

Haematological and biochemical indices of three breeds of goats at Trans-Amadi slaughter, Port Harcourt, Nigeria

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ABSTRACT

The study was conducted to examine the variation haematological and biochemical indices due to stress and poor nutrition of three breeds of goats at the Trans-amadi Slaughter, Port Harcourt, Nigeria. 5ml of blood was collected from the jugular vein of 30 goats that were randomly selected from the goats at the slaughter (10 Red Sokoto, 10 Sahel and 10 West African Dwarf goats). Blood samples were taken to the laboratory to determine the concentration of haematological and biochemical parameters of the goats. Data generated were subjected to Analysis of Variance (ANOVA) and correlation using SPSS version 16. The results revealed a significant difference ($p < 0.05$) in PCV (Packed Cell Volume) across breeds with Sahel goats having the highest value (35.10 ± 0.90). White blood cell (WBC), Erythrocyte sedimentation rate (ESR) and direct coombs test (DCT) were also not significantly ($p > 0.05$) affected by breed. However, there was a significant breed effect ($p < 0.05$) on hemoglobin concentration with Sahel breed having the highest value (11.68 ± 0.30). Total Cholesterol was significantly different ($p < 0.05$) across breeds with the highest value of $41.18 + 2.88$ g/L was seen in Red Sokoto. Random blood sugar was also significant different ($p < 0.05$) with the highest value of $13.19 + 1.87$ mmol/L seen in Sahel breed. The correlations between haematological and biochemical parameters were generally low. The result of this study showed that the goats at the slaughter are healthy and that haematological and biochemical parameters varied across breeds with Sahel breed of goat having better health indices.

Keywords: Haematological, Biochemical, Red Sokoto, Sahel and West African Dwarf goats

INTRODUCTION

The contribution of Nigeria in goat production in Africa is a major one over the years (Ngereet *al.*, 1984). In Nigeria, goat breeds kept are mainly composed of local breeds of Sahel, Red Sokoto and the West African Dwarf. These goat breeds are well known for their good adaptation to harsh environmental conditions but their productivity is low when compared to exotic breeds (Odoet *al.*, 2000). Different efforts have been made over the years to improve the productivity of the Nigerian goat breeds. Among the strategies adopted for improving Nigerian goat breeds is the

introduction of exotic breeds such as White Bornu and Anglo-Nubian breed (Tambuwalet *al.*, 2002).

Goat is one of the most popular animals killed daily in our abattoirs. FAOSTAT (2011) reported that goats constitute the largest group of small ruminant animals in Nigeria which is estimated at 53.8 million and also constituting 6.2 percent of the World's goat population. Most of these goats killed in slaughter houses in the southern part of Nigeria are transported from the north exposing the animals to stress, poor nutrition and disease condition

that lead to the death of some of these goats even before slaughter. The health condition of animals we eat is very important as Olanike (2002) reported that unhygienic issues related to food animals could emanate from slaughtering processes, inefficient standard operating procedures, marketing and improper meat handling practices. The quality of an animal's blood helps in distinguishing animals in normal state from stressed animals (Kamal *et al.*, 2007). Haematological and biochemical parameters have been widely used to determine systematic relationship and physiological adaptation including the assessment of the general health condition of animals (Alade *et al.*, 2005). Variation in blood parameters as affected by goat breeds has been reported by Kopp and Hetesa (2000). Other factors have been identified to affect blood indices. These include nutrition, stress, disease and environmental factors. Heat stress has a greater effect on the total cholesterol levels, which may be due to increased use of fatty acids for energy production as a consequence of the reduction of glucose concentration in animals undergoing heat stress (Ocak and Guney, 2010). This study therefore assessed the variation in haematological and biochemical parameters of three breeds of goats at Trans-Amadi slaughter, Port Harcourt, Nigeria.

MATERIALS AND METHODS

The experimental location for this research was the Trans-Amadi Slaughter, ObioAkpokor Local Government Area, of Rivers State. Trans-Amadi is a 3000 hectare (2,500-acre) industrial area, in Port Harcourt. This area is located at 4°48'53" N latitude and 7°2'14" E longitude. Trans-Amadi is a strong manufacturing sector and a major industrial zone hosting companies that produce materials such as glass bottles, tires, aluminum, paper etc. The main abattoir of the city is also located in Trans-Amadi. Thirty goats at the Trans-Amadi slaughter were randomly

selected for the purpose of this study. These included 10 Red Sokoto, 10 Sahel and 10 West African dwarf goats. These animals are shipped from various parts of the country especially the northern part and kept until they are slaughtered. The goats are usually fed with grasses and concentrates until they are slaughtered. The goats were bled through the jugular vein and 5ml of blood was collected using a syringe into sample bottles with and without EDTA to allow separation of serum needed for biochemical analysis. All sample bottles were well labeled and stored at -20°C until laboratory analyses. Data generated were subjected to Analysis of Variance (ANOVA) and correlation using SPSS (Statistical Package for Social Sciences) version 16. Significant means were separated by Duncan Multiple Range Test at $p < 0.05$ and result presented as the least square means + standard error.

RESULTS

The variation in hematological parameters across breeds is shown in Table 1. From the table, there was a significant difference ($p < 0.05$) in PCV (Packed Cell Volume) across breeds with Sahel goats having the highest value ($35.10 \pm 0.90\%$) and Red Sokoto having the lowest value ($25.90 \pm 1.39\%$). The PCV values varied across breeds. However, the values were within the normal range. White blood cell (WBC) however showed no significant ($p > 0.05$) difference between breeds but the values reported were little lower than the normal range. Erythrocyte sedimentation rate (ESR) and direct coombs test (DCT) were also not significantly ($p > 0.05$) affected by breed though the values recorded were within the normal range. Furthermore, there was a significant breed effect ($p < 0.05$) on hemoglobin concentration with Sahel breed having the highest value (11.68 ± 0.30 g/dL) and West African Dwarf having the lowest value (8.10 ± 0.91 g/dL). All breeds however had hemoglobin values within the normal range.

Table 1. Variation in hematological parameters across goat breeds

Breed	Packed Cell Volume (%)	White Blood Cell($\times 10^9/L$)	Erythrocyte Sedimentation Rate (mm/1hr)	Direct coombs test	Hemoglobin(g/dL)
Red Sokoto	25.90 \pm 1.39 ^b	3.67 \pm 0.58	1.30 \pm 0.21	0.10 \pm 0.10	8.60 \pm 0.46 ^b
Sahel	35.10 \pm 0.90 ^a	3.31 \pm 0.46	1.30 \pm 0.21	0.00 \pm 0.00	11.68 \pm 0.30 ^a
WAD	27.10 \pm 0.28 ^b	3.02 \pm 0.38	1.00 \pm 0.00	0.00 \pm 0.00	8.10 \pm 0.91 ^b
*Normal value	22.00-38.00	4.00-13.00	1-5	-	8.00-12.00

a, b, c : Means with different superscripts in the same row are significantly different ($p < 0.05$)

* Source: Veterinary Drug Handbook, D.C. Plumb, Iowa State University Press, 1999

Biochemical parameters also showed some degree of variation across breeds as shown in Table 2. Calcium was not significantly different ($p > 0.05$) but the values recorded were below the normal range. The same trend was observed for albumin. Total Cholesterol was however significantly different ($p < 0.05$) across breeds. The highest value of 41.18 \pm 2.88 g/L was seen in Red Sokoto and the least value of 19.92 \pm 5.82 g/L was observed in the Sahel breed. The values recorded were however

below the normal range. Random blood sugar was significantly different ($p < 0.05$) with the highest value of 13.19 \pm 1.87mmol/L seen in Sahel breed and the least value of 6.47 \pm 0.88mmol/L observed in West African Dwarf goats. The values observed for all breeds were within the normal range. Breed had no significant effect ($p > 0.05$) on Free calcium and the values recorded were below the normal range.

Table 2. Variation in biochemical parameters across goat breeds

Breed	Calcium (mmol/L)	Albumin (g/dL)	Total Cholesterol (g/L)	Random blood sugar (mmol/L)	Free Calcium (mmol/L)
Red Sokoto	3.47 \pm 0.12	22.93 \pm 1.34	41.18 \pm 2.88 ^a	6.61 \pm 0.90 ^b	3.81 \pm 0.13
Sahel	3.32 \pm 0.27	20.29 \pm 1.58	19.92 \pm 5.87 ^b	13.19 \pm 1.87 ^a	3.71 \pm 0.35
WAD	3.54 \pm 0.11	21.33 \pm 0.96	21.41 \pm 3.98 ^b	6.47 \pm 0.88 ^b	3.91 \pm 0.11
*Normal value	8.9–10.6	24–44	64.6–136.4	6–10	8.9–10.6

a, b – Means with different superscripts are significantly ($P < 0.05$) different

* Source: Veterinary Drug Handbook, D.C. Plumb, Iowa State University Press, 1999

The correlation values between hematology parameters are presented in Table 3. The relationship between breed and White Blood Cell was low, negative but not significant ($r = -0.181$). Also, the correlation between breed and PCV was low, positive and not significant ($r = 0.098$). The same trend was seen in the relationship between breed and ESR. It was low, negative and not significant ($r = -0.226$). Breed versus Direct Coombs Test

was low, negative and not significant ($r = -0.227$). Furthermore, the relationship between breed and hemoglobin concentration was low, positive and not significant ($r = 0.095$). For White Blood Cell and Packed Cell Volume, the relationship was also low, negative and not significant ($r = -0.042$). The relationship between White Blood Cell and Erythrocyte Sedimentation Rate was low, positive but not significant ($r = 0.105$). Also, the

relationship between White Blood Cell and Direct CoombsTest was low, positive and significant ($r = 0.389$). White Blood Cell versus hemoglobin was low, negative and not significant. The relationship between Packed Cell Volume and Erythrocyte Sedimentation Rate was low, positive and not significant. For Packed Cell Volume and hemoglobin, the relationship was high, positive but significant. The relationship

between Erythrocyte Sedimentation Rate and Direct CoombsTest was low, negative and not significant ($r = -0.069$) while that between Erythrocyte Sedimentation Rate and Hemoglobin was also low, positive and not significant ($r = 0.127$). The correlation between Direct CoombsTest against hemoglobin was low, positive and not significant ($r = 0.084$).

Table 3.Correlation between hematological parameter of goats

	Breed	White Blood Cell ($\times 10^9/L$)	Packed Cell Volume (%)	Erythrocyte Sedimentation Rate (mm/1hr)	Direct coombs test	Hemoglobin (g/dL)
Breed	1					
White Blood Cell ($\times 10^9/L$)	-0.181	1				
Packed Cell Volume (%)	0.098	-0.042	1			
Erythrocyte Sedimentation Rate (mm/1hr)	-0.226	0.105	0.120	1		
Direct coombs test	-0.227	0.389	-0.088	-0.069	1	
Hemoglobin (g/dL)	0.095	-0.040	1.000	0.127	0.084	1

The correlation between biochemical parameters studied is presented in Table 4. From the correlation, the relationship between breed and calcium was high, positive but not significant ($r = 0.97$). However, the relationship between breed and albumin was low, negative and not significant ($r = -0.160$). The correlation between breed and total cholesterol was medium, negative and significant ($r = -0.493$). Also, the relationship between breed and random blood sugar was low, negative and not significant ($r = -0.11$). For breed against free calcium, the value was low, positive and not significant ($r = 0.133$). The effect of calcium on albumin was low, positive and not significant, with a correlation value of $r = 0.032$. The correlation value between calcium and total cholesterol was also low, negative and not significant ($r = -0.023$). More so, the relationship between calcium and

random blood sugar was low, negative and not significant ($r = -0.243$). Calcium versus free calcium was high, positive and significant ($p < 0.05$) with a correlation value of 0.958. The relationship between albumin and total cholesterol was medium, positive and significant, with the value of $r = 0.656$. Furthermore, albumin versus random blood sugar was low, positive and not significant, with the value of $r = 0.237$. For Albumin and free calcium, the value was low, negative and not significant, with the value of $r = -0.238$. The correlation total cholesterol and random blood sugar was low, positive and not significant, with the value of $r = 0.024$. Total cholesterol versus free calcium was also low, negative and not significant ($r = -0.188$). The relationship between random blood sugar and free calcium is low, negative and not significant ($r = -0.311$).

Table 4. Correlations for biochemical parameters of goats

	Breed	Calcium (mmol/L)	Albumin(g/dL)	Total Cholesterol (g/L)	Random blood sugar (mmol/L)	Free Calcium (mmol/L)
Breed	1					
Calcium (mmol/L)	0.97	1				
Albumin (g/dL)	-0.160	0.032	1			
Total Cholesterol (g/L)	-0.493**	-0.023	0.656**	1		
Random blood sugar (mmol/L)	-0.11	-0.243	0.237	0.024	1	
Free Calcium (mmol/L)	0.133	0.958**	-0.238	-0.188	-0.311	1

** Values are significant at 0.05

DISCUSSION

Packed cell volume (PCV) evaluates anaemia by measuring the red blood cell (RBC) number indirectly. The breed effect on the values of PCV observed in this study is supported by Njiddaet *al.* (2013) who in their work on haematological and biochemical parameters of goats of semi-arid environment fed on natural grazing rangeland of northern Nigeria observed that packed cell volume was significantly different ($P < 0.05$) between breeds. The values of PCV recorded in this study are within the range reported by Al-Bulushiet *al.* (2017) and Hyeldaet *al.* (2017). White blood cell (WBC) concentration has been used to evaluate infection, allergy or immunosuppressant in animals (Njiddaet *al.*, 2013). Values of WBC observed in this study are lower than the normal level. Low values of white blood cells (Leucopenia) as seen in some of these animals could be due to drug toxicity, bone marrow failure, overwhelming infection, vitamin B₁₂ and iron deficiency. Autoimmune disease and hypersplenism have been implicated as well. Low WBC values have also been reported by Njiddaet *al.* (2013) and Dias *et al.* (2010). Higher values of WBC were however reported by Hyldaet *al.* (2017) and Al-Bulushiet *al.* (2017).

Erythrocyte sedimentation rate is used to detect illnesses associated with chronic and acute infection. The values recorded in this

study were all normal. This implies that the animals were not associated with any chronic or acute infection but that the variation in the parameters observed could be associated with stress or unbalanced diet. The values reported are similar to those reported by Shah *et al.* (2010). Direct Coombs Test has been used to identify immune haemolysis (lysis of red blood cells (RBC)). The values observed in this study were relatively normal. Haemolysis could be from cancer which is the most common cause of haemolysis in animals. Other reasons for lysis of red blood cells are mycoplasmal infection, infectious mononucleosis and idiopathic. Haemoglobin concentration evaluates the oxygen carrying capacity of blood. Breed significantly affected the values of haemoglobin though all goat breeds had normal haemoglobin concentration. Breed effect on haemoglobin has also been reported by Njiddaet *al.* (2013). The haemoglobin values recorded in this study are higher than those reported by Shah *et al.* (2010) but similar to those reported by Njiddaet *al.* (2013); Al-Bulushiet *al.* (2017) and Hyeldaet *al.* (2017). Dias *et al.* (2010) recorded higher values of haemoglobin.

Calcium evaluates many metabolic enzymatic pathways. Variation in both bound and unbound calcium is associated with conditions of vitamin D intoxication,

immobilization, hyperthyroidism and hyperparathyroidism. The values recorded in this study are lower than the normal level. This could be attributed to the diet given to the animals at the slaughter. Similar values of calcium in goats have been reported by Dias *et al.* (2010) when they assessed the haematological and biochemical parameters in Churra-da-Terra-Quente ewes from the northeast of Portugal. Albumin monitors, evaluates and diagnose disease course. The values of albumin were low (hypoalbuminemia) compared to the normal values. This low albumin values can be attributed to intestinal/renal protein washing state, immune disorder, impaired nutrition, overhydration, increased capillary permeability and third space losses like ascites. It could also be attributed to stress and lack of complete diet. Similar values were reported by Al-Bulushi *et al.* (2017) and Njidda *et al.* (2013).

Total cholesterol is used to determine the risk for arteriosclerotic heart diseases in animals. Values of total cholesterol were low (hypocholesterolemia) when compared to the normal values. This could have been from the feed given to the animals. It could also be attributed to kidney disease like nephrotic syndrome. Other factors could be stress and hypertension in the animals due to long hours of transportation from the north. The values of cholesterol reported in this study are lower than those reported by Al-Bulushi *et al.* (2017) but higher than those reported by Dias *et al.* (2010). Random blood sugar is commonly used to evaluate diabetic animals. The values of random blood sugar were normal except for Sahel goats. This could be attributed to high level of sugar in diet, chronic kidney injury, acute pancreatitis, glucagonoma, pheochromocytoma and acute stress response. Lower values were recorded by Njidda *et al.* (2013) and Dias *et al.* (2010). Correlation between haematological and biochemical parameters were generally low. This implies that these parameters could be

influenced by many environmental factors. Cholesterol was affected by breed.

CONCLUSION

Breed significantly affected packed cell volume and haemoglobin with Sahel goats having the highest concentration. White blood cell count, erythrocyte sedimentation rate and Direct comb test were not significantly affected by breed and their values were relatively normal. Also, breed significantly affected total cholesterol and random blood sugar. Calcium (bound or free) as well as albumin were not affected by breed but their values were lower than the normal level. Only the relationship between breed and total cholesterol, calcium and free calcium and albumen and total cholesterol were significantly different. The results generally suggested that the variation in the haematological and biochemical indices studied was due to stress and poor nutrition and not chronic infections. However, Sahel goats are more resistant to stress and poor nutrition since they recorded better haematological and biochemical indices.

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