

Blood profile of red sokoto bucks fed diets containing varying levels of yam peel meal with *Ficus polita* as basal diets

Oloche*, J., Kume, A.B. and Ayoade, J.A.

Department of Animal Production University of Agriculture, Makurdi, Benue State

*Corresponding author: julianaoloch082@gmail.com

Target Audience: Nutritionists, Feed millers, Livestock Producers

Abstract

Sixteen (16) Red Sokoto bucks with an average weight of 9.11 kg and aged 6 - 8 months were used to assess the blood profile of Red Sokoto goats fed diets containing high levels of yam peels with *Ficus polita* as basal diets in a completely randomized design (CRD). Yam peels were collected from food vendors from markets within Makurdi Metropolis, it was sun-dried for 3 days and crushed into a meal using mortar and pestle. This was used to compound four experimental diets designated D1 (0%), D2 (50%), D3 (75%) and D4 (100%) Yam Peel Meal (YPM) and were used to feed the Red Sokoto bucks for 105 days. Results obtained from this study shows that there was no effect of treatment ($P>0.05$) on the haematological parameters measured. Similarly, mean values of serum biochemistry parameters assayed did not show treatment effect ($P>0.05$). The total protein value of D1 (5.28mg/dl) was significantly lower ($P<0.05$) than those of D2 (7.93mg/dl), D3 (7.33mg/dl) and D4 (7.68mg/dl). However, there was no statistical difference ($P>0.05$) in the total protein values of D2, D3 and D4. The serum minerals measured (calcium, potassium, sodium, phosphorus, magnesium and chloride) were similar ($P>0.05$) across the treatments. Cost analysis of treatments showed that none of treatments resulted in loss, but treatment D2 appears to have the best profit margin. The study shows that YPM can be used to replace maize offal up to 100% without compromising the health of the goats and enhance profitability of the goat enterprise.

Keywords: Yam peel meal, Red sokoto bucks, *Ficus polita*

Description of Problem

Animal protein is rich for tissue maintenance and for sustaining growth because of its high biological value (1). However, the intake of animal protein required to enhance human growth is low in Nigeria. The problem of inadequate animal protein consumption in Nigeria and in most developing countries is enormous; hence there is an urgent need to avert the imminent protein malnutrition (2). The potential of small ruminant production in alleviating the low animal protein intake by man in developing nations such as Nigeria needs no emphasis (3). The severity of this

problem has been blamed on low level of livestock productivity due to seasonal feed deficits, erratic supply of feed ingredients due to competition between human and livestock for available feed resources (4). Goats however have the ability to offer the cheapest sources of animal protein in form of meat, milk and their products. They have a unique ability to convert feedstuffs of low nutritional value into useful end products that are utilized for productivity and growth (5). Hence, the need to the search for alternative unconventional feed resources that can be used in ration formulation without adverse effects on the health of the animals.

Crop by-products are potential feed resources described as non-conventional feeds for livestock. Prominent among these are yam peels, sweet potato peels, cassava peels and Irish potato peels. Yam peels form about 10% of the total root as valuable feed for ruminants especially sheep and goats (6).

Yams are starchy staples in form of large tubers produced by annual and perennial vines grown in Africa, America, Asia and Worldwide (7). Botanically it belongs to the family Dioscoreaceae and in the genus Dioscorea. Ninety four percent (94%) of the World's production of yam comes from West Africa with Nigeria alone producing 71%, hereby accounting for over 70% of the world total output [8]. Yams are boiled, roasted, baked or fried. It is during the preparation of yam for food that yam peels are obtained.

Yam peels are readily available in all parts of Nigeria at little or no cost and it constitutes environmental hazard where it is not properly utilized (7). It has been analysed to contain 11.21% crude protein, 9.47% crude fibre, 1.17% ether extract, 9.76% ash and 68.29% nitrogen free extract (9). On the other hand (10) reported that yam peels contain 9.02% crude protein, 8.79 % crude fibre, 9.92% Ash, 6.88% ether extract and 63.89%. YPM has also been reported to contain 0.57% tannins, 0.87% saponin, 1.19% oxalate, 0.89% phytate and 0.0% trypsin inhibitor (10). Haematological profile is an index of the general health status of an animal (12). Beside nutrition, the health condition of an animal is a function of the blood and serum constituents as these determines its ability to transport oxygen and nutrients to tissues and to defend itself against infections (11). Therefore, the effects of diets on blood and serum chemistry should be of paramount interest (11). This study was designed to access the blood profile of Red Sokoto bucks fed diets containing varying

levels of yam peels with *Ficus polita* as basal diets.

Materials and method

Experimental site

The research was conducted at a private farm in North Bank, within Makurdi Metropolis. Makurdi lies between latitude 70 43' N and longitude 80 3' E (13) with an average temperature of 26°C and average annual rainfall 623mm respectively (14).

Collection of test ingredient and preparation of the experimental diets

Yam peels were collected from food vendors in North bank market within Makurdi Metropolis who peel yams either for pounding or other uses. The peels were properly sun-dried for 3 days, crushed and kept in bags for use. Four experimental diets were formulated and compounded to contain 0%, 50%, 75% and 100% Yam Peel Meal (YPM) and these were designated D1, D2, D3, and D4, respectively.

Experimental Design

The experimental design for the study was the completely randomized design. The feeding trial lasted for a period of 105 days (15 weeks).

Experimental Animals and Management

Sixteen (16) grower Red Sokoto bucks aged between 6 to 9 months with average weight of 9.11kg were used for the experiment. The animals were bought from medium scale goat sellers within Makurdi Metropolis who buy goats from Kano State and sell in Makurdi. Before the commencement of the feed trial, the bucks were vaccinated using *peste des petits ruminants* vaccine and dewormed with ivermectin. The experimental house was a dwarf walled building fitted with elaborate windows space and a high roof for

proper ventilation. The house was divided into pens which were further subdivided into individual compartments. Each compartment was equipped with pre washed and dried feeding troughs and drinkers. Before the arrival of the animals, the animal house was thoroughly washed, disinfected and allowed to dry. Wood shavings were used as litter materials and bedding for the animals. At the commencement of the study, the animals were weighed and randomly distributed into four treatment groups (n=4). Three hundred grammes of the concentrate feed was given daily to the bucks at 8:00 hour, while the forage was fed to the animals *ad libitum*. The feeding of the forage was done twice daily. The bucks were first fed at about 10:00hr and fed the second time at 14:00hr to help reduce feed wastage and enhance intake. The feeding of the forage was done by suspending small bundles of the *Ficus polita* from the roof of each compartment down to the animal using light ropes to prevent the animals from trampling the forage under foot. The quantity of forage consumed was recorded as the difference of the initial weight of forage supplied and the left over after each feeding. Mineral supplements were provided for each animal in form of mineral blocks. All the experimental animals were provided with fresh clean water daily.

Blood Parameters

On the last day of the experiment, before morning feeding, blood samples were aseptically collected from all the animals via the jugular vein using needles and syringes. The blood collected from each animal was put into two sets of sample bottles, one set of the bottles contained ethylene diamine tetra acetic acid (EDTA) for analysis of haematological constituents such as packed cell volume (PCV), haemoglobin (Hb), red blood cells (RBC), white blood cells (WBC), neutrophils,

basophils, lymphocytes, and eosinophils, the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), were derived from the PCV, RBC, and HB. The second set of sample bottles were plain bottles for analysis of serum biochemical constituents [total protein, serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), alanine phosphate (ALP) creatinine and cholesterol].

Chemical Analysis

Samples of the feed and feed ingredients were analysed for their proximate constituents by the methods of (15).

Statistical Analysis

All data obtained were subjected to Analysis of Variance (ANOVA) using (16) Statistical Software.

Results and Discussion

The feed ingredients and proximate composition of the experimental diets is presented in Table 1. Dry matter (DM) of the diets ranged from 86.85% - 89.95%. The crude protein (CP) values were 15.27%, 15.68%, 15.90% and 16.10% for D1, D2, D3 and D4 respectively. The CP values of the compounded diets in this study were higher than 10 - 12% CP required by ruminants for optimum growth (17). Observed values were similar to 15.40 - 16.20% CP reported by (18) for red Sokoto goats fed Sabara leaf meal and values of 15.03 - 15.67% for red Sokoto bucks fed varying levels of Irish potato (*Solanum tuberosum*) peels (19). Values were also within 13.20 - 18.44% CP reported by (20) for WAD goats fed diets containing graded levels of malted sorghum sprout mixed with pineapple waste based diets.

The CF values were 12.81%, 12.04%, 11.65% and 11.26% for D1, D2, D3 and D4 respectively. The CF values seemed to decrease slightly from D1 - D2 with increase in percentage of YPM in the diets. However, the CF values here were adequate as goats were also fed forages. The NFE values were between 58.54 - 60.76% indicating that there was appreciable fermentable carbohydrate available for energy production for the animals

(19). The ash values were 4.22%, 6.63%, 7.83% and 9.04% for D1, D2, D3 and D4 respectively, unlike the CF, values increased from D1 - D4 with increasing levels of YPM in the diets. This means that the diets containing the YPM would provide more minerals than the control diet. Observed values of ash were comparable with 6.34 to 9.34% reported by (21) for WAD bucks fed *Panicum maximum* and Bambara nut seed meal.

Table 1: Feed ingredients and proximate composition of Concentrate diets fed to Red Sokoto bucks

Ingredient (%)	Experimental diets			
	D1 (0%)	D2 (50%)	D3 (75%)	D4 (100%)
Yam peel meal	0.00	30.67	46.00	61.34
Maize offal	61.34	30.67	15.34	0.00
Full fat soya bean	15.66	15.66	15.66	15.66
Rice offal	10.00	10.00	10.00	10.00
Brewers dried grain	10.00	10.00	10.00	10.00
Bone Ash	2.00	2.00	2.00	2.00
Common Salt	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00
<i>Calculated proximate parameters (%)</i>				
Dry matter	86.85	89.87	89.95	89.81
Crude Protein	15.27	15.68	15.90	16.10
Crude fibre	12.31	11.99	11.86	11.67
Nitrogen Free Extract	60.76	59.65	59.10	58.54
Ether extract	7.44	6.05	5.53	4.65
Ash	4.22	6.63	7.83	9.04

The result for the haematology of the Red Sokoto bucks fed the experimental diets is presented in Table 2. There was no treatment effect on any of the haematological parameters measured. The PCV values ranged from 33.75 - 37.50% which was within the normal range of 22 - 38% PCV reported by (22) for clinically healthy goats. Although (11) reported slightly lower PCV values of 27.25 - 32.75% for red Sokoto goats fed supplement diets containing *Adansonia digitata*, but values from this study were comparable with 33.00 - 38-67% for West African dwarf goats fed diets containing unfermented and fermented sweet orange (*Citrus sinensis*) peel meal with gamba as

basal feed (23). The Hb values (11.25 - 12.75g/dl) were within the normal range, and comparable with 8.55 - 12.58g/dl reported by (11) for red Sokoto goats fed supplement diets containing *Adansonia digitata*, while (21) reported values of 11.80 - 12.20g/dl for WAD goats fed diets containing graded levels of bambara nut. Reduction in the concentration of haemoglobin and packed cell volume suggests the presence of toxic factors which has adverse effect on blood formation (24). This was not the case in this study, PCV and Hb values were within the normal range indicating the absence of toxic factor adverse to blood formation. The RBC values ($12.55 - 16.55 \times 10^9/l$) were within

the normal reference range of 8.00 - 18.00 $\times 10^{12}/l$ reported by (22) for goats. The PCV, RBC and Hb all indicated that the goats were not anaemic and that the oxygen carrying capacity of the haemoglobin was also adequate, this indicate that the test ingredient was not deleterious to the proper functioning of the PCV, RBC and the Hb.

The WBC values of 5.70 - 9.95 $\times 10^9/l$ obtained in this study fall within the normal range of 6.96 - 7.57 $\times 10^9/l$ reported by (25) and also indicating the absence of disease invasion, implying that the goats were healthy. Observed values were within 4.00 - 13.0 $\times 10^9/l$, reported by (22) for goats and comparable with 5.30 - 7.40 $\times 10^9/l$ for West African dwarf goats fed complete diets containing graded levels of sweet orange peel meal (26). However, (11) reported higher values of 11.98 - 18.90 $\times 10^9/l$ for red Sokoto goats fed baobab (*Adansonia digitata* L.) fruit meal supplement. Neutrophils values were between 26.75 - 36.50%, values seemed to increase slightly from D1 - D2 with increasing levels of YPM. Neutrophils are chemically drawn to sites of infection, they are phagocytes that engulf the target cell (bacteria, diseased or

dead cells) and destroy it. Abnormally high levels can be an indication of infection or physical stress (27). The Neutrophils values in this study were within the normal range of 17 - 52% reported by (28) for healthy goats and comparable to 29.75 - 32.75% reported by (29) for West African dwarf goats fed *Gmelina aborea* as basal diet and supplemented with diets containing high levels of water soaked sweet orange peel meal. Higher values of 35.00 - 40.60% was reported by (23) for West African dwarf goats fed diets containing unfermented and fermented sweet orange (*Citrus sinensis*) peel meal with gamba as basal feed. The MCV, MCH and MCHC values were 22.20 - 27.40 fl, 7.65 - 9.15 Pg and 33.33 - 34.12g/dl respectively. These were all normal further indicating that the experimental animals were by no means anaemic. Observed values for MCHC was 33.33 - 34.12g/dl and within the normal range of 32.00 - 34.6g/dl reported by (28) for goats and comparable with 33.27 - 33.39g/dl reported by (20) for West African dwarf goats fed diets containing graded levels of malted sorghum sprouts mixed with pine pineapple waste based diets.

Table 2: Haematology of Red Sokoto bucks fed diets containing Yam Peel Meal

Parameter	Experimental diets				SEM
	D1 (0%)	D2 (50%)	D3 (75%)	D4 (100%)	
Pack cell volume (%)	35.25	37.50	36.25	33.75	1.52 ^{ns}
Haemoglobin (g/dl)	11.75	12.78	12.08	11.28	0.49 ^{ns}
Red blood cell ($\times 10^{12}/l$)	16.55	15.45	15.25	12.55	2.22 ^{ns}
White blood cell ($\times 10^9/l$)	7.75	9.95	5.70	6.20	1.04 ^{ns}
Neutrophils (%)	26.75	28.00	35.00	36.50	7.87 ^{ns}
Eosinophil (%)	8.00	7.00	5.25	4.00	1.55 ^{ns}
Lymphocytes (%)	59.75	56.75	44.00	57.00	7.89 ^{ns}
MCV (fl)	22.20	24.83	25.36	27.40	5.83 ^{ns}
MCH (Pg)	7.65	8.42	8.45	9.15	1.91 ^{ns}
MCHC (g/dl)	33.33	35.12	33.31	33.41	0.36 ^{ns}

SEM = Standard Error of Mean, * = ns = not significantly different (P>0.05), MCV = Mean corpuscular volume, MCH= Mean corpuscular haemoglobin, MCHC= Mean corpuscular haemoglobin concentration

The result for the Serum biochemistry of the experimental bucks is presented in Table 3. The total protein (TP) values were 5.28, 7.93, 7.33 and 7.68g/dl for D1, D2, D3 and D4 respectively. TP value of treatment D1 was significantly lower ($P<0.05$) than the other treatments however, D2, D3 and D4 were similar ($P>0.05$). Treatments containing the test ingredient were similar and had higher total protein values (7.93, 7.33 and 7.68g/dl) than the control (5.28 g/dl). The similarities ($P>0.05$) of the total protein values of the treatments containing the differently processed sweet orange peels indicate that there was no protein-energy deficiency (30) as a result of replacement of maize offal with the YPM, and also that the crude protein levels of experimental diets were adequate. Observed values were within the range of 5.90 - 7.80g/dl reported by (31) for clinically healthy goats. Normal total protein values implies adequacy in crude protein of the diets, that is to say the experimental goats were healthy. Values in this study were comparable to 6.45 - 7.71 g/dl for goats fed varied inclusion of neem (*Azadirachta indica*) leaf meal (32), but higher than 5.08 - 5.40g/dl reported by (33) for WAD goats fed varying levels of corncobs and 3.33 - 5.52g/dl reported by (21) for WAD bucks fed *Panicum maximum* and Bambara nut (*Vigna subterranean*) seed meal,.

Cholesterol is a group of fats that is vital to cell membranes, nerve fibre and bile salts and it is a necessary precursor for the sex hormone (34). Cholesterol values in this study

were between 122.60 - 135.68 mg/dl. Although observed values were higher than 61.50 - 92.00 mg/dl reported by (24) for WAD goats fed diets containing graded levels of sweet orange peel meal but they were within the normal range of 64.60-136.40 mg/dl reported by (22) for healthy goats. Lower values of 60.95 - 67.25 mg/dl for red Sokoto goats fed baobab (*Adansonia digitata*) fruit meal supplement has been reported (11). Cholesterol levels of 180 mg/dl and below is safe in ruminants and may not result to arteriosclerosis (35). This showed that diets containing the YPM did not unduly elevate the cholesterol levels to cause hepatic damage. Abnormally high cholesterol is not desirable as continual deposition of cholesterol may lead to narrowing of the coronary arteries resulting to cases of cardiac arrest and heart failure (36).

Creatinine values of 0.50 - 0.85 mg/dl obtained in this study were not significant ($p>0.05$) across treatment. Observed values fall within the normal range of 0.45 - 0.72 mg/dl reported by (21) for WAD bucks and 0.79 - 0.93 mg/dl reported by (11) for red Sokoto bucks, meaning that there was no emaciation of the lean muscle tissues of all the experimental animals. The ALT and AST are liver enzymes and values obtained across treatments were similar with the control, implying that replacing maize offal completely with YPM did not compromise the normal functioning of these enzymes as to cause liver damage.

Table 3: Serum Biochemistry of Red Sokoto bucks fed diets containing varying levels of Yam Peel Meal

Parameter	Experimental diets				SEM
	D1 (0%)	D2 (50%)	D3 (75%)	D4 (100%)	
Total Protein (mg/dl)	5.28 ^b	7.93 ^a	7.33 ^a	7.68 ^a	0.75*
Cholesterol (mg/dl)	135.68	131.08	133.68	122.60	8.56 ^{ns}
Creatinine (mg/dl)	0.60	0.80	0.50	0.85	0.15 ^{ns}
ALT (IU/l)	35.33	37.25	47.95	53.80	11.74 ^{ns}
AST (IU/l)	29.50	34.72	29.65	22.70	10.38 ^{ns}
ALP	53.55	48.75	65.42	49.17	8.82 ^{ns}

^{ab} Mean on the same row with different superscripts are significantly different ($P < 0.05$), SEM = Standard Error of Mean, * = Significant difference ($P < 0.05$), ns = not significant ($P > 0.05$)

The result for serum minerals of the Red Sokoto bucks fed the experimental diets is presented in Table 4. The mean values of the minerals were not significantly different ($P > 0.05$) across treatments. This implies that replacing maize offal with YPM up to 100% level did not compromise the availability of these minerals to the animals as to cause deficiency symptoms which are usually adverse. Minerals are critical elements in the body and deficiencies may negatively alter the health and the performance of the animals. The Calcium (Ca) values of 10.05 - 10.23 mg/dl obtained in this study falls within the normal range of 8.9 - 10.6 mg/dl reported by (22) for healthy goats. The result is also in agreement with those of (37) who had earlier reported Ca values of 10.00 - 12.00 mg/dl for goats.

Phosphorus (P) values of 2.45 - 3.10 mg/dl reported in this study fall within the

normal range of 0.42-24.67 mg/dl reported (38). Calcium and phosphorus are inter-related and they are needed for proper bone development. There was no significant difference ($P > 0.05$) in Ca and P values obtained in this study hence the animals did not have impairments with the development of the skeleton. Sodium and potassium (K) values also were similar ($P > 0.05$) across the treatments, this agrees with the report of (39) that K and sodium (Na) concentrations in the blood are constant and may not be affected by diets. Magnesium and chloride values were between 1.95 - 2.43 mg/dl and 80.83 - 89.35 mg/dl respectively and were not significantly different ($P > 0.05$) across the treatments, implying that replacement of maize offal with YPM did not exert negative effects on Mg and Cl₂ as to deficiency in these minerals.

Table 4: Serum minerals of the red Sokoto bucks fed diets containing varying levels of Yam Peel Meal

Parameter	Experimental diets				SEM
	D1 (0%)	D2 (50%)	D3 (75%)	D4 (100%)	
Calcium (mg/dl)	10.15	10.05	10.23	10.10	0.23 ^{ns}
Potassium (mEq/L)	5.10	4.30	4.28	5.58	0.71 ^{ns}
Sodium (mEq/L)	109.33	114.85	115.88	108.55	4.78 ^{ns}
Phosphorus (mg/dl)	3.10	2.58	2.80	2.45	0.28 ^{ns}
Magnesium (mg dl)	2.25	2.43	2.10	1.95	0.14 ^{ns}
Chloride (mg/dl)	86.43	83.30	89.45	80.83	4.35 ^{ns}

Ns = not significant ($P > 0.05$)

SEM = Standard Error of Mean, ns = not significant

Conclusion and Applications

Results obtained from this study shows that:

1. Yam Peel Meal can be used to replace maize offal up to 100% to enhance profitability of the goat enterprise without compromising the health of the goats. .

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