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Full Length Research Paper

Comparative effect of hot, dry and rainy seasons on biochemical parameters (PCV, Haemoglobin, total protein, RBC and differential leucocyte count) in red Sokoto Goat

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This study was conducted to compare the effects of hot dry season and rainy season on PCV, haemoglobin, total protein, RBC and differential leukocyte count of Red Sokoto goats. A total number of ten clinically healthy Red Sokoto goats do were selected during dry season and rainy season from the same herd situated 5km away from Sokoto metropolis in Sokoto South Local Government Area of Sokoto state. Blood samples were collected weekly during the hot dry season (February to May) and rainy season (June to October). Some haematological parameters were evaluated and data obtained during hot dry season are compared with that of rainy season.Results of hot dry season showed significant increase in PCV, neutrophils and lymphocytes while that of rainy season showed significant increase in total plasma protein. The result indicated that season has influence on haematological parameters.

Key words: Dry season, Rainy season, Red Sokoto goats, PCV, Haemoglobin, RBC.

INTRODUCTION

Nigeria and especially the northern region have important role in goat production in the Africa continent and the world in general (Njidda *et al.,* 2013). In this region, the herd is mainly composed of local animals which are characterized by good adaptation to environmental conditions but lower productivity rates when compared to the breeds coming from the temperate regions (Njidda *et al.,* 2013). The goat is multipurpose animal; it produces milk, meat, skin and fibre (Abdelatif *et al.,* 2009). Majority of Red Sokoto goats are reared in the northern part of the country and this breed plays an important role in the life of many families as favorite animals (Abdelatif *et al.,* 2009).

The Red Sokoto goat is the predominant and most important breed of goat found mainly in the Sudan and Sahel savanna zone or in the Sokoto province, North-western zone of Nigeria (Obua *et al.,* 2012). It is well adapted to the arid zones.It is well adapted to the arid zones. It account for 17.3 million of goat population in Nigeria or about 70% of the estimated 34.50 million goats in Nigeria (Obua *et al.,* 2012). This breed of goat is better adapted to ecological zones where it is indigenous, but they seem to adapt to areas outside their ecological zone (Obua *et al.,* 2012).

The performance of animals is a product of interaction between the environment and genotype (Dagris, 2007). Since genetic potentials cannot be expressed unless an adequate environment is produced, the maintenance of productivity is essentially a function of environment (Abdelatif *et al.,* 2009). The productivity of goats is affected adversely by extreme climatic conditions. Depression of the food intake and reduction in production are commonly observed in heat stressed goats (Abdelatif *et al.,* 2009). Proper understanding of how climatic factors affect the physiological responses of the goats

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Provides a film basis of improving their husbandry and health status (Abdelatif *et al.,* 2009).

Heat is produced in the animal's body by metabolic activities and may also gain from the environment (Chandra *et al*., 2012). Heat is lost from the body by radiation, conduction, convection, evaporation of water from the skin and respiratory passages and excretion of faces and urine (Chandra *et al.,* 2012). A thermal steady state exists when the heat gain and heat lost are balanced. In homotherms, the various regulatory mechanisms consist of a series of physiological adjustments that serve to establish a thermal steady state at the level of normal body temperature, which consequently struggle to maintain equality in heat gain and heat loss (Chandra *et al.,* 2012). Activation of such adjustments is highly dependent on the external temperature (Chandra *et al.,* 2012). The variable insulation, mainly due to circulatory adjustments in the thermos-neutral zone of constant metabolism is sufficient to maintain a thermal steady state (Chandra *et al.,* 2012). But above and below this thermo-neutral zone, circulatory adjustments are no longer enough for maintenance of heat balance (Chandra *et al.,* 2012). In high and cold temperatures, an increase of evaporative heat loss through skin and respiratory vaporization and an increase in metabolism occur respectively (Chandra *et al.,* 2012). Physiological equilibrium is maintained mainly by the blood in the body but many physiological conditions may alter this equilibrium (Chandra *et al.,* 2012).

The importance of haematobiochemical indices in animal husbandry is well acknowledged. The changes in haematological constituents are important indicators of the physiological or pathological state of animal (Chandra *et al.,* 2012). The complete blood count (CBC), PCV, Haemoglobin (Hb) concentration and total protein are important and powerful diagnostic tools as a component of minimum database. It can be used to monitor response to therapy to gauge the severity of illness or a starting point for formulating a list of differential diagnosis (Chandra *et al.,* 2012). It is well known that variables such as breed, physiological stage, age, reproductive and lactation stage and environmental conditions have influence on physiological parameters, determination of normal values are important for clinical interpretation of laboratory data (Chandra Bhan *et al*., 2012).

MATERIALS AND METHODS

Study Area

The study was conducted at Alh.Sada Maruda's farm located at Durbawa area along Gajara road, about 5km away from Sokoto metropolis in Sokoto South Local Government area of Sokoto state. Sokoto state is located between latitude 9^0 – 14^0N and longitude of 2^0 – 14.5^0E. It is in the dry Sahel, surrounded by sandy savanna and isolated hills with annual average temperature of 28.3^0C (82.9^0F), Sokoto is on the whole a very hot area (Wikipedia, 2015). However, maximum day time temperatures are for most of the year generally under 40^0C (104.0^0F) and dryness makes the heat bearable.

Experimental animals

10 clinically healthy Red Sokoto goats made up of 8 female (does), and 2 male (bucks) between the ages of 18 months to 24 months were used for this study, the animals were ear tagged for easy identification.

Blood sample collection

After proper restraining of experimental animals in standing position, 5mls of blood samples for haematological analysis were collected weekly from the jugular vein of the goats using 5ml syringes and 21 gauge needles into labeled sample bottles containing ethylene diaminetetraacetic acid (EDTA) corresponding with each animal's tag after disinfecting the collection site with methylated spirit and cotton wool, the blood samples were then immediately rockedto prevent clotting. 2mls of blood were also collected for serological analysis into plain sample bottles as well. These samples were then immediately taken to laboratory for analysis. The blood in plain sample bottles were used to determine the total plasma protein while the one in sample bottles containing anticoagulant (EDTA) were used to evaluate the following parameters;

- Packed cell volume (PCV)
- Mean corpuscular haemolglobin
- Mean corpuscular haemoglobin concentration
- Total plasma protein

Determination of Packed Cell Volume (PCV)

This was determined using microhaematocrit method. A heparinized capillary tube 7.5cm long and 0.1mm in diameter was filled with blood up to 2/3 by capillary action. One end was sealed by using plastacine and placed in the microhaematocrit centrifuge with the sealed end out. The tubes were then centrifuged at 1000r/min for 5 minutes. Blood separated into its three major components: red cells, white cells and plasma. Microhaematocrit leader was used to read the volume of red cells as the percentage of total volume of the blood.

Determination of Haemoglobin

Principle:

Blood was diluted in a solution containing potassium

Cyanide and potassium in ferricyanide. The latter converts Hb to methemoglobin which is converted to cyanomethemoglobin by potassium cyanide. The absorbance of the solution is then measured in a spectrophotometer at a wavelength of 540nm.

Equipment:

- Haemoglobin pipette
- Spectrophotometer
- Drabkin's solution

Procedure: Three clean test tubes labeled as standard, tests and blank were used.

1. 5mls of drabkin's solution was added into three test tubes
2. The blood was gently mixed and 0.02ml of blood was drawn into the pipette and then the outer surface of the pipette was wiped to remove excess blood.
3. The pipette was then emptied into the test tubes (i.e. the test and standard) containing drabkin's solution. The solution was then mixed and left for 5min undisturbed.
4. The absorbance of solution was measured at 540nm in a spectrophotometer after blanking was set at zero.

Calculation:

$$\frac{Absorbance\ of\ the\ test}{Absorbamce\ of\ standard} \text{X} \frac{\text{Concentration of the standard x 250}}{1000}$$

Whereby:

Concentration of the standard = 56mg/dl;
Dilution factor = 250

Determination of Total Plasma Protein

2mls of blood sample were collected into the plain sample bottle from the jugular vein of each experimental animal using 5ml syringe and 21 gauge needles and then immediately submitted to the laboratory for analysis.

The blood sample was then centrifuged at 2000RPM for 5min using centrifuging machine in order to separate serum from the plasma.

Reagent:

R1: biuret reagent
- Potassium iodide30mmol/L
- Potassium sodium tartrate100mmol/L
- Cupric sulphate 30mmol/L
- Sodium hydroxide3.8mmol/L

R2:Standard
- Solution of albumin60g/dl

Procedure:

1. 1ml of R1 reagent was added into the first test tube; this is called Blank.
2. 1ml of R1 reagent and 10µL of standard R2 (known concentration of protein solution) were also added into the second test tube; this is called Standard.
3. 1ml of R1 reagent and 10µL of unknown protein sample (serum) were added into the third test tube using micro pipette and this is called Sample.

	BLANK	STANDARD	SAMPLE
R1 reagent	1ml	1ml	1ml
R2 reagent	-	10µL	-
Serum	-	-	10µL

4. The samples were then mixed and incubated for 30min at 20^0c – 25^0cat 546nm i.e. the wavelength.
5. The analyzer (colorimeter) measures light absorption rate and shows protein concentration in g/dL.

Calculation:

. Concentration of protein (g/dl) = $\frac{\text{Absorbance of sample}}{\text{Absorbance of standard}}$ x Conc. Of the standard

Whereby concentration of the standard is given as a constant 6.0g/dl.

RESULT AND DISCUSSION

The result of haematological parameters of Red Sokoto Goat obtained during hot dry season (February to May) and rainy season (June to October) are represented in the table 4.1 above using student's t test. The result sows that the values with asterisk are significantly different between the HDS, and RS, ($P<0.05$), while values without asterisk are not significantly different between the HDS and RS, ($P>0.05$).The result from the table 4.1above indicated that the PCV (%), Neutrophils (%), Lymphocytes (%) and total plasma protein (g/dl) are significantly different when comparing HDS with RS for ($P<0.05$).

The result also shows that RBC x 10^6/µl, WBC x 10^3/µl, Monocytes (%), Eosinophis (%), Basophiles (%), Band cells (%) and Haemoglobin concentration (g/dl) are not significantly different when comparing HDS with RS, for ($P>0.05$).This study examined the effect of hot dry season and rainy season on haematological parameters of 10 Red Sokoto Goats. Result showed that, the season of the year had significant effect ($P<0.05$) on the Packed Cell Volume (PCV), Neutrophils, Lymphocytes and total Plasma protein of Red Sokoto Goat. Other parametersthat are not affected by the two seasons include Eosinophils, Basophiles, Band cells and

Table 1.showing the mean ± SEM of haematological values of red Sokoto goat during hot dry and rainy seasons.

S/N	Blood Parameter	HDS	RS	Level Of Significance
1	PCV (%)	32.60 ± 1.08*	30.00 ± 0.73	P<0.05
2	RBC (x 10^6/µl)	10.82 ± 1.38	11.12 ± 0.466	P>0.05
3	WBC (x 10^3/µl)	12.85 ± 1.44	11.43 ± 0.83	P>0.05
4	Neutrophils (%)	28.20 ± 4.54*	25.50 ± 4.19	P<0.05
5	Lymphocytes (%)	60.40 ± 48.83*	52.10 ± 4.25	P<0.05
6	Monocytes (%)	2.10 ± 0.23	2.20 ± 0.63	P>0.05
7	Eosinophils (%)	0.30 ± 0.21	0.10 ± 0.11	P>0.05
8	Basophils (%)	0.00 ± 0.00	0.00 ± 0.00	P>0.05
9	Band Cells (%)	0.00 ± 0.00	0.00 ± 0.00	P>0.05
10	Haemoglobin (g/dl)	11.02 ± 0.48	11.27 ± 0.47	P>0.05
11	Total Protein (g/dl)	6.98 ± 0.09	14.29 ± 7.08*	P<0.05

KEY: PCV = Packed cell volume, WBC = White Blood Cells, RBC = Red Blood Cells, HDS = Hot Dry Season, RS = Rainy Season.

Haemoglobin concentration (P<0.05). PCV in this study is higher in HDS than RS, the rise of haematocrit in this study during HDS may be attributed to increase in environmental temperature, which leads to an increase loss of body fluid resulting in haemoconcentration, it could also be attributed to low quality feed (malnutrition) during hot dry season that could affect the process of erythropoiesis. This is in agreement with the findings of (Njidda *et al.,* 2013).

The mean values for neutrophils for HDS and RS were 28.20% and 25.5%, with a SEM of 4.54% and 4.19% respectively. The value obtained for HDS was said to be higher than the RS (P<0.05). This may be attributed to stress. The ambient temperature was high during HDS and could predispose the animal to oxidative stress that lead to rise in circulating neutrophil level. The mean values for total plasma protein during HDS and RS were 6.98g/dl and 14.29g/dl with SEM of 0.09g/dl and 7.08g/dl respectively. This shows that the values obtained during RS are higher than the values obtained during HDS (P<0.05). This may be attributed to availability of high quality feed during the rainy season.

There was a significant difference (P<0.05) between the hot dry season and rainy season in the values of lymphocytes in Red Sokoto Goat. Higher values were obtained during hot dry season; this study is consistent with earlier report by (Etim *et al.,* 2013). The relative lymphocytes observed during hot dry season may be attributed to presence of viral infection that does not show clinical manifestationduring the period of the study. Likewise allergic reactions may also cause relative lymphocytosis during the hot dry season (Frandson, 1981).

CONCLUSION

Based on the research findings, seasons have significant effect on PVC, Neutrophils, lymphocytes and total plasma protein of Red Sokoto Goat.

RECOMMENDATIONS

Based on the above findings, it is recommended that more research work should be conducted using large population size and considering all the seasons and different sexes.

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