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HAEMATOLOGY AND SERUM BIOCHEMISTRY OF GROWING RED SOKOTO BUCKS FED DIETS CONTAINING GRADED LEVELS OF CASSAVA PEEL MEAL AS SUPPLEMENT TO NEEM LEAVES

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ABSTRACT

The study evaluated the haematology and serum biochemistry of growing Red Sokoto bucks fed diets containing graded levels of cassava peel meal as supplement to neem leaves. Sixteen (16) Red Sokoto bucks aged about 8 – 9 months old were allocated into four (4) treatments of four (4) bucks each. The bucks were fed neem leaves at 300g/buck/day and a concentrate supplement diet at 250g per buck/day for a duration of fifty (50) days, water was served ad libitum, feed intake was monitored and recorded. The experimental design was a complete randomized design. Concentrate, cassava peels and neem leaves samples were analyzed for their proximate composition. At the end of the experiment, haematological and serum biochemical parameters were analyzed. All haematological parameters evaluated were significant (P < 0.05) except Basophil and were within the normal range of values for goats. Serum biochemical parameters evaluated were statistically significant (P < 0.05) except Chloride, Creatinine, total bilirubin, total protein and albumin; and were within the normal range of values for goats. It was concluded that cassava peel meal in the concentrate diet of growing Red Sokoto bucks had no adverse effect on haematology and serum biochemistry. Inclusion of graded levels of cassava peel meal up to 15% is safe for growing Red Sokoto bucks.

Keywords: Haematology, Serum biochemistry, Cassava Peel Meal, Neem Leaves, Supplement

1.0 INTRODUCTION

Livestock farmers in developing countries are faced with various challenges that lead to considerable fall in the production of certain livestock species like goats, cattle, swine and poultry, which further leads to protein shortage. This is due to high cost of production that originates from increase in prices of conventional feed ingredients and livestock species. There is therefore an urgent need for alternative locally available and cheap sources of feed ingredients particularly those that do not attract competition in consumption between human and livestock or have no direct relevance in human food chain

(Shettima *et al*., 2024).

Nigerian Goats are reared traditionally at subsistence level. They are usually left to scavenge and cater for their own nourishment. A major obstacle to ruminant livestock production in most tropical ecosystem is the seasonal fluctuation in forage availability and quality due to modal rainfall patterns (Garba and Ibrahim, 2019). During the dry season, forage yield and quality reportedly decline drastically, for both cultivated pastures and natural pastures (Ocheja *et al*., 2021).

Cassava peels meal is cheap and readily available, by-product of cassava processing contains 5% crude protein, 5.8% fat, 9.5% crude fibre, 7.2% ash and 2036 kcal Metabolizable energy (Gboshe and Ukorebi, 2020). Exploitation of cheap feed resources for animal production would lower the market price of animals and their products in Nigeria (Ocheja *et al*., 2023). The relationship between nutrition, production and reproduction is a topic of increasing importance and concern among farmers, veterinarians, feed dealers and extension workers. The interaction between nutrition, production and reproduction has long been known to have important implications for the reproductive performance of animals (Butler, 2000; Shettima *et al*., 2024). The efficiency of sperm production, libido and quality of sperm tend to remain uniform throughout the reproductive life of an animal but may be significantly altered by age, nutrition, environment, health status, drugs and chemicals (Ahemen *et al*., 2016) and among these factors nutrition is the most prominent.

The potential of cassava as a grain substitute in livestock feed is yet to be fully explored probably due to the presence of cyanogenic glucoside (Amin *et al*., 2020). Processing of cassava Peel helps in reducing the levels of cyanogenic glycosides and phytate component while preserving its nutritive quality (Oboh, 2006). Common methods used in processing cassava Peel include; sun drying, ensiling and soaking + sun drying (Amin *et al*., 2020). Dietary components have measurable effects on haematological and serum biochemical parameters such that significant changes in their values can be used to draw inference on the safety or toxicity of feeds offered to the animals (Shettima *et al*., 2021).

The aim of this study therefore was to evaluate the haematological and serum biochemical profile of growing red Sokoto bucks fed diets containing graded level of cassava peel meal as supplement to neem leaves.

2.0 MATERIALS AND METHODS

2.1 Experimental site

The study was conducted at the Teaching and Research Farm, Department of Animal Science Faculty of Agriculture, Federal University of Kashere in Gombe State, Nigeria The state is situated within latitude 9º54'46N and longitude 9º 46º'27E and 10º57º E and altitude of 349m above sea level. The annual rainfall of Kashere ranges between 800mm-900mm per annum and is characterized by distinct dry season (October-May) and rainy season (June-September) seasons. The annual mean temperature ranges from 30-32º C and it experiences a relative humidity of 17-90% (National Geospatial Intelligence Agency, 2019).

2.2 Experimental Animal and their Management

Sixteen (16) Red Sokoto bucks aged between 8-9 months were sourced from Kashere Market and housed in individual pens for one week for acclimatization. They were randomly allocated into four (4) Treatments of four (4) goats each (T1, T2, T3 and T4). The Experimental animals were treated with antibiotic (Oxytetracycline L.A) at 1ml/10kg body weight and Ivermectin injection at 1ml/50kg live weight to control ecto and endo-parasites; and bacterial infection prior to the commencement of the experiment.

2.3 Experimental Diets

The feed ingredients consist of Bambara nut shell meal, Cassava peel meal (CPM), Groundnut cake (GNC) Maize offal (MO), Egg shell meal (ESM), and Table salt (TS). These components were thoroughly mixed together after pounding and grinding.

Table 1 Composition of Experimental Diet (%)

Ingredient	% T1	% T2	% T3	% T4
Groundnut Cake	25.00	25.00	25.00	25.00
Bambara nut shell meal	15.00	10.00	5.00	0.00
Cassava peel meal	0.00	5.00	10.00	15.00
Maize offal	58.00	58.00	58.00	58.00
Egg shell meal	1.00	1.00	1.00	1.00
Table salt	1.00	1.00	1.00	1.00
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated nutrient content				
Crude Protein %	18.54	18.54	18.49	17.63
Crude Fibre %	13.84	13.12	12.92	12.72
MetabolizableEnergy Kcal/kg diet	3182	3145	3150	3122

2.4 Chemical Analysis

Samples of the experimental diets, cassava peels meal and neem leaves were analyzed for their proximate composition using the method outlined by AOAC (2000).

2.5 Experimental Procedure

The Bucks were randomly allocated into four (4) treatments after balancing the weight; each treatment had four (4) replicates. Treatment one (T1) contained 0.00% level of cassava peels meal; treatment two (T2) was 5.00% level of cassava peels meal; treatment three (T3) was 10.00% level of cassava peels meal and Treatment four (T4) was 15.00% level of cassava peels meal.

The neem leaves were offered at 300g/buck/day, followed by the concentrate 250g/buck/day 2hours later, and the left over were also weighed and subtracted from the quantity of feed that was served to determine the feed intake of the animal. The experiment lasted for fifty (50) days, after an adjustment period of 7 days.

2.6 Haematology and Serum biochemistry

At the last day of the feeding trial, blood samples for haematology and serum biochemistry analysis were

collected via the jugular vein from all the experimental animals using 10ml syringes and needles. 5mls was transferred into a well labeled test tube containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant for haematological analysis. The un-coagulated blood samples were analysed for packed cell volume, haemoglobin concentration, red blood cell count, white blood cell count, mean corpuscular haemoglobin, mean corpuscular volume and mean corpuscular haemoglobin concentration using methods described by Ogbuagu *et al*., (2022). 5mls of the blood sample were transferred into a test tube without anticoagulant for serum biochemical analysis. The blood samples for serum biochemical analyses were kept at a temperature of 25-26ºC for 15 minutes for the blood to clot. The samples were centrifuged at 3000r for 10minutes and the serum samples obtained were refrigerated at -25ºC until analysis, serum biochemical parameters were determined as described by Ogbuagu *et al*., (2022). The Serum was analyzed for lipid profile (cholesterol, triglyceride, high density lipoprotein, low density lipoprotein); serum electrolytes (sodium, potassium, chloride, creatinine, urea); liver function test (aspartate aminotransferase, alanine aminotransaminase, total bilirubin, total protein, albumin, globulin) and blood glucose.

2.7 Experimental Design and Statistical Analysis

The experimental Design was Completely Randomized Design (CRD). Data obtained was analyzed using a one-way Analysis of variance (ANOVA), means with significant differences were separated using Least Significant Differences (LSD) with the aids of Statistical Packages identified as Statistical Analysis System (SAS) version 9.04, 2018.

3.0 RESULTS AND DISCUSSION

3.1 Proximate Composition of Concentrate diets, Neem Leaves and Cassava Peels Meal

Proximate composition of experimental diets, cassava peel meal (CPM) and neem leaves is presented in Table 2. The crude protein values of about 18% for the experimental diets fell within the values of 12.00-18.00% recommended for growing ruminants in the tropics (NRC, 2001) and

also above the critical values of 8% required to provide adequate ammonia for normal rumen functions (Lakpini, 2002).

The crude fibre (CF) and Nitrogen free extract (NFE) were within recommended values (Lakpini, 2002). The low levels of NFE in the neem leaves will be compensated for by the high value of NFE in the CPM. The ash content of the experimental diets was within the recommended values reported by (Arigbede *et al,* 2012).

Table 2: Proximate Composition of Concentrate diet, Neem Leaves and Cassava Peel Meal (%DM)

(%DM Nutrient)	T1	T2	T3	T4	Neem Leaves	Cassava Peel Meal
Crude Protein	18.30	18.10	18.05	18.00	9.40	6.50
Crude Fibre	12.80	12.85	12.89	12.9	19.01	10.42
NFE	61.2	60.36	60.96	60.51	59.69	71.98
Ether Extract	3.50	3.10	3.00	3.00	2.50	2.80
Ash	4.02	4.95	5.10	5.59	9.40	8.30

3.2 Haematological Parameters of Experimental Bucks

Haematological profile of growing Red Sokoto bucks fed diets containing graded levels of Cassava Peel Meal is presented in Table 3. All haematological parameters evaluated were significant ($P < 0.05$) except Basophil. All haematological parameters evaluated across the groups were within the normal range of values for goats reported by Duncan *et al*. (1994) and Radostits *et al*. (2005). This indicated that the supplement diets were nutritionally adequate. The normal values of PCV, Hb and RBC indicate that the protein utilization of the bucks was not adversely affected. The decrease in the WBC values and the increase in Monocytes, MCH and MCHC values insinuate allergic conditions. The findings of this work agrees with the findings of Amin *et al*. (2020) who fed diets containing differently processed cassava peel meal to red Sokoto bucks and reported no adverse effect on haematology. It also agrees with the work of Ocheja *et al*., (2021) who fed

yearling West African dwarf goats with cashew nuts shell based diets and reported no adverse effect on haematology; and Shettima *et al*., (2021) who fed weaner Yankasa Rams a mixture of Bambara nut offal and rice offal as supplement to *Panicum maximum* and reported no negative effect on haematology.

Table 3: Haematological Profile of Experimental Bucks

	Treatments					
Parameters	T1	T2	T3	T4	SEM	Reference Value
PCV (%)	28.00^{c}	38.00^{a}	33.75^{b}	33.25^{b}	1.08	24.0 – 45.0
Hb (g/dL)	9.18^{b}	12.78^{a}	11.13^{a}	10.88^{b}	0.34	8.0 – 16.0
RBC (g/dL)	3.75^{a}	4.08^{a}	3.05^{b}	3.60^{b}	0.23	3.0 – 16.4
WBC (x 10^{9}/L)	14.53^{a}	14.48^{a}	13.50^{b}	13.80^{b}	0.10	13.0 – 33.5
Basophil (%)	0.00	0.00	0.00	0.00	0.00	0.00 – 3.00
Monocytes (%)	5.00	5.50	5.60^{c}	5.75	0.70	0.00 – 6.00
Eosinophil (%)	9.00^{a}	8.00^{a}	7.30^{b}	7.50^{b}	0.70	0.00 – 10.00
Neutrophil (%)	48.25^{a}	48.75^{a}	38.75^{b}	38.50^{b}	1.04	
Lymphocytes (%)	48.75^{c}	48.00^{a}	46.00^{b}	45.75^{b}	0.25	35.00 – 74.00
MCV (fl)	44.25^{c}	49.50^{a}	44.25^{c}	45.00^{b}	0.85	23.00 – 119.00
MCH (pg)	24.00^{b}	24.50^{b}	25.50^{a}	25.75^{a}	1.70	7.00 – 26.00
MCHC (%)	30.60^{b}	31.77^{a}	31.97^{a}	31.73^{a}	1.17	19.00 – 31.00

a, b, c; means in the same row with different superscripts differ significantly ($P < 0.05$). PCV = Packed cell volume, Hb = haemoglobin, RBC = Red blood cell, WBC = white blood cell, MCV= Mean Corpuscular Volume, MCH = Mean Corpuscular Haemoglobin, MCHC = Mean Corpuscular Haemoglobin Concentration, SEM = standard error of mean, Reference Value = normal haematological value for goats.

3.3 Serum biochemical Parameters of Experimental Bucks

Serum Biochemistry of growing Red Sokoto bucks fed diets containing graded levels of Cassava Peel Meal is presented in Table 4 All Serum biochemical parameters evaluated were statistically significant ($P < 0.05$)

except Chloride, Creatinine, total bilirubin, total protein and albumin. All Serum biochemical parameters evaluated across the groups were within the normal range of values for goats reported by Duncan *et al*. (1994) and Radostits *et al*. (2005). High density lipoprotein (HDL) was high across the groups but T3 and T4 had the highest values; Aspartate aminotransferase (AST) was low across the groups with T4 having the highest value. Alanine aminotransferase (ALT) T1, T2 and T3 were low with T4 having the highest value. Serum biochemical components are sensitive to elements of toxicity in feeds, high level could indicate cardiovascular disease or metabolic syndrome (Russell and Roussel 2007). Lower level of AST and high value for ALT could suggest liver damage, muscle damage or heart attack (Jewad and Jihad 2021). The findings of this work agrees with the findings of Amin *et al*. (2020) who fed diets containing differently processed cassava peel meal and reported no adverse effect on serum biochemistry of red Sokoto bucks. It also agrees with the work of Ocheja *et al*., (2021) who fed yearling West African dwarf goats with cashew nuts shell based diets and reported no adverse effect on serum biochemistry; as well as Shettima *et al*., (2021) who fed weaner Yankasa Rams a mixture of Bambara nut offal and rice offal as supplement to *Panicum maximum* and reported no negative effect on serum biochemical parameters.

Table 4: Serum Biochemistry of Experimental Bucks

Parameters	Treatments					
	T1	T2	T3	T4	SEM	Reference Value
Cholesterol (mg/dl)	131.25[b]	141.50[b]	151.00[a]	149.00[a]	2.73	50 – 200
Triglyceride (mg/dl)	121.00[a]	118.50[a]	115.25[b]	121.75[a]	0.87	50 – 150
HDL (mg/dl)	50.75[c]	53.75[b]	55.75[a]	58.75[a]	1.59	40 – 60
LDL (mg/dl)	30.00[b]	37.00[a]	41.75[a]	41.50[a]	2.01	0 – 150
Sodium (mmol/L)	136.00[b]	138.00[a]	139.75[a]	140.25[a]	0.53	135 – 145
Potassium (mmol/L)	3.50[b]	3.47[b]	3.60[b]	4.17[a]	0.09	3 – 5
Chloride (mmol/L)	96.75	96.75	96.00	96.00	0.20	95 – 110
Urea (mmol/L)	4.10[a]	3.67[a]	3.17[b]	3.45[a]	0.15	2.5 – 5.8
Creatinine (mmol/L)	52.00[a]	52.75[a]	53.00[a]	50.75[b]	1.17	44 – 132
AST (IU/L)	56.00[b]	54.50[b]	61.75[b]	67.00[a]	1.97	58 – 109
ALT (IU/L)	24.75[b]	24.75[b]	25.00[b]	29.25[a]	2.28	24 – 29
Tbilirubin (mmol/L)	10.82[b]	10.75[b]	10.75[b]	12.57[a]	0.54	
Tprotein (mmol/L)	69.00	69.75	69.75	69.00	0.71	62 – 79
Albumin (mmol/L)	35.00[a]	34.50[b]	33.00[b]	36.25[a]	0.68	29 – 38
Globulin (mmol/L)	34.50[b]	35.50[a]	36.75[a]	32.75[b]	0.58	24 – 48
Glucose (mmol/L)	4.70[a]	4.60[a]	4.47[a]	4.30[b]	0.05	3.5 – 6.5

a, b, c; means in the same row differ significantly ($P < 0.05$), HDL = high density lipoprotein, LDL = low density lipoprotein, AST = Aspartate aminotransferase, ALT = Alanine aminotransferase, Tb = Total bilirubin, Tp = Total protein, SEM = standard error of the mean.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Cassava peel meal in the concentrate diet of growing Red Sokoto bucks had no adverse effect on haematology and serum biochemistry. Inclusion of graded levels of cassava peel meal up to 15% is safe for growing Red Sokoto bucks.

4.2 Recommendations

Cassava peel meal can be used in supplement diets for Red Sokoto bucks from 5% - 15% level of inclusion. Further research using other breeds of goat is also recommended.

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