi *et al.* (2007). This offers an advantage in terms of oxygen carrying capacity of the blood as MCHC measures the haemoglobin concentration of the packed red cells.

In the present study, the observed significant increase in the platelet count of White Fulani breed as compared to the other breeds of cattle (White Fulani Cross, Muturu and N'dama) were consistent with the findings of Ewuola *et al.* (2014) in which platelet count of Jersey, N'Dama and Sokoto Gudali breeds of cattle were significantly (p<0.05) lower than the White Fulani breed. Furthermore, Ewuola *et al.* (2014) reported that the leucocyte count of Jersey breed was statistically similar with that of N'Dama but it was higher than that of White Fulani and Sokoto Gudali breeds of cattle. This was however not in agreement with the findings of this study, in which there was no statistical difference in the leucocyte counts among the cattle breeds.

In the present study, no eosinophilia was observed from the haematology. However, N'Dama cattle had a significantly higher

eosinophil count as compared to the other breeds of cattle. This was in contrast to the findings of Ode *et al.* (2017) in which there was no significant difference in the eosinophil count between Muturu and Bunaji cattle. Eosinophils play a vital role in long-term humoral immune protection, as they are essential for the elongation of antibody-producing plasma cells in the bone marrow (Berek, 2016). Thus, it can be assumed that the N'Dama cattle have better immunity against parasites.

From the haematological parameters observed in the present study, a significantly higher lymphocyte count was observed in trypanotolerant breeds of cattle (Muturu and N'Dama) as compared to the susceptible breeds. This implies that the trypanotolerant nature of N'Dama and Muturu cattle were responsible for the high lymphocytes count which was perhaps involved in antibody production from the B cells. Also, Abenga and Vuza (2005) reported that during infection, N'Dama cattle had more circulating lymphocytes that could be activated *in vitro* to undergo differentiation into IgM and IgG-secreting cells.

Conclusion: The study showed that MCHC, eosinophils and lymphocytes have significant roles in immunity and are important trypanotolerant indices in N'Dama and Muturu breed of cattle.

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