

EFFECT OF SEXUAL DIMORPHISM ON HAEMATOLOGICAL PARAMETERS IN TWO NIGERIAN INDIGENOUS GOAT BREEDS IN SOUTH-WESTERN NIGERIA

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ABSTRACT

This study evaluated the Haematological variations in two-Nigerian indigenous goat breeds reared under controlled conditions for ten weeks at the Teaching and Research Farm, the Federal University of Technology, Akure. A total of 36 goats comprising 18 West African Dwarf (WAD) and 18 Red Sokoto breeds were procured and used for the study. They were made of 9:9 male to female ratio for each breed. Each breed was further divided into 3 replicates at 6 goats per replicate which were then divided into equal sexes of 3:3 per replicate. The goats were acclimatized for 21 days and then distributed according to experimental layout. At the end of the study, blood samples were collected from 24 randomly selected goats at 12 for each breed via venipuncture. Data generated were subjected to 2x2 factorial analysis of variance using SPSS 2023. Results showed no significant difference ($p>0.05$) for the effect of breed, sex and their interaction in all haematological parameters except basophils. The WAD goats had higher erythrocytes and lower basophils that may enhance oxygen transport and resilience against parasitic infections while Sokoto Red goats exhibited a stronger immune response through elevated leucocytes. It was concluded that both goat breeds possessed unique immunological advantages as most indigenous animals for their hardy nature. It was recommended that the genetic constitution of these animals be conserved and utilized for their improvement through strategic selection and breeding programmes to retain the unique traits of both breeds for sustainable goat production in Nigeria.

Key words: Intensive management, West African Dwarf, Red Sokoto, Health, Adaptability

INTRODUCTION

Goat farming has been an integral part of Nigerian agriculture for centuries, contributing significantly to the country's economy and food security. Nigeria has the largest goat population in West Africa, with approximately 76 million goats recorded in 2019 (FAO, 2021). Goat husbandry is primarily practiced at a subsistence level, often in mixture of crop-livestock production system and are common in rural areas (Ogundipe *et al.*, 2020). Goats provide meat, milk and income through the sale of live animals and their products (Adebowale *et al.*, 2019).

The Sokoto Red and West African Dwarf are two indigenous goat breeds that are particularly notable for their adaptability to different tropical agro-ecological zones and are of valuable economic importance (Yakubu *et al.*, 2018). The Red Sokoto or Maradi goats are predominant in Northern Nigeria and are valued for their high-quality skin, known as "Morocco leather" (Alphonsus *et al.*, 2017). This medium-sized breed thrives in semi-arid conditions and is known for its meat and milk production (Tsado *et al.*, 2021). Conversely, the WAD goat is quite common in the Southern and middle belt regions, where its small body size constitutes an adaptability trait to this tsetse fly-infested humid zones (Odubote, 2019). The breed is prolific, trypanotolerant and capable of thriving on low-quality feed (Daramola *et al.*, 2021) that are commonly witnessed in the dry season period. These indigenous breeds constitute valuable genetic resources, possessing traits that enhance adaptation to local conditions and resistance to diseases (Adjei *et al.*, 2021). With climate change and environmental challenges, conserving and improving these breeds is vital for sustainable livestock production in Nigeria (Onzima *et al.*, 2018).

Therefore, this study was carried out to evaluate the variations in the haematological parameters of Sokoto Red and WAD goats by focusing on the breed and sex effects to better understand their health, physiological and adaptability statuses. The study will also serve to generate baseline data on these goats for research and improvement purposes.

MATERIALS AND METHODS

Location of study

The research was conducted at the Small Ruminant Unit of the Teaching and Research Farm, the Federal University of Technology, Akure, (FUTA) located between 7°18'5N and 5°8'5E. The climate Akure follows the South-Western Nigeria pattern, influenced by rain-bearing Southwest monsoon winds and dry Northwest winds from the Sahara Desert. The rainy season lasts from March to October with a break in August and annual rainfall ranging from 1,150 mm to 2,000 mm (Ogunrayi *et al.*, 2016). Temperatures range between 21°C and 29°C with an attendant high relative humidity.

Animal procurement and Pre-experimental operations

The goats used for the study were procured from trusted local farmers within close proximity to FUTA to minimize transport-related stress. Upon arrival, the goats were quarantined approximately 4 weeks, screened for diseases, where they were vaccinated and medicated against ecto- and endo-parasites. The quarantine period also served the purpose of gradual acclimatization for the goats where they were familiarized with the farm environment. Each goat was assigned a unique identification number for accurate health monitoring and record tracking.

To ensure optimal animal welfare and biosecurity, goat housing and pens were inspected, repaired and cleaned with disinfectant. Feeding and watering systems were optimized with adequate ventilation. These preparations minimized disease risks and ensured smooth operations throughout the experimental period.

Experimental design and Management practices

A total of 36 goats comprising 18 West African Dwarf and 18 Red Sokoto breeds were procured and used for the study. The goats were made of 9:9 male to female ratio for each breed. Each breed was divided into 3 replicates at 6 goats per replicate which were divided into equal sexes of 3:3 per replicate.

The goats were managed under an intensive farming system in well-ventilated and secure pens with regular cleaning. Bedding material was frequently replaced on weekly basis to maintain hygienic condition. The diet used for the study included a controlled measure of concentrates plus forage mixture and water supplied *ad libitum*. Routine health management including deworming and prompt treatment of illnesses were done to ensure optimal health condition. Accurate records were maintained using the goats' unique identification numbers.

Blood and data collection

Blood samples were collected from 24 randomly selected goats at 12 for each breed (West African Dwarf and Red Sokoto), 6 goats per sex and 2 goats from each of the 3 replicates. The blood samples were collected into EDTA anticoagulant containing sample bottles from the goats' jugular vein-puncture using sterile syringes to minimize animal stress. Samples collected were gently rocked to prevent blood coagulation, the bottles were properly labeled and taken to the laboratory for haematological analysis. Data were generated from the analyses and were recorded as appropriate. Haematological parameters examined include erythrocyte sedimentation rate (ESR), packed cell volume (PCV), haemoglobin concentration (Hb), red blood cell (RBC), white blood cell (WBC) and differential leukocyte counts via lymphocytes (LYM), neutrophils (NEU), monocytes (MON), eosinophils (EOS) and basophils (BAS). These parameters provided insights into the animals' health, immune function, physiological status, welfare and overall performance.

Statistical analysis

Data generated were subjected to 2x2 factorial analysis of variance (ANOVA) using the Statistical Package for Social Sciences 2023, Version 25 to evaluate the goats' haematological parameters for the effect of breed, sex and their interaction. Significant means were separated using Duncan Multiple Range Test of the same statistical package.

RESULT AND DISCUSSION

Results

The effects of breed, sex and their interaction on haematological characteristics of experimental goats as shown in Table 1 indicated that all the blood parameters were not significantly different ($p>0.05$) between the factors considered in this study except for basophils. The erythrocyte sedimentation rate and packed cell volume were

0.89 mm/hr and 31.50% and 0.71 mm/hr and 31.93% in Red Sokoto and WAD goats respectively. This indicates similar precipitation rates and oxygen-carrying capacities of the red cells. Red blood cell counts in WAD goats ($12,570.60 \times 10^6/\mu\text{L}$) was higher compared to Red Sokoto goats ($12,227.50 \times 10^6/\mu\text{L}$) while the white blood cell counts in Red Sokoto goats exhibited higher WBC levels ($319.00 \times 10^3/\mu\text{L}$) than WAD goats ($285.85 \times 10^3/\mu\text{L}$). Also, the haemoglobin levels in Red Sokoto (9.85 g/dL) were slightly higher than that of

Table 1: Effects of breed, sex and interaction on haematological characteristics of experimental goats

BREED	SEX	ESR (mm/hr)	PCV (%)	RBC ($10^6/\mu\text{L}$)	WBC ($10^3/\mu\text{L}$)	Hb (g/dL)	LYM (%)	NEU (%)	MON (%)	EOS (%)	BAS (%)
SRD		0.89	31.50	1222.75	319.00	9.85	57.75	32.25	6.75	3.00	1.50 ^a
WAD		0.71	31.93	12570.60	285.85	9.51	56.35	31.68	6.88	3.55	0.55 ^b
±SEM		0.11	0.95	200.98	35.16	0.48	0.60	1.40	0.42	0.29	0.25
P-value		0.33	0.76	0.60	0.53	0.64	0.14	0.78	0.84	0.10	0.03
	Male	0.78	31.55	1214.60	288.60	9.12	57.60	30.55	6.50	3.30	1.05
	Female	0.81	31.88	1208.75	316.25	10.24	56.50	33.38	7.13	3.25	1.00
±SEM		0.11	0.97	225.75	35.83	0.49	0.61	1.42	0.43	0.21	0.25
P-value		0.82	0.82	0.59	0.60	0.14	0.23	0.19	0.33	0.87	0.89
B×S											
SRD	Male	0.75	31.50	1225.00	321.00	9.30	58.00	31.50	6.00	3.00	1.50
	Female	1.00	31.50	1220.50	317.00	10.40	57.50	33.00	7.50	3.00	1.50
WAD	Male	0.80	31.60	1204.20	256.20	8.94	57.20	29.60	7.00	3.60	0.60
	Female	0.63	32.25	1197.00	315.50	10.08	55.50	33.75	6.75	3.50	0.50
±SEM		0.15	1.35	235.86	49.69	0.69	0.84	1.97	0.60	0.29	1.03
P-value		0.21	0.82	0.59	0.55	0.98	0.50	0.53	0.19	0.87	0.89

^{a,b}Means with different superscript on the same column for the same parameter are significantly ($p < 0.05$) different, SEM = Standard Error of Mean; ESR = erythrocyte sedimentation rate, PCV = Packed cell volume, RBC = Red blood cell, WBC = White blood cell, Hb = Haemoglobin concentration, LYM = Lymphocytes, NEU = Neutrophils, MON = Monocytes, EOS = Eosinophils, BAS = Basophils, SRD = Sokoto Red, WAD = West African Dwarf and B×S = Interaction of breed and sex

WAD (9.51 g/dL) goats. Moreover, the lymphocytes counts were marginally higher in Red Sokoto goats (57.75%) than in WAD goats (56.35%) while WAD goats had a slightly higher eosinophil count (3.55% vs. 3.00%) as compared to Red Sokoto. However, basophil levels were significantly ($p < 0.05$) higher in Red Sokoto goats (1.50%) than in WAD goats (0.55%). The sex variations male and female goats exhibited no significant difference ($p > 0.05$) in all the parameters. Female goats had slightly higher haemoglobin concentration (10.24 g/dL) and neutrophil counts (33.38%) compared to their male counterparts (9.12 g/dL and 30.55%) respectively.

Similar observations were observed in breed-sex interaction where no significant interaction ($p > 0.05$) between breed and sex was observed in all the haematological parameters, indicating that breed and sex independently influenced the expression of these traits.

Discussion

Haematological analysis provided insights into the physiological mechanisms surrounding growth, health, adaptations and survival of animals such as goats and this reflect breed-specific variations. Of the erythrocyte parameters, the packed cell volume values were similar between breeds, but WAD goats had higher red blood cell counts, albeit not statistically significant. This suggests a potential advantage for oxygen transport in WAD goats, which may be an adaptation to more oxygen-demanding activities (Daramola *et al.*, 2005). In contrast, slightly elevated haemoglobin (Hb) levels in Sokoto Red goats imply higher haemoglobin concentration per cell, possibly enhancing oxygen utilization efficiency (Opara *et al.*, 2010). However, for the leukocyte parameters, the Sokoto Red goats had higher white blood cell counts than WAD goats, suggesting a stronger immune response, though not statistically significant which agreed with the findings of Oni *et al.*, (2012) in their research. Differential leukocyte analysis revealed that lymphocyte levels were slightly higher in Sokoto Red goats, indicating a more active adaptive immune system (Yakubu *et al.*, 2013). A significant difference in basophil levels, though found lower in WAD goats may point to breed-specific differences in allergic or parasite resistance (Tambuwal *et al.*, 2002).

On the basis of sex-based differences, all the haematological parameters showed no significant sex-based differences. Female goats exhibited slightly higher haemoglobin and neutrophil levels than their male counterparts, potentially reflecting physiological or hormonal differences (Egbe-Nwiyi *et al.*, 2000). Similarly, there were no significant breed-sex interaction and suggests that breed and sex independently influence haematological parameters. It then follows that breeding plans can be executed by focusing on either factor without much concern for complex interactions (Ikhimioya and Imasuen, 2007).

CONCLUSION

The study highlighted that there were no significant haematological differences between Sokoto Red and WAD goats while trends in certain variables suggest breed-specific adaptations. West african dwarf (WAD) goats' higher red blood cell (RBC) counts and lower basophil levels may enhance oxygen transport and resilience against parasitic infections. Also, Sokoto Red goats exhibited a stronger immune response through elevated white blood cell (WBC) counts. It follows that both goat breeds possess unique immunological advantages that gave most indigenous animals their hardy nature. These findings underscore the importance of utilizing and conserving both breeds for sustainable goat production in Nigeria.

RECOMMENDATIONS

Based on the findings of this study, it can be recommended that the genetic constitution of these animals should be conserved and utilized for their improvement through strategic selection and breeding programmes to retain the unique traits of both breeds. Crossbreeding should be approached cautiously to avoid diluting their genetic diversity. The breeding efforts should be focused on enhancing the growth rates and physical fitness traits of WAD and Sokoto Red goats respectively.

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