

HAEMATOLOGICAL PROFILES AND BLOOD PROTEIN LEVELS OF WEST AFRICAN DWARF AND RED SOKOTO GOAT IN IBADAN, NIGERIA: POSSIBLE ASSOCIATION WITH TRYPANOTOLERANCE

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ABSTRACT

Haematological and blood protein parameters were determined in 12 West African Dwarf goats (WAD) and 15 Red Sokoto goats in order to evaluate trypanotolerant indices. The mean PCV, Hb and RBC values of WAD and Red Sokoto goats were within the reference interval and no significant difference was observed in all the erythrocytic values. WAD had significantly higher platelet, lymphocyte and neutrophil counts than Red Sokoto goats ($1.89 \pm 0.58 \times 10^5/\mu\text{L}$, $4.53 \pm 1.13 \times 10^3/\mu\text{L}$, $5.28 \pm 2.30 \times 10^3/\mu\text{L}$ and $0.79 \pm 0.20 \times 10^5/\mu\text{L}$, $2.04 \pm 1.51 \times 10^3/\mu\text{L}$ and $2.61 \pm 0.93 \times 10^3/\mu\text{L}$ respectively, $p < 0.05$). The values obtained for plasma protein and serum total protein were significantly higher in the WAD ($8.12 \pm 0.41 \text{ g/dL}$ and $7.34 \pm 0.45 \text{ g/dL}$ respectively) as compared to the Red Sokoto goats ($7.43 \pm 0.44 \text{ g/dL}$ and 6.65 ± 0.40 respectively, $p < 0.05$). The results suggest that lymphocytes, neutrophils, platelet and blood proteins are considered as possible trypanotolerant indices owing to the observed significant increase in trypanotolerance of WAD as compared to the susceptible Red Sokoto goats.

Keywords: haematology, blood proteins, trypanotolerance, WAD, Red Sokoto.

INTRODUCTION

Small ruminants have an important role in the rural economies of Africa. They are mainly kept to generate income, as savings, and for ceremonial purposes. In Africa, certain breeds of ruminants are found to resist trypanosomosis more than others. This is characterized by the ability of such breeds to live in tsetse-infested areas. Several authors have shown that WAD goats and Djallonke sheep are more resistant to trypanosome infections than other breeds (such as Sahelian or Red Sokoto goats and Sahelian or Fulani sheep) or crossbreeds (such as F1 Sahelian–Djallonke) (Goossens *et al.*, 1999).

Trypanotolerance is the ability to survive, reproduce and remain productive under trypanosomosis endemic environs without the need for the use of chemicals to control the vector or drugs to control the parasite (d' Ieteren *et al.*, 1998). It offers farmers an important option for sustainable livestock production in areas at risk of trypanosomosis. Contrary to the widespread belief that these trypanotolerant breeds are less productive than others because of their small size, it has been convincingly demonstrated that the productivity of trypanotolerant small ruminant is similar to or even better than that of trypanosusceptible breeds when kept under similar conditions (Geert *et al.*, 2009).

Blood profiling is a helpful tool in detecting the health status, metabolic diseases, nutritional deficiencies, and welfare of animals. Haematology and blood protein assay of livestock determine the physiological disposition of the animals to their nutrition (Madubuike *et al.*, 2006; Menon *et al.*, 2013). This present study investigated the trypanotolerant indices by assessing the haematological and blood protein parameters of West African Dwarf goats known to be trypanotolerant as compared to the Red Sokoto goats known to be trypanosusceptible, as trypanotolerance is a complex mechanism involving factors which are not yet fully known.

MATERIALS AND METHODS

SAMPLING

Apparently healthy animals were selected for this study. Red Sokoto (15) and WAD (12) goats were sourced from Bodija, Ibadan, Oyo State.

SAMPLE COLLECTION

Blood (7-10 ml) was obtained aseptically by jugular venipuncture. The collected blood samples were transferred into icepacks and transported to the laboratory for processing and analysis. Two millilitres of the collected blood samples was dispensed into lithium heparin bottles for haematology.

The remaining 5-8 ml of the collected blood samples were dispensed into universal bottles without anticoagulant to obtain serum samples. Clear serum was obtained by centrifugation at 3000 rpm for 10 minutes. Serum samples were then stored in 2 ml portion in deep freezer (20°C) until analysis.

DETERMINATION OF HAEMATOLOGICAL PARAMETERS

Red Blood Cell Parameters

The red blood cell parameters considered for this study were red blood cell 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 method described by Jain (1986).

White Blood Cell Parameters

The white blood cell 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 method described by Jain (1986).

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 Jain (1986).

BLOOD PROTEINS ESTIMATION

The plasma proteins (total plasma protein and fibrinogen) were measured using the refractometer. The fibrinogen levels were determined using the heat precipitation method. The serum total proteins were measured using the Biuret colorimetric method according to the manufacturer's instruction using the Total Protein kit (Randox, TP245). The albumin level was also assessed using the kit (ALB362). The globulin level was evaluated using the method described by Evans, (2011) using the formula below:

$$\text{Globulin (g/dL)} = \text{Total Protein (g/dL)} - \text{Albumin (g/dL)}.$$

The Albumin: Globulin ratio is calculated mathematically as described by Evans, (2011) using the values obtained from the albumin test and the calculated globulin level.

STATISTICAL ANALYSIS

All data collected were analysed using SAS software (version 9.3). Descriptive statistics of the haematological parameters were presented as Mean $\pm$ S.D. Comparison of the mean of the

haematological parameters of the trypanotolerant and susceptible breeds were also determined using Student t-test. A p-value <0.05 was considered statistically significant.

RESULTS AND DISCUSSION

PARASITOLOGICAL INVESTIGATION

All the blood samples were examined for trypanosomes and other parasites using wet mount, buffy coat techniques and Giemsa thin blood smears. None was positive for parasites.

Platelets Values.

HAEMATOLOGY

The means and SE of the effect of breed on the haematology of indigenous goats is presented on Table 1.

Erythrocytic values

The PCV, Hb and RBC values of WAD and Red Sokoto goats were within the reference interval and no significant difference was observed in all the erythrocytic values (Table 1). This indicates that the animals sampled for this study were equally healthy.

Table 1: Means and SE of the Effect of Breed on Haematology of Indigenous Goat

Parameters	WAD n=12	RS n=15	Level of Significant
PCV (%)	32.60±6.39	22.50±11.7	ns
Hb (g/dL)	10.92±2.24	8.63±0.75	ns
RBC (x10 ³ /μL)	11.66±2.03	9.58±0.45	ns
Platelet (x10 ⁵ /μL)	1.89±0.58	0.79±0.20	*
MCV(fL)	27.85±0.89	23.90±12.70	ns
MCH (pg)	9.31±0.35	8.99±0.42	ns
MCHC (g/dL)	33.45±0.69	34.00±8.40	ns
Total WBC (x10 ³ /μL)	9.97±2.28	4.98±1.68	**
Lymphocyte (x10 ³ /μL)	4.53±1.13	2.04±1.51	**
Neutrophil (x10 ³ /μL)	5.28±2.30	2.61±0.93	*
Monocyte (x10 ³ /μL)	0.37±0.33	0.33±0.30	ns
Eosinophil (x10 ³ /μL)	0.23±0.01	0.01±0.01	ns
Basophil (x10 ³ /μL)	0.00	0.00	ns

n=number of animals; Values significantly different.(*= $p < 0.05$, **= $p < 0.01$) WAD= West Africa Dwarf, RS= Red Sokoto, ns = not significant

WAD had a significantly ($p < 0.05$) higher platelet count ($1.89 \pm 0.58 \times 10^5/\mu\text{L}$) than Red Sokoto goats ($0.79 \pm 0.20 \times 10^5/\mu\text{L}$) (Table 1). This is however in contrast to the findings of Obua *et al.* (2012) in which reported no significant difference in the platelet count between these breeds. Platelets play a vital role in

thrombosis and hemostasis, innate immunity, initiating and participating in multiple inflammatory processes, directly binding pathogens, and even destroying them. The significant increase in the platelet count observed in the WAD goats implies that the WAD goats have a stronger immune system as compared to the Red Sokoto goats.

Table 2: Blood Protein Values of WAD and Red Sokoto Goats

Parameters	WAD n=12	RS n=15	Level of significance
Plasma protein (g/dL)	8.12±0.41	7.43±0.44	*
Fibrinogen (mg/dL)	220.0±43.6	230±73.5	ns
Serum total protein (g/dL)	7.34±0.45	6.65±0.40	*
Albumin (g/dL)	3.06±0.40	2.83±0.17	ns
Globulin (g/dL)	4.28±0.56	3.83±0.33	ns
A/G Ratio	0.73±0.13	0.74±0.02	ns

n=number of animals; Values significantly different (*= $p < 0.05$). WAD= West Africa Dwarf, RS= Red Sokoto, ns = not significant.

Leucocytic values

Total white blood cell count (TWBC)

WAD had significantly ($p < 0.01$) higher total WBC ($9.97 \pm 2.28 \times 10^3/\mu\text{L}$) than the Red Sokoto goats ($4.98 \pm 1.68 \times 10^3/\mu\text{L}$). This is however in contrast to the findings of Obua *et al.* (2012) in which there was no significant difference in the leucocyte count between these breeds but is in agreement with the findings of Opara *et al.* (2010). From this study, the significant increase in the TWBC is derived from the lymphocytes and neutrophils which are known to play a vital role in innate immunity.

Lymphocyte count

The Red Sokoto breed had a significantly lower lymphocytes count ($2.04 \pm 1.51 \times 10^3/\mu\text{L}$) than the WAD breed ($4.53 \pm 1.13 \times 10^3/\mu\text{L}$). This is however in contrast to the findings of Obua *et al.* (2012) in which there was no significant difference in the lymphocyte count between these breeds but is in agreement with the findings of Opara *et al.* (2010). This may imply that the high lymphocytes count which is involved in antibody production from the B cells is responsible for the trypanotolerance of WAD goats.

Neutrophil count

WAD had significantly ($p < 0.05$) higher neutrophil count ($5.28 \pm 2.30 \times 10^3/\mu\text{L}$) than the Red Sokoto goats ($2.61 \pm 0.93 \times 10^3/\mu\text{L}$). This is however in contrast to the findings of Obua *et al.*, (2012) in which there was no significant difference in the neutrophils count between these breeds but is in agreement with the findings of Opara *et al.* (2010). This implies that WAD goats

seem to possess a protective system, providing a rapid and potent defense against any infectious agent and this is probably the physiological basis for the adaptation of this species to their ecological zone characterized by high prevalence of diseases.

Monocyte, Eosinophil and Basophil count

No significant difference was observed in the monocyte, eosinophil and basophil counts.

BLOOD PROTEINS

Blood proteins serve many different functions, including the transport of lipids, hormones, vitamins, and minerals and the functioning of the immune system. In this study, the significant increase observed in the serum total protein and plasma protein of the WAD goats (7.34 ± 0.45 g/dL and 8.12 ± 0.41 g/dL respectively) (Table 2) implies that the WAD goats have an advantageous immune system than the Red Sokoto goats (6.65 ± 0.40 and 7.43 ± 0.44 g/dL respectively, $p < 0.05$) (Table 2), because of the major role the blood proteins play in immunity and this can be likened to their trypanotolerant nature. No significant difference was observed in the fibrinogen, albumin, globulin, and A/G ratio among the breeds of cattle. This implies that the animals used for this study were equally healthy as these proteins are biomarkers that are used to monitor the health status of animals. They also play a vital role in inflammation and are referred to as acute phase

proteins which increase or decrease in response to infection.

CONCLUSION AND RECOMMENDATIONS

This study revealed the haematological profile and blood protein levels of WAD and Red Sokoto goats and possible association with trypanotolerance. According to this study, lymphocytes, neutrophils, platelets and blood proteins are considered as possible trypanotolerant indices due to the observed significant increase in trypanotolerant breed of goat (WAD) as compared to the susceptible (Red Sokoto). Each of this indices has been shown to enhance the immune response of WAD Goat to trypanosome infection. Thus, these indices may play a significant role in trypanotolerance.

Considering the recent advances in molecular study of trait involved in trypanotolerance, the role of micro-nutrient in enhancing haemopoiesis and immune responses to trypanosome infections should be investigated.

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