

Variations in haematological and serum biochemical indices among White Fulani bulls, Ouda rams and West African Dwarf bucks

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Abstract

Variations in haematological and serum biochemical indices among White Fulani bulls, Ouda rams and West African Dwarf (WAD) bucks were studied. Ten each of mature bulls, rams and bucks were used for the experiment. Blood was sampled from all the animals and analysed for haematology and serum was separated for serum biochemical analysis. The result showed that species had effect on some haematological and serum biochemical indices of White Fulani bulls, Ouda rams and WAD bucks. Packed cell volume, haemoglobin, white blood cells, red blood cells, monocytes and eosinophils were not significantly different among the species, while platelets, lymphocytes, and neutrophils counts were significantly influenced by specie differences. Platelets was significantly ($p < 0.05$) lower in rams ($93.20 \times 10^3/\mu\text{L}$) than in bulls ($136.00 \times 10^3/\mu\text{L}$) and bucks ($141.90 \times 10^3/\mu\text{L}$). Lymphocytes and neutrophils count was significantly ($p < 0.05$) influenced by species differences. Serum biochemical parameters showed that there was no significant difference in the mean values for albumin, glucose, cholesterol, urea and Aspartate amino transferase, while the values obtained for total protein, creatinine and Alanine amino transferase (ALT) were significantly ($p < 0.05$) different among the animal species. Total protein (7.21 ± 0.52 g/dL) and creatinine (1.21 ± 0.19 mg/dL) were significantly ($p < 0.05$) higher in bucks than other species. The ALT was also higher ($p < 0.05$) in bucks (20.83 iu/L) than in rams (7.59 iu/L) and bulls (6.27 iu/L). This study suggests that the effect of specie of an animal influences blood indices. The values obtained in this study can be used as references for haematological and serum biochemical assessment of indigenous male cattle, sheep and goat in Nigeria.

Keywords: Haematology, serum metabolites Ruminants blood variation, Bull, Ouda Ram, Male goat

Introduction

Cattle, sheep and goats play important roles in the livestock subsector of the Nigerian agricultural economy (Lakpini *et al.*, 2002). Ruminant production is important in meeting man's protein requirement as well as supporting the livelihood of livestock keepers, traders and labourers throughout the developing world. The health status of farm animals as well as the safety of animal products is of primary concern to livestock producers and the society at large. Diseases

affecting livestock can have a devastating impact on the productivity and trade of animals and animal products, on human health and consequently, on the overall process of economic development (FAO, 2015). Thus, the need for timely and regular assessment of the health status of the animals becomes essential.

Blood composition of animal might be influenced by certain factors such as nutrition, management, sex, age, diseases and stress factors (Schalm *et al.*, 1975).

Blood tests via haematology and serum biochemistry can be used to assess the health status and the state of organs of farm animals. Blood act as a pathological reflector of the status of exposed animals to toxicant and other conditions (Olafadehan *et al.*, 2010). Haematology refers to the study of the numbers and morphology of the cellular elements of the blood – the red blood cells (erythrocytes), white blood cells (leukocytes), and the platelets (thrombocytes) and the use of these results in the diagnosis and monitoring of diseases. Haematological studies are of ecological and physiological interest in helping to understand the relationship of blood characteristics to the environment (Ovuru and Ekweozor, 2004). Changes in haematological parameters are often used to determine the various status of the body and to determine stresses due to environmental, nutritional and/or pathological factors (Afolabi *et al.*, 2010). Haematological parameters are also good indicators of the physiological status of animals (Khan and Zafar, 2005). As reported by Isaac *et al.* (2013), animals with good blood composition are likely to show good performance. Laboratory tests on the blood are vital tools that help detect any deviation from normal in the animal (Ogunbajo *et al.*, 2009). Serum biochemical analysis can include many different tests, each of which provides information about one or more organs in the body. Assessment of the test results may indicate that the activity of an organ has been affected, and may provide information about the nature and severity of the disease condition. Therefore, it is important to evaluate the blood profiles of indigenous farm animals in order to accurately interpret their health status (Perez *et al.*, 2003, Aengwanich, 2007). Serum biochemical parameters often assess include Aspartate aminotransferase (AST),

Alanine aminotransferase (ALT), cholesterol, urea, glucose, creatinine, total protein and albumin. Great variation in the haematological and biochemical parameters has been observed between breeds of goats (Tambuwal *et al.*, 2002). Over the years, physiological diagnoses have been done adopting reference values obtained from exotic breeds. These exotic breeds are exposed to a totally different climatic condition compared to breeds indigenous to other localities. Appropriate reference haematological and serum biochemical values for indigenous breeds is essential to provide a baseline for interpreting routine laboratory blood tests in order to assess nutritional status, stress or disease. (Vojta, 2011). Hence, this study aims at establishing reference values and variations in haematological and serum biochemical indices of male species of cattle (bull), sheep (ram), and goat (buck) indigenous to Nigeria.

Materials and methods

Study location

The study was carried out at the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria, coordinates: 7.4417°N, 3.9000°E. Ibadan has a tropical wet and dry climate (Koppen Climate Classification) (BBC Weather). The climate is typically dominated by rainfall pattern ranging from 1400mm-1500mm and an average temperature of 32°C with two distinct seasons: Dry season (usually between November and March) and Rainy season (from April to October) (FRIN Annual Metrological report, 2011).

Experimental animals

The species of animals used in this study were White Fulani bulls, Ouda rams and West African Dwarf (WAD) bucks. Ten (10) males of each species within the ages and weight range bulls (12-15 months, 280-

330 kg), rams (12-15 months old, 35- 50 kg) and WAD (12-15 months, 10-15 kg), respectively were used.

The experimental animals were housed and managed under semi intensive system. They were fed concentrate composed of cassava peel, PKC and corn bran. The experimental diet for each group was compounded to meet their nutritional requirement. Feed and water were provided to each group daily. Routine management practices were carried out as appropriate. The experiment lasted for four weeks.

Blood Collection and Evaluation

At the end of four weeks, prior to feeding in the morning, 5 mL of blood was sampled through the jugular venepuncture of each animal using sterile disposable syringes and needles. The blood samples for haematological assessment were placed in sample bottles containing heparin. The haematological parameters assessed include Packed Cell Volume (PCV), Haemoglobin (Hb), Red Blood Cell (RBC) counts, White Blood Cell (WBC) counts, platelet counts and leukocytes differential (neutrophils, lymphocytes, eosinophils, and monocytes). The packed cell volume (PCV) was determined using microhaematocrit method, while the haemoglobin concentration was determined by the cyanmethaemoglobin method. Red blood cells (RBC) and white blood cells (WBC) were counted using haemocytometer as outlined in Ewuola and Egbunike (2008). Blood samples were stained with Giemsa stain for differential leukocyte counts. The blood samples for serum biochemical evaluation were placed in collecting bottles containing no anticoagulant. The blood was allowed to clot, and the serum was separated immediately by centrifugation at 3500rpm for 10 minutes. The serum biochemical parameters assessed include: Aspartate aminotransferase (AST), Alanine

aminotransferase (ALT), cholesterol, urea, glucose, creatinine, total protein and albumin. Serum biochemical parameters were estimated using spectrophotometric technique following the kit (RONDAX™) manufacturers' procedure.

Data analysis

All data obtained were subjected to descriptive statistics and analysis of variance (SAS, 2003) and means was separated using Duncan Multiple Range test of the same software.

Results

The haematological indices of White Fulani bulls, Ouda rams and WAD bucks are presented in Table 1. Among the haematological parameters assessed, only the mean values obtained for platelets, lymphocytes and neutrophils showed significant ($p<0.05$) differences among the species. Packed cell volume (PCV), Haemoglobin (Hb), Red blood cell count, White blood cell count, monocytes and eosinophils count were not significantly different among the species.

The values obtained for PCV ranged from 25.30 to 27.40 %, Hb (7.45 - 8.20 g/dl), RBC ($9.85 - 10.45 \times 10^6 \mu\text{L}$), WBC ($7.46 - 8.15 \times 10^3 \mu\text{L}$), monocytes (1.6 - 2.5 %) and eosinophils (1.5 - 2.2 %). Platelet counts was significantly ($p<0.05$) higher in bulls ($136.00 \times 10^3 / \mu\text{L}$) and bucks ($141.90 \times 10^3 / \mu\text{L}$) than in rams ($93.20 \times 10^3 / \mu\text{L}$), but there was no significant difference between that of bulls and bucks. Lymphocytes count was significantly ($p<0.05$) different among the species with the least value recorded in bulls ($57.40 \pm 2.40\%$) and highest value recorded in rams ($69.90 \pm 0.99\%$) with bucks having $64.10 \pm 1.90\%$. In the rams, a significantly ($p<0.05$) lower value ($27.60 \pm 1.25\%$) for neutrophils count was recorded compared to that of bulls

(37.7±2.30%). But the values for the rams and bulls were not significantly different from that of the bucks (32.40±2.19%).

Table 1: Haematological indices of WAD bucks, Ouda rams and White Fulani bulls

Parameters	WAD bucks		Ouda rams		White Fulani bulls	
	Mean	Range	Mean	Range	Mean	Range
PCV (%)	26.30±1.26	19 – 33	25.30±2.94	17 – 32	27.40±1.07	20.5 – 31.0
Haemoglobin (g/dL)	8.06±0.51	5.7 – 10.7	8.20±0.41	5.7 – 9.8	7.45±0.47	5.6 – 10.0
Red Blood Cells (×10 ⁶ /μL)	10.45±0.23	9.49– 11.48	10.07±0.44	8.37 – 13.42	9.85±0.62	5.25 – 115.0
White Blood Cells (×10 ³ /μL)	7.97±7.52	6.25 – 10.85	7.46±1.026	4.15 – 14.65	8.15±7.80	4.15 – 14.65
Platelets (×10 ³ /μL)	141.90±15.31 ^a	104 – 205	93.20±7.50 ^b	28.00 – 111.00	136.00±12.69 ^a	94 – 190
Lymphocytes (%)	64.10±1.90 ^b	55 – 73	69.90±0.99 ^a	65 – 74	57.40±2.40 ^c	45 – 64
Neutrophils (%)	32.40±2.19 ^{ab}	25 – 44	27.60±1.25 ^b	21 – 33	37.70±2.30 ^a	25 – 50
Monocytes (%)	1.60±0.22	1 – 3	1.70±0.21	1 – 3	2.50±0.43	1 – 5
Eosinophils (%)	1.70±0.80	0 – 7	1.50±0.27	0 – 3	2.20±0.39	0 – 4

abc: Means in the same row with different superscript are significantly (P<0.05) different

PCV – Packed Cell Volume

The serum biochemical indices of bulls, rams and bucks are shown in Table 2. Among the serum biochemical parameters assessed, only the mean values obtained for total protein, creatinine and alanine aminotransferase (ALT) showed significant (p<0.05) variations among the species. Albumin, glucose, cholesterol, urea and aspartate aminotransferase (AST) were not significantly different among the species. Total protein was significantly (p<0.05) lower in rams (5.70±0.25g/dL) compared to that of bucks (7.21±0.52g/dL). The serum

total protein of bulls was not significantly different from that of rams and bucks. However, creatinine was significantly (p<0.05) lower in bulls (0.7±0.08 mg/dL) compared to that of bucks (1.21±0.19 mg/dL). The creatinine in rams (1.00±0.09 mg/dL) was not significantly different from that of bulls and bucks. Alanine amino transferase (ALT) concentration was significantly (P<0.05) lower in bulls (6.27±0.41 IU/L) and rams (7.95±1.77 IU/L) than in bucks (20.82±3.19 IU/L), while the ALT activity in bulls and rams were not significantly similar.

Table 2: Serum biochemical indices of WAD bucks, Ouda rams and White Fulani bulls

Parameters	WAD bucks		Ouda rams		White Fulani bulls	
	Mean	Range	Mean	Range	Mean	Range
Total Protein (g/dL)	7.21±0.52 ^a	4.65 – 10.19	5.70±0.25 ^b	4.67 – 6.33	6.77±0.31 ^{ab}	5.38 – 8.43
Albumin (g/dL)	2.75±0.52	1.89 – 3.71	2.82±0.15	1.68 – 3.39	2.78±0.18	2.02 – 3.79
Glucose (mg/dL)	46.01±5.90	31.73 – 71.25	45.00±5.10	37.37 – 63.17	42.63±1.67	35.05 – 47.01
Cholesterol (mg/dL)	68.54±5.28	47.85 – 100.37	59.14±6.55	29.98 – 98.21	79.00±6.38	48.00 – 115.46
Urea (mg/dL)	37.29±3.61	19.18 – 56.23	37.54±4.21	21.36 – 60.14	30.71±1.94	24.32 – 42.19
Creatinine (mg/dL)	1.21±0.19 ^a	0.64 – 2.52	1.00±0.09 ^{ab}	0.61 – 1.35	0.70±0.08 ^b	0.45 – 1.22
ALT (IU/L)	20.82±3.19 ^a	11.52 – 46.26	7.95±1.77 ^b	0.67 – 15.13	6.27±0.41 ^b	5.12 – 9.6
AST (IU/L)	64.34±6.87	31.69 – 86.38	62.35±5.02	39.51 – 75.05	70.65±5.61	47.39 – 92.89

a, b: Means in the same row with different superscript differ significantly (P<0.05)

ALT – Alanine amino transferase, AST – Aspartate amino transferase

Discussion

Haematological indices can be used to evaluate the immune status, efficiency of nutrient absorption and utilisation in animals. In this study, it was observed that specie differences influenced haematological parameters in bull, ram and buck. The values obtained for PCV, Hb, RBC, WBC, Monocytes and eosinophils which were not significantly influenced by the species of the animals were also found to be within the physiological ranges reported for cattle, sheep and goats (RAR, 2009). This implies that the three ruminant species possessed similar potential for erythropoiesis and oxygen carrying capability. The PCV range (25.30 - 27.40%) recorded in this study was lower than 35.20% reported by Olayemi *et al.* (2007). However, the mean value fell within the range (26.97-29.23%) reported by Ayoade *et al.* (2015) in grazing bunaji bulls fed supplements. Isidahomen *et al.* (2011) attributed increase in PCV values in ruminants to increase in environmental temperature. Thus, the lower PCV value recorded in this study might be probably due to the dry cold harmattan during the period this study was carried out. For goat, the mean value obtained for PCV 26.30% was similar to 25.70% obtained for Red Sokoto goats (Tambuwal *et al.*, 2002) but lower than 28.10% obtained for WAD goats by Daramola *et al.* (2005). Oni *et al.* (2012) reported a PCV range of 21.5% to 25.5% in WAD goats.

The WBC, monocytes and eosinophil counts were also higher in bulls compared to rams and bucks which indicates their immune response capability to infection since cattle are often subjected to various infection or disease conditions. The higher values of the WBC observed may be attributed to the challenges from microbes when grazing. Animals with low white

blood cells are exposed to high risk of disease infection, while those with high counts are capable of generating antibodies in the process of phagocytosis and have high degree of resistance to diseases (Soetan *et al.*, 2013). West African Dwarf bucks had the highest RBC counts ($10.45 \times 10^6/\mu\text{L}$) which is higher than $6.49 \pm 0.01 \times 10^6/\mu\text{L}$ reported by Njidda *et al.* (2014) in goats raised in semi-arid environment, thus indicating efficient erythrocyte production and oxygen utilization. Platelet counts were significantly influenced by the specie of the animal. A platelet count of $136.00 \times 10^3/\mu\text{L}$ was recorded in bulls and $141.90 \times 10^3/\mu\text{L}$ in bucks. Blood platelets are involved in blood clotting thus low platelet concentration suggests that the process of clot-formation (blood clotting) will be prolonged resulting in excessive loss of blood in the case of injury (NseAbasi *et al.*, 2014). The white blood cell differentials (lymphocytes and neutrophils) levels were significantly influenced by the specie of the animal. Ouda rams had a significantly higher lymphocyte count compared to WAD bucks and white Fulani bulls. Lymphocytes are important in cellular immune response.

In this study, it was observed that species differences influenced serum biochemical parameters in bulls, rams and bucks. However, only total protein, creatinine and ALT levels were significantly different among the species. The West African Dwarf bucks had the highest level of total protein 7.21g/dL which was apparently higher than mean values reported by other authors in WAD goats and other goat breeds (7.1g/dL, Daramola *et al.* (2005); 6.37g/dL, Waziri *et al.*, 2010; 6.45 ± 0.92 g/dL, Akinrinmade and Akinrinde (2012) but lower than 7.53g/dL reported in WAD by Ikhimiya and Imasuen (2007). In white Fulani bulls, total protein level (6.77g/dL) recorded in this

study was similar to 6.40g/dL reported by Al-Fartosi *et al.* (2010). Serum protein is not related to the amount of calories contained in diets but to the availability of protein for utilization (Tewe and Maner, 1980). Serum total protein in ouda rams in this study was lower (5.7g/dL) than the 9.40±0.023 g/dL reported for ouda rams by Njidda *et al.* (2014). Urea and glucose levels were lower in bulls compared to other species. Lower glucose level might be due to differences in energy expenditure because of the semi-intensive system of management under which the study was carried out.

Creatinine was significantly higher in bucks (1.21mg/dl) than in bull (0.7mg/dl) but the value was not significantly different from that of rams (1.00mg/dl). The values obtained in this study for bulls is lower than 1.82mg/dl reported by Olayemi *et al.* (2001), 1.89mg/dl (Olayemi, 2004) and 1.48mg/dl (Akinrinmade and Akinrinde, 2012). The ALT was significantly influenced by specie in this study, a significantly higher value of ALT recorded in bucks (20.83 iu/l) than in rams (7.59 iu/l) and bulls (6.27 iu/l) was also higher than 9.0±0.04 iu/L reported for red sokoto bucks (Njidda *et al.* 2013). The difference may be as a result of breed effects.

Conclusion

Based on findings from this study, White Fulani bulls, Ouda ram and West African Dwarf bucks possessed similar potential for erythropoiesis and oxygen carrying capacity with little variation in thrombopoiesis and cellular and non-cellular immune response under tropical conditions. The values recorded may be used as baseline reference values for these species of male farm animals.

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