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## The influence of sex on the haematological values of apparently healthy adult Nigerian Sahel goats

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### Abstract

Blood samples were collected from fifty apparently healthy adult Sahel goats, twenty five each of male and female in Maiduguri to assess the influence of sex on their haematology. The red blood cell (RBC) counts, white blood cell (WBC) counts, haemoglobin (Hb) concentration, packed cell volume (PCV), platelet counts, neutrophils, eosinophils, lymphocytes, monocytes and basophils counts were determined. The mean corpuscular volume (MCV), the mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were also determined. The RBC, WBC, MCH and neutrophil values were higher ( $P < 0.05$ ) in female than male goats. However, the platelet, MCV, eosinophil and monocyte values were higher ( $P < 0.05$ ) in male than female goats. The PCV, Hb, MCHC, lymphocytes and basophil values were comparable ( $P > 0.05$ ) in both sexes. The variations may be due to breed idiosyncrasies or inherent sex differences among male and female Sahel goats. The haematological values obtained in this study were significant, but did not differ from the normal values for caprine species. In conclusion, sex significantly influenced the RBC, WBC, MCV, MCH, platelet, neutrophil, eosinophil and monocyte values in this study.

**Keywords:** Haemogram, Maiduguri, Nigeria, Sahel Goats, Sex

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### Introduction

Goat is one of the small ruminants that are in high demand for meat, milk and ritual sacrifices (Bourn *et al.*, 1994). Goats are renowned for their tolerance as they survive in most environments. Nigeria has the largest population (34.5 millions) of goats in Africa and there are three major breeds namely; Sahel, Red Sokoto and west African dwarf. Sahel goats are mostly found in the north eastern part of Nigeria and along frontiers with Niger Republic (Bourn *et al.*, 1994; Daramola *et al.*, 2005).

The Sahel or West African long-legged goat resembles the West African Dwarf in coat colour except for its long twisted horn, long leg and its larger size. The ear is usually short and horizontal, but sometimes moderately long in the female and the commonest colour is white pied with black or brown or self coloured (Bourn *et al.*, 1994). The breed is adapted to the arid sub-Saharan savanna

region and does not thrive well in humid areas (Devendra & Burns, 1970).

Blood being a fluid tissue is essential for the survival of multicellular organisms (Jain, 1986). The importance of determining the haematological values of domestic farm animals has been well documented (Oduye & Adadevoh, 1976; Anosa & Isoun, 1978; Opara *et al.*, 2010). Haematology is pivotal to clinical diagnosis, surgical intervention and responses to therapy (Coles, 1986; Biu *et al.*, 2009; Yaqub *et al.*, 2013).

Several factors (sex, breed, physiologic status, nutrition, age, genetics, stress, disease, management system, location and season) are known to affect haematological values in domestic animals (Anosa & Isoun, 1978; Coles, 1986; Egbe-Nwiyi, 1995; Adejinmi *et al.*, 2000; Daramola *et al.*, 2005; Addass *et al.*, 2010). Various reports have underlined the emerging

observation that it may be difficult to formulate a universal haematologic profile for indigenous goats due to interplay of the aforementioned factors (Daramola *et al.*, 2005; Addass *et al.*, 2010).

Sex has been reported to influence haematological values in many animal species (Tambuwal *et al.*, 2002; Daramola *et al.*, 2005; Olayemi *et al.*, 2006; Oladele *et al.*, 2007). Much work has not been done on the influence of sex on haematological values of Sahel goats in the arid zone of Borno State. Therefore, this study focused on the haematological values of apparently healthy Sahel goats as influenced by sex in Borno State, Nigeria.

### Materials and methods

Fifty apparently healthy adult sahelian goats of both sexes (25 each of male and female) were used in this study. Female goats on estrus, pregnant or lactating were not considered for the study.

Five millilitres (5ml) of blood was collected from the jugular vein of each goat into ethylene diamine tetracetate (EDTA) coated sample bottles for haematology. The microhaematocrit and cyanometheamoglobin methods (Coles, 1986) were used to determine the Packed Cell Volume (PCV %) and haemoglobin concentration (Hb g/dl) respectively. The Red Blood Cell (RBC) ( $\times 10^6/\mu\text{l}$ ) and White Blood Cell (WBC  $\times 10^3/\mu\text{l}$ ) and platelets ( $\times$

$10^5/\mu\text{l}$ ) counts were done by haemocytometry (Brown, 1976; Dacie & Lewis, 1991).

The mean corpuscular haemoglobin concentration (MCHC) representing the percentage of haemoglobin in one deciliter (dl) of packed red blood cell, expressed as percentage (%), mean cell volume (MCV) as the average of a single cell expressed in femtolitres (fl) and the mean corpuscular haemoglobin (MCH) expressed as the average haemoglobin concentration in picogram (pg) of a single red blood cell were all determined (Bush, 1975; Jain, 1986). Values obtained were expressed as mean  $\pm$  standard deviation (SD) and the paired students "t" test used to compare variations among sex of goats examined (Graphpad Instat 2003).

### Results

The haemogram of 50 clinically normal Nigerian Sahel goats was studied, and the results obtained are presented in Table 1. The RBC, WBC, Platelets, neutrophils, eosinophils and monocytes counts of male goats varied significantly ( $P < 0.05$ ) compared with those of the female goats; however Hb, PCV, lymphocytes and basophils of male goats did not vary significantly ( $P > 0.05$ ) from those of female goats. Also, the haematological indices of MCV and MCH were significantly different ( $P < 0.05$ ) in both sexes while the MCHC showed no significant ( $P > 0.05$ ) variation among sexes.

**Table 1:** Mean ( $\pm$  SD) haematological values of apparently healthy adult Sahelian goats examined in Maiduguri, Borno State, Nigeria

Parameters (units)	SEX		Normal range of values
	Male (n=25)	Female (n=25)	
RBC ( $\times 10^6/\mu\text{l}$ )	10.0 $\pm$ 2.8 <sup>a</sup>	13.5 $\pm$ 17.8 <sup>b</sup>	8.0 - 18.0
Hb (g/dl)	9.5 $\pm$ 2.8 <sup>a</sup>	9.8 $\pm$ 3.9 <sup>a</sup>	8.0 - 12.0
PCV (%)	31.9 $\pm$ 11.5 <sup>a</sup>	32.6 $\pm$ 7.3 <sup>a</sup>	22.0 - 38.0
WBC ( $\times 10^3/\mu\text{l}$ )	9.9 $\pm$ 3.7 <sup>a</sup>	11.9 $\pm$ 3.5 <sup>b</sup>	4.0-13.0
Platelets ( $\times 10^3/\mu\text{l}$ )	6.8 $\pm$ 3.7 <sup>a</sup>	5.2 $\pm$ 4.8 <sup>b</sup>	3.0 - 6.0
MCV (fl)	24.1 $\pm$ 2.8 <sup>a</sup>	22.1 $\pm$ 1.8 <sup>b</sup>	16.0 – 25.0
MCH (pg)	8.1 $\pm$ 1.6 <sup>a</sup>	9.9 $\pm$ 2.3 <sup>b</sup>	5.2 - 8.0
MCHC (g/dl)	35.2 $\pm$ 19.1 <sup>a</sup>	33.6 $\pm$ 19.6 <sup>a</sup>	30.0 – 36.0
Absolute DLC ( $\times 10/\mu\text{l}$ )			
Neutrophils (mature)	3629.3 $\pm$ 1708.1 <sup>a</sup>	5677.3 $\pm$ 3015.8 <sup>b</sup>	1,200- 7,200
Lymphocytes	5393.2 $\pm$ 1923.1 <sup>a</sup>	5392.3 $\pm$ 2383.2 <sup>a</sup>	2,000-9,000
Eosinophils	570.9 $\pm$ 367.6 <sup>a</sup>	487.6 $\pm$ 262.6 <sup>b</sup>	50 – 650
Monocytes	671.3 $\pm$ 1099.8 <sup>a</sup>	489.9 $\pm$ 293.1 <sup>b</sup>	0 - 550
Basophils	58.3 $\pm$ 187.2 <sup>a</sup>	57.2 $\pm$ 101.1 <sup>a</sup>	0 - 120

Key: n = no. of goats examined, DLC = differential leucocyte counts

Values in rows with different superscripts differ significantly ( $p < 0.05$ )

\*Jain, 1986

## Discussion

The haematological values obtained in this study were within the normal range for goats (Jain, 1986). We observed a significantly higher RBC values in female than in male goats. This agreed with the findings of Holman & Dew (1966) in goats, Babeker & Elmansoury (2013) in Sudanese Desert goats, but differ from the findings of Wilkins & Hodges (1962) who reported higher values in male than female goats, while Addass *et al.* (2010), Opara *et al.* (2010) and Obua *et al.* (2012) reported no significant difference between male and female RBC in West African Dwarf goats and Red Sokoto goats. The mean PCV in this study were comparable in both male and female goats and it agreed with the reports of Wilkins & Hodges (1962), Igbokwe *et al.* (1991), Daramola *et al.* (2005), Adamu *et al.* (2010) and Opara *et al.* (2010), but is in disagreement with the findings of Tambuwal *et al.* (2002) and Okonkwo *et al.* (2011) who reported higher values in male Red Sokoto goats.

Mean Hb values in both sexes showed no significant variation and is in consonance with the values reported by Egbe-Nwiyi *et al.* (2000), Tambuwal *et al.* (2002), Opara *et al.* (2010) and Babeker & Elmansoury (2013). Significantly higher mean MCV values were observed in male goats in this study when compared with the female goats. This did not agree with the observations of Wilkins & Hodges (1962) who reported higher values for female than male goats and Obua *et al.* (2012) who reported no significant difference. But agreed with the findings of Opara *et al.* (2010) and Babeker & Elmansoury (2013). The mean MCH values in the female was significantly higher than that of the male and this was in consonance with the finding of Wilkins & Hodges (1962). Babeker & Elmansoury (2013) reported a significant higher MCH values for male than female goats, while Opara *et al.* (2010) observed no significant variation in both sexes. The mean MCHC values in this study which were comparable in both sexes were in agreement with previous studies (Wilkins & Hodges, 1962; Opara *et al.*, 2010; Obua *et al.*, 2012).

The RBC, PCV, Hb, MCV, MCH and MCHC values help to determine and classify anaemia (Jain, 1986). The mean platelet counts which were higher in male than female goats are involved in maintaining haemostasis as they help to preserve vascular integrity (Jain, 1986). The mean WBC counts were significantly higher in female than in male goats and this agreed with the reports of previous workers

(Tambuwal *et al.*, 2002; Babeker & Elmansoury, 2013; Haldar, 2012; Njidda *et al.*, 2013), but is in contrast to the observations of Egbe-Nwiyi *et al.* (2000) who recorded higher values in male goats and Daramola *et al.* (2005) who reported no sex effect on the WBC of West African Dwarf goats. The neutrophil counts which was significantly higher in female goats were in consonance with the findings of Tambuwal *et al.* (2002), Daramola *et al.* (2005), Opara *et al.* (2010) and Babeker & Elmansoury (2013), but ran counter to the findings of Egbe-Nwiyi *et al.* (2000), although the authors worked on Red Sokoto and Borno White breeds.

The lymphocyte counts in both sexes were comparable and differ from that previously reported by Egbe-Nwiyi *et al.* (2000), Tambuwal *et al.* (2002), Daramola *et al.* (2005) and Opara *et al.* (2010), but agreed with the observations of Obua *et al.* (2012) and Habibu *et al.* (2014) in West African Dwarf and Red Sokoto goats respectively. Eosinophil and monocyte counts which were significantly higher in the male goats in the present study agreed with Babeker & Elmansoury (2013) who reported higher eosinophil values in male but higher monocyte values in female. There is no significant variation in the basophil values in both sexes and this is in harmony with the reports of several authors (Egbe-Nwiyi *et al.*, 2000; Opara *et al.*, 2010; Babeker & Elmansoury, 2013; Obua *et al.*, 2012; Njidda *et al.*, 2013). Circulating leucocytes represent the outcome of the dynamic production of bone marrow, the release of cells to the peripheral circulation and the storage in different organs or pools (Yaqub *et al.*, 2013). They play an important role in immunity and defense against foreign invaders (Ganong, 2005). The variations observed between haematological parameters in this study as influenced by sex may be due to inherent sex differences among male and female Sahel goats (Addass *et al.*, 2010) while, the variations observed in this study and those reported by other authors, could be due to differences in breed, species, age, climate, season, blood collection procedure, animal housing, nutrition and subclinical illness (Egbe-Nwiyi, 1995; Daramola *et al.*, 2005).

In conclusion, this study showed remarkable influence of sex on the RBC, WBC, MCV, MCH, platelets, neutrophils, eosinophils and monocytes values of Sahel goats in the arid zone of Borno State. These variations may be attributed to breed idiosyncrasies or inherent sex differences among male and female Sahel goats.

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