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# Haematology and serum biochemical profile of Kalahari Red goats reared in the hot-humid south-west Nigeria

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**Abstract**

*The aim of this study was to determine the biochemical and haematological profiles of Kalahari Red goats reared in the tropical environment. The Kalahari Red goats were imported into Nigeria from South Africa by the Federal University of Agriculture Abeokuta, Nigeria. The study was carried out on fifty animals of both sexes. The animals were managed under semi-intensive system where they were allowed to go out and graze on paddocks during some part of the day and brought back to the pens in the evening. The goats were fed with concentrate and grazed on sown pastures of Chloris gayana and Stylosanthes amata. Water was given ad-libitum. The serum biochemical analysis was determined using Randox$^R$ analysis kits. The sex of each animal was noted and recorded. The packed cell volume, haemoglobin concentration, red blood cell count, white blood cell count, neutrophils, lymphocytes, monocytes, eosinophils and basophils were determined as haematological parameters while total protein, albumin, globulin, sodium, potassium, calcium and phosphorus were determined in serum analysis. The results showed that there was no significant ($p>0.05$) difference in all the haematological parameters determined across sex. There were significant ($p<0.05$) differences in total protein and albumin across sex of which the mean values were higher in the female goats. The value of the mean total protein in the female goats was 5.93±0.88 while the value was 5.31±0.23 in the male goats. It can be concluded that sex did not have any influence on the haematology but had association on only the protein component of the serum biochemistry. This result obtained can be used as a reference value for Kalahari Red goats reared in the tropics and under similar nutrition.*

**Keywords:** Exotic goats, Blood profile, Adaptation to tropical environment

## Introduction

Small ruminants are very important livestock to smallholder farmers in developing countries (Kioumarsi *et al*., 2008, 2009; Khorshidi *et al*., 2008, 2010; Abdelrahman, 2009). However, inadequate nutrition is one of the most problematic constraints to the ruminant livestock industry in developing tropical countries. In particular, meat-type goats need attention since they do not fatten in ways similar to other livestock and their growth rate is slower (Morand-Fehr, 2005; Gasmi-Boubaker *et al*., 2007).

Evaluation of haematological parameters or attributes serves as an index of general physiology, nutrition and health status of animals. The haematological profile of goat may be influenced by several physiological factors especially the age, sex, breed, nutrition and also management and stress (Schalm *et al*., 1975; Tambuwal *et al*., 2002). The life of all flesh is in the blood and its usefulness for assessing the health status, chemical evaluation for survey, physiological, pathological conditions and diagnostic and prognostic evaluation of various types of diseases in animals cannot be over emphasized (Tambuwal *et al*., 2002; Alade *et al*., 2005). The blood also helps in distinguishing normal state from state of stress, which can be maturational,

environmental or physical (Aderemi, 2004). Haematological values are widely used to determine systematic relationship and physiological adaptation including the assessment of general health condition of animals (Kamal *et al*., 2007). The changes in these parameters have been studied in cattle (Ghergariu *et al*., 1984) sheep (Kausslish and Arora, 1977) and Red Sokoto goats (Tambuwal *et al*., 2002), but not in the Kalahari Red goats reared in the tropics.

The Kalahari Red Goats are ideally suited to the harsh and outstretched conditions of large parts of South Africa (SA). In SA they are bred in harsh conditions, arid and semi-desert areas. To prevail under these conditions, animals must be sun-resistant and hardy, fit to walk over a long distance in the harsh environment in search of food and water. The Kalahari Red goat breed is native to South-Africa (Simela and Merkel, 2008). The breed is highly productive, has good mothering ability, excellent growth rate and chevron conformation (Campbell, 2003). These animals were imported into Nigeria by the Federal University of Agriculture Abeokuta (FUNAAB) and the goat project is anchored in the Institute of Food Security, Environmental Resources and Agricultural Research (IFSERAR). These animals have been found to be hardy and are adapting to the hot humid zone of the south-west Nigeria in the tropics (Tukur *et al*., 2014). Their hardiness has made them to show some level of tolerance to diseases and pest in the IFSERAR Farm environment. This breed also has a good foraging and excellent mothering ability and so is regarded as "minimum care/maximum profit" breed (Ramsay *et al*., 2001).

The goats are generally large, tall and long. The adult male can weigh 115kg while the female weighs up to 75kg. A birth weight of 3kg has been recorded on the IFSERAR Farm while a kid weight gain of 1.5kg per week has also been recorded (unpublished data of Kalahari Red goat project of IFSERAR, FUNAAB). This would mean more meat from higher carcass yield per animal per hectare of farm land. This breed is kept for both meat and milk.

The haematological and biochemical indices is a reflection of the effects of diets on the animals in terms of the type and amount of feed ingested and were available for the animals to meet its physiological, biochemical and metabolical necessities (Ewuola *et al*., 2004). Also the level of anti-nutritional element or factors present in the feed influences the haematological and biochemical values (Akinmutimi, 2004). There is a great variation in the haematological and biochemical parameters as observed between breeds of goats (Azab and Abdal-Maksoud, 1999) and in this regard, it may be difficult to formulate a universal metabolic profile test for goat (Okpara *et al.,* 2010). The present work was undertaken to study haematological parameters and biochemical analysis of Kalahari Red goats of both sexes. Scanty work has been done on haematology of Kalahari Red goats reared in the hot- humid tropical zone. Therefore, this study focused on the haematological and serum biochemical components of Kalahari Red goats of both sexes reared in south-west Nigeria.

## Materials and methods

### *Experimental site*

The study was carried out at the IFSERAR Farm in Opeji. The IFSERAR Farm is one of the research Farms in the Federal University of Agriculture, Abeokuta (FUNAAB). Abeokuta, capital city of Ogun State in south-west Nigeria, situated at $7^0$9'39" N, $3^0$20'54"W and it is 76m above sea level and falls within the rainforest vegetation zone of south-western Nigeria. It has a relative humidity averaged of 82%;

mean annual precipitation of 1037mm, and a mean annual temperature of 33.7°C.

***Experimental animals and management***

Fifty Kalahari Red goats were sampled which included both male and female. The goats were reared semi-intensively. They were housed from the evening to early morning in the goat pens and were released to go and graze at about 10:00AM on pasture paddocks sown with *Chloris gayana* and *Stylosanthes amata.* Before the animals were released into the paddocks in the morning, they were fed with concentrate rations and this was repeated in the evening after grazing. Water was provided *ad-libitum*.

***Sample collection and laboratory analysis***

Blood samples were collected from the jugular vein using the vacutainer kits into EDTA bottle for haematology and into plain bottles for serum biochemical analysis aseptically and also ensuring the welfare of the animals. The blood samples were processed and analysed in the Physiology and Pharmacology Department of the College of Veterinary Medicine (COLVET), FUNAAB.

***Packed Cell Volume (PCV)***

Packed cell volume (PCV) was determined using a Micro-Haematocrit Centrifugation technique. The blood was drawn into capillary tubes, one for each sample, and spun for 5 minutes at 3000 revolutions per minute (rpm). The packed cell volume was read in percentage using a PCV Reader.

## *Blood Cells Count*

The red blood cell (RBC) and total white blood cell (WBC) counts were obtained using Neubauer Chamber. The Haemoglobin concentration was determined by calculation from the values of the PCV.

The differential blood counts were determined as proportion of different types of leucocytes (WBC) on the blood smear and were expressed in percentages.

***Serum biochemical analysis***

The serum biochemical analyses were carried out using RANDOX$^{R}$ KITS following the manufacturer's protocol.

***Statistical analysis***

Data generated were subjected to analysis of variance (ANOVA) in a General Linear Model (GLM) design using SAS 9.1 Statistical package in a one-way ANOVA. Means were separated using Duncan Multiple Range Test in the same package.

**Results and discussion**

***The association of sex with haematological parameters***

The association of sex with haematological parameters measured is shown in Table 1. There was no significant ($p>0.05$) difference in the values of all measured haematological parameters between the males and the females according to Table 1. The PCV was 26.42±0.82% in the males while it was 24.80±0.92% in the Females. The haemoglobin concentration (Hb) was 8.76±0.27g/dL in the males while it was 8.15±0.27g/dL in the females. The red blood cell (RBC) count was 11.08±0.34x$10^{12}$/L in the males while the value was 10.44±0.39 in the females. The white blood cell (WBC) count was 8.28±0.46 x$10^{9}$/L in the males while the value was 7.65±0.47 x$10^{9}$/L in the females. The neutrophil in percentage was 47.17±0.77% in the males while the value was 50.30±1.57% in the females. The lymphocyte in percentage was 47.17±0.80% in the males while the value was 45.10±1.54 in the females. The monocyte was 0.63 ±0.10% in the males while the value was 0.40±0.16% in the females. The eosinophil was 4.21±0.16% in the males while the value in the females was 4.20±0.29%. The basophil was 0.04±0.41% in the male while the value was 0.00±0.00% in the females.

**Table 1: The association of sex with haematological parameters of the Kalahari Red goats**

| SEX | PCV (%) | HB (g/dl) | RBC ($X10^{12}$/L) | WBC ($X10^{12}$/L) | N (%) | L (%) | M (%) | E (%) | B (%) |
|---|---|---|---|---|---|---|---|---|---|
| MALE | 26.42±0.83 | 8.76±0.27 | 11.08±0.34 | 8.28±0.36 | 47.76±0.77 | 47.17±0.80 | 0.63±0.10 | 4.21±0.16 | 0.04±0.41 |
| FEMALE | 24.80±0.92 | 8.15±0.27 | 10.44±0.39 | 7.65±0.47 | 50.30±1.57 | 45.10±1.54 | 0.40±0.16 | 4.20±0.29 | 0.00±0.00 |

HB=Haemoglobin; RBC=Red Blood Cell; WBC=White Blood Cell; N=Neutrophil; L=Lymphocyte; M=Monocyte;
E=Eosinophil;
B=Basophil



**Table 2: The association of sex with serum biochemical parameters of Kalahari Red goats**

| SEX | Total Protein (g/dl) * | Albumin (g/dl)* | Globulin (g/dl) | Sodium (mEq/L) | Potassium (mEq/L) | Calcium (mg/dl) | Phosphorus (mg/dl) |
|---|---|---|---|---|---|---|---|
| MALE | $5.31^{b}$±0.23 | $3.10^{b}$±0.17 | 2.24±0.22 | 134.00±3.51 | 2.78±0.18 | 7.49±0.50 | 7.84±0.60 |
| FEMALE | $5.93^{a}$±0.88 | $3.51^{a}$±0.07 | 2.44±0.11 | 131.57±1.88 | 3.00±0.10 | 7.42±0.26 | 8.67±0.27 |

* Significant difference at $p<0.05$

***The association of sex with the serum biochemical parameters***

The association of sex with the serum biochemical parameters measured is shown in Table 2. There was significant ($p<0.05$) difference in the total protein and albumin concentrations between the sexes. But there was no significant difference in the globulin, sodium, calcium, potassium and phosphorus contents of the blood. The total protein concentration (g/dL) in the males was 5.31±0.23 while the value in the females was 5.93±0.88. The value was significantly ($p<0.05$) higher in the females than in the males.

The Albumin concentration (g/dL) in the males was 3.10±0.17 while the value was 3.15±0.07 in the females. The value was significantly ($p<0.05$) higher in the female than in the male. There was no significant ($p>0.05$) difference in all the other serum parameters measured.

The globulin concentration (g/dL) in the males was 2.24±0.22 while the value was 2.44±0.11 in the females. The sodium concentration (mEq/L) in the males was 134.00±3.51 while the value was 131.57±1.88 in the females. The potassium concentration (mEq/L) in the male was 2.78±0.18 while the value was 3.00±0.10 in the female. The calcium concentration (mg/dL) in the males was 7.49±0.50 in the males while the value was 7.42±0.26 in the females. The phosphorus concentration (mg/dl) in the males was 7.84±0.60 while the value was 8.67±0.27 in the females.

Sex had no significant ($p<0.05$) influence on all the measured haematological parameters. Sex had no influence on the packed Cell Volume in this present study. This report is dissimilar to that of Egbe-Nwiyi *et al*., 2000 of which sex had influence on the PCV in percentage. There was no significant ($p>0.05$) difference in the values of Hb between the sexes in this present study which is also similar to the report of Egbe-Nwiyi *et al*., 2000. Sex had no significant influence ($p>0.05$) on the RBC count in this present study. This report is dissimilar to that of Egbe-Nwiyi *et al*., 2000.

The total WBC count in the males was 8.28±0.36 $x10^9$/L and 7.65±0.47 $x10^9$/L in this study while it was 10.45 ± 0.26 $x10^9$/L in males and 14.36 ± 0.97 $x10^9$/L in females (Egbe-Nwiyi *et al*.,2000).

**Conclusion**

It can be concluded that sex did not have any influence on the haematological indices but had association on only the protein component of the serum biochemistry. This study on the haematology and serum biochemistry can be used as reference value for Kalahari Red goats reared in the tropics and under similar nutrition.

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