



Haematology and Serum Chemistry of Uda Rams with Graded Levels of *Xylopiya aethiopic* (Ethiopian Pepper)

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Authors' contributions

This work was carried out in collaboration between all authors. Author IM managed the experimental process. Author KMA managed the literature searches, analyses of the study performed and wrote the first draft of the manuscript. Authors NM, SAM and SB designed the study, wrote the protocol and supervised the experimental process and author MMM assisted with literature searches and lab analysis. All authors read and approved the final manuscript.

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ABSTRACT

Aim: A study was carried out to evaluate the effect of inclusion levels of *Xylopiya aethiopic* on Haematology and serum profile of Uda rams.

Methodology: 16 Uda rams were used in the experiment, The animals were grouped into four treatments and are fed diets containing 0, 2.5, 5 and 7.5 g/Kg inclusion levels of *Xylopiya aethiopic* in a completely randomized experimental design replicated five times. Blood sample evaluation was carried out at the end of a ninety (90) day feeding trial.

Results: The Haematological parameters were significant only in the platelets ($P < 0.05$). However,

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serum evaluation indicated significant differences in total and direct bilirubin, potassium, AST, HDL, triglycerides, cholesterol and glucose ($P < 0.05$).

Conclusion: It was concluded that inclusion of the test ingredient *Xylopi aethiopica* in higher quantity above 2.5 g/kg of their total feed may lead to liver disorder thus could not be safe to be used for feeding sheep as it will interfere with their liver function.

Keywords: *Xylopi aethiopica*; *Uda rams*; haematology; serum chemistry.

1. INTRODUCTION

The immune system of animals generally benefits from plant products rich in phytochemicals such as *Xylopi aethiopica* fruits. These plant products can also improve the activity of lymphocytes, macrophages and NK cells; they increase phagocytosis or stimulate the interferon synthesis [1]. Examining blood for their constituents is used to monitor and evaluate health and nutritional status of animals. The significance and great variation in the haematological and biochemical indices observed between breeds of small ruminants has been well documented [2]. These differences have underscored the need to establish an appropriate physiological baseline for other breeds of small ruminants including the Uda sheep that could be used in realistic evaluation of management practices, nutrition and diagnosis of health condition of the animals. Haematological traits are essential parameters for evaluating the health and physiological status of animals and herds [3]. According to [4], haematological values could serve as a baseline information for comparison in conditions of nutrient deficiency, physiology and health status of farm animals especially those kept under native husbandry system in Nigeria. The examination of blood provides the opportunity to clinically investigate the presence of several metabolites and other constituents in the body of animals and it plays a vital role in the physiological, nutritional and pathological status of an organism [5]. It also helps in distinguishing normal state from state of stress, which can be nutritional, environmental or physical [5]. The present study evaluated *Xylopi aethiopica* inclusion levels on haematology and serum chemistry of Uda rams.

2. MATERIALS AND METHODS

2.1 The Experimental Site and Location

The study was conducted at the Usmanu Danfodiyo University Livestock Teaching and Research Farm. The farm is located within the main campus of the University at about 10 km

North of Sokoto Metropolis in Wamako Local Government Area of Sokoto State. Sokoto is located in the Sudano-Sahelian zone in extreme North-Western part of Nigeria. It lies between longitude 4°8'E and 6°54'E and latitudes 12°0'N and 13°58'N and at altitude of 350 m above sea level [6]. The average annual environmental temperature is 28.3°C (82.9°F). However, the maximum daytime temperature are most of the year generally under 40°C (104.0°F). The low humidity of Sokoto state makes the heat bearable. Heat is more severe in the state in March and April. But the weather in the state is always cold in the mornings and hot in the afternoons except during the hamattan period [7]. The warmest months are February to April, where daytime temperature exceed 42°C (107.6°F) [7]. The rainy season is from late May to October. Rainfall starts late and ends early with annual rainfall ranging between 500 mm to 700 mm. There are two major seasons in the state namely: wet and dry seasons. The dry season starts from October and last up to April, in some part and may extend to May or June in other part. The wet season on the other hand begins in most part of the state in May and last up to September or October [7]. The hamattan, a dry, cold and fairly dusty wind is experienced in state between November and February of each year due to high environmental temperature.

2.2 The Experimental Feed, Sourcing and Formulation

The *Xylopi aethiopica* fruits was purchased from Sokoto central market together with other feed ingredients which included maize, cowpea husk, cotton seed cake, rice bran, cowpea hay, salt, bone meal and premix. The *Xylopi aethiopica* was properly sorted for any possible debris or foreign matter, sun dried and ground by grinding machine. One experimental diet was formulated with the following ingredients maize (38.65%), cowpea husk (15.70%), cotton seed cake (14.70%), Rice bran (0.95%), Cowpea hay (26.50%), Salt (0.50%), Bone meal (2.50%) and Premix (0.50%), the feed have calculated energy (ME/Kg) of 2600, calculated protein 12% and

calculated Fibre 19.8%. The Ethiopian pepper was then added at the rate of 0, 2.5, 5.0, and 7.5 kg/100 kg diet for diet 1, 2, 3 and 4 respectively. The experimental design was completely randomized design (CRD) with number of animals representing replication and graded levels of *Xylopiya aethiopica* representing treatments. Four animals were allocated to each treatment each animal serving as replicate. The weight of the animals were balanced between treatments. Each animal was housed in a pen measuring 2 m × 1 m, which was previously disinfected. Each group was assigned to one of the experimental diets and fed *ad libitum* in the morning for 12 weeks. Water was offered *ad libitum*.

2.3 Experimental Animal and Their Management

Sixteen yearlings Uda rams used in this experiment were purchased from Achida market, Sokoto state. The apparently healthy sheep were stationed at the Livestock Teaching and Research Farm Usmanu Danfodiyo University Sokoto, for 7 days for adaptation to new environment. The animals were dewormed using Albendazole based on the manufacturer's recommendation, the animals received oxytetracycline injection for possible bacterial infection. The feeding pens were cleaned regularly and disinfected a week before the commencement of the experiment. Faeces and urine of the animals were removed every day from the feeding pens to ensure adequate hygiene and minimal ammonia accumulation. Feed and water troughs were cleaned every morning before feeding.

2.4 Blood Sample Collection

Blood samples were collected once from all the animals at the end of the experiment. The blood samples were aseptically collected via jugular vein using separate sterilized disposable 5 ml syringe and 23 gauge needle. The samples from each replicate was collected in plain tubes, and tubes coated with fluoride oxide. The samples in fluoride oxide bottles was used for glucose level analysis, while the samples in the plain tubes is centrifuged for five minutes to separate the serum from the blood at room temperature. The serum was taken to chemical pathology lab of Usmanu Danfodiyo Teaching Hospital for analysis.

2.5 Proximate Composition of the Experimental Feed

Standard analytical methods [8] was used to determined dry matter (DM), crude protein (CP), ether extract (EE), crude fibre (CF) and nitrogen free extract (NFE). The gross energy of the samples was determined by bomb calorimetry [8]. The fibre fraction of the feed was analysed according to the method of [9].

2.6 Statistical Analysis

Data generated from this experiment were subjected to analysis of variance (ANOVA) for a completely randomized design using the procedure of [10]. Significant difference between individual means were separated using the Duncan's multiple range test according to [11]. Significant difference was tested at 5% probability level.

3. RESULTS

3.1 Haematological Profile of Uda Ram Fed Graded Levels of *Xylopiya aethiopica*

The results (Table 1) indicated no significant difference in Haemoglobin, PCV, RBC, MCH, MCV, MCHC and WBC ($P=0.05$). There was no significant difference between treatments 2, 3 and 4 in platelets ($P=0.05$). Platelet was significantly higher for animals that receive feeding without *Xylopiya aethiopica* (treatment 1).

3.2 Serum Chemistry of Uda Ram Fed Graded Levels of *Xylopiya aethiopica*

The Results (Table 2) indicated that HDL (Mmol/l), glucose (Mmol/l) and creatinine (Mmol/l) decreases with increasing level of the test ingredient from treatment 1 to 4 ($P=0.05$), while triglycerides increases with the increasing level of the test ingredient. There were no significant differences in Albumin (g/dl), globulin (g/dl), Total protein (g/dl), LDL (Mmol/l), urea (Mmol/l) and cholesterol (Mmol/l) across the treatments ($P=0.05$). The result also showed that treatment 4 had a significantly lower ($P=0.05$) AST (u/L) while direct bilirubin and ALP is significantly higher ($P=0.05$). The results showed that potassium (Mmol/l) is significantly decreasing from treatments 1 to 4 ($P=0.05$). Result indicated no significant differences in ALT, chlorine, bicarbonate and sodium across the treatments.

Table 1. Haematological profile of Uda ram fed graded levels of *Xylopiya aethiopic*

Parameter	Treatments (inclusion level of <i>Xylopiya aethiopic</i>) (g/kg)				SEM
	1	2	3	4	
Haemoglobin (g/dl)	8.47	9.27	8.87	9.40	0.49
PCV (%)	24.17	24.90	25.23	26.03	1.25
RBC	8.93	10.18	9.42	9.99	1.25
MCH	32.1	31.0	30.4	32.65	1.41
MCV	27.13	24.67	26.80	26.23	1.67
MCHC	35.07	37.23	35.10	35.98	0.99
WBC (x 10 ⁹ /L)	70.67	70.00	74.00	73.57	4.11
Platelets (x 10 ⁹ /L)	616.00 ^a	424.67 ^b	467.67 ^b	420.33 ^b	40.92

a, b means values with different superscripts in a row denotes significant ($p < 0.05$) difference between means within the same rows. PCV-Pack cell volume; RBC-Red blood cell; MCH-Mean corpuscular Haemoglobin; MCV-Mean corpuscular volume; MCHC-Mean corpuscular Haemoglobin concentration; WBC-White blood cell

Table 2. Serum chemistry of Uda ram fed graded levels of *Xylopiya aethiopic*

Parameter	Treatments				SEM
	1	2	3	4	
Albumin (g/dl)	2.55	2.75	2.73	2.60	0.59
Globulin (g/dl)	3.05	2.75	3.08	2.90	0.34
Total protein (g/dl)	5.6	5.5	5.8	5.5	0.25
HDL (mmol/L)	40.5 ^{ab}	55.8 ^a	50.0 ^{ab}	38.0 ^b	3.78
LDL (Mmol/L)	27.5	38.5	25.0	24.5	3.88
Triglycerides (Mmol/L)	37.0 ^b	42.5 ^b	54.0 ^{ab}	70.8 ^a	6.14
Creatinine (Mmol/L)	77.0 ^b	106.5 ^a	83.5 ^{ab}	63.0 ^b	6.81
Cholesterol (Mmol/L)	0.65	0.65	0.85	0.70	0.63
Urea (Mmol/L)	2.8	2.35	3.06	2.28	0.21
Glucose (Mmol/L)	4.0 ^a	3.63 ^a	3.15 ^{ab}	2.67 ^b	0.22
AST (u/L)	107.5 ^a	129.0 ^a	106.7 ^a	47.3 ^b	9.33
ALT (u/L)	15.5	16.0	16.5	13.5	1.07
ALP (u/L)	478 ^c	534 ^{bc}	566 ^b	663 ^a	87.5
Direct bilirubin (Mmol/L)	0.07 ^b	0.05 ^b	0.03 ^b	0.28 ^a	0.3
Total bilirubin (Mmol/L)	3.77 ^a	0.26 ^b	1.14 ^b	0.95 ^b	0.54
Chlorine (Mmol/L)	101	97.5	93.5	93.5	2.16
Bicarbonate (Mmol/L)	26.5	26.0	24.0	23.5	1.16
Potassium (Mmol/L)	4.90 ^{ab}	4.95 ^a	4.50 ^b	4.05 ^c	0.10
Sodium (Mmol/L)	142.75	143.5	141.0	137.5	2.42

a,b,c means in the same row with different superscripts are significantly different ($P = .05$)
HDL- High density lipoprotein, LDL- Low density lipoprotein, ALP- Alkaline phosphate, ALT- Alanine aminotransferase, AST- Aspartate aminotransferase

4. DISCUSSION

4.1 Haematological Profile of Uda Ram Fed Graded Levels of *Xylopiya aethiopic*

The non-significant difference in Haemoglobin, PCV, MCH, MCHC and MCV composition of the experimental animals irrespective of the level of supplement suggest that even the highest level of supplementation is not detrimental to the animals. The same reason could be attributed to WBC although it is slightly lower than the normal reference value for sheep [12]. However, the

WBC values reported in the present study were higher than $6.93 - 12.66 \times 10^9/l$ observed by [13]. This variation could be attributed to variation in diet, environment and the breed of the animals. PCV and RBC values of the animals obtained in the present study were within normal for healthy sheep. [14–17] also made the same observation when testing the effect of spices on immune function and health in ruminants. The change in the Platelets counts could be due to the changes in the immune system as a result of feeding *Xylopiya aethiopic*. The changes could be attributed to deficiency in Vitamin B12 and iron which *Xylopiya aethiopic* possess.

4.2 Serum Chemistry of Uda Ram Fed Graded Levels of *Xylopia aethiopica*

The Albumin, Globulin, total protein and creatinine were within the normal reference values as reported by [18,19]. The cholesterol falls slightly below the normal reference range although it significantly ($P=.05$) increase with increasing level of the test ingredient. Low cholesterol is recognized in inherent deficiencies, intestinal mal-absorption/mal-digestion of lipoprotein [20]. The glucose concentration obtained was within normal value as reported by [21] though it is decreasing with decreasing level of the tests ingredient.

The urea levels are below the normal reference range. This could suggest slight impairment of the liver and kidney that could be attributed to anti-nutritional factors. Total protein being within the normal range is an indication that protein synthesis is adequate [22]. The creatinine values were within the normal reference range although on the lower side. This could be attributed to the fact that the experimental animals are in growing stage because creatinine concentration tend to increase progressively with age [23]. The HDL and LDL obtained in the present study are higher than those obtained by [22] but were within the range reported by [24].

The bicarbonate, potassium, total and direct bilirubin, and ALT are within the normal values while the chlorine and sodium are slightly below normal. The sodium and potassium were similar to the findings of [22,25] for Uda and Yankasa rams respectively. The electrolytes being within normal range is an indication that the test ingredient may not interfere with the normal renal function of the animals. High ALP could indicate liver flukes and pyrrolizidine alkaloid toxicity. However, high levels of ALP can be normal in growing animals due growth of bones [26]. The ALP values being high are an indication of high quality protein in the diet. The AST is above the normal values. This further indicate that the animals may have liver disorder when they ingest test ingredient in high quantity which will interfere with liver dysfunction.

5. CONCLUSION

From the study it can be concluded that inclusion of the test ingredient *Xylopia aethiopica* in higher quantity above 2.5 g/kg of their total feed may lead to liver disorder thus could not be safe to be used for feeding sheep as it will interfere with

their liver function. Because higher dosage of *Xylopia aethiopica* shows to have effects on the liver of the animals which may be due to high metabolic process taking place in the liver.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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