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Serum Biochemistry and Organ Weights of Growing West African Dwarf Goats Fed Bambara Nut Offal and Millet Spent Grains Based Concentrate

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Keywords: Serum; Organ; Fed intake; Bambara nut offal; Cereal spent Grains; West African Dwarf Goats.

Abstract

Twenty growing West African Dwarf (WAD) bucks were allotted to four dietary treatments of five goats each. The goats were fed concentrate supplement diets containing varying levels of bambara nut offals and cereal spent grains at ratios 100:0%, 50:50%, 33:67% and 0:100% for T1, T2, T3 and T4 respectively at 100 g/goat/day; and *Panicum maximum* at 250 g/goat/day for 63 days. Data were analyzed using one-way analysis of variance for a Completely Randomized Design on the SPSS statistical software version 23, 2015 edition [25]. Samples of concentrate diets and *Panicum maximum* were analyzed according to AOAC [1]. On Day 63 of the experiment blood samples for serological studies were collected in sample bottles from the jugular veins of the goats, using needles and syringes. Three goats from each treatment were slaughtered, eviscerated, and the heart, liver, kidney, lungs and spleen were cut off and weighed. Their weights were presented as a percentage of the slaughter weights. Values for daily supplement intake and total daily feed intake were not significant ($P>0.05$). The mean values for daily forage intake ranged from 230.70 – 244.50 g with T1 having significantly ($P<0.05$) more forage intake than the rest. All the serum biochemical parameters and organ weights determined were not significantly ($P>0.05$) different. All the mean values were within the range of normal values reported for goats. Thus, Bambara nut offal and cereal spent grain-based concentrate had no adverse effects on the serum biochemical profile and organ weights of growing WAD goats. It is therefore recommended that WAD goats can be fed millet-spent grains alone with forage supplementation without compromising performance and blood profile. Further research is recommended to compare the performance of other ruminants at similar inclusion levels evaluated in this study.

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Introduction

During the long dry season feeds become scarce, most grasses dry up and become low in nutritive value and as such not suitable for livestock production [2]. The use of agro by-products have been suggested by some researchers [3-5] as a way of ameliorating this problem.

When using agro by-products it is important to assess the health status of the animals because some are known to affect blood parameters [6]. Haematological analysis is a readily available and fast means of assessing the clinical and nutritional health status of the animals in feeding trial.

Nutrition, breed, sex, age, reproductive status, environmental factors, stress etc. are known to affect blood biochemical parameters [7]. Belewu and Ogunsola [8] asserted that serum creatinine helps in evaluating the liver functions and diseases while serum urea evaluates renal function, which may also indicate dehydration. There is great variation in biochemical parameters as observed between breeds of goats and thus may be difficult to stipulate a standardized universal metabolic profile test for goats. These differences have further underlined the need to establish appropriate physiological baseline values for breeds of livestock in Nigeria, which can help in the realistic evaluation of management practices, nutrition and diagnosis of their health condition [9].

Serological analysis is important since many by-products are now used to feed ruminant animals because of inadequate availability of grass due to seasonality; as well as high cost of feed materials especially during the long dry season. The safety of these materials may be tested through blood analysis [10] and by organ weight analysis [11].

The aim of this work therefore was to assess the serum biochemical profile and organ weights of growing West African dwarf goats fed, supplement diets containing graded levels of Bambara nut offal's and cereal millet grains as supplement to *Panicum maximum.*

Materials and methods

Location of the study

The experiment was conducted at the Sheep and Goat Unit of Livestock Teaching and Research Farm, Kogi State University, Anyigba. Anyigba is located in the derived Guinea Savannah zone of Nigeria on latitude 7°15′ and 7°29′ N of the equator and longitudes 7°11' and 7°32'E of the Greenwich meridian. The zone lies in the warm humid climate of the tropics with clearly marked wet and dry season in April to October and November to March respectively. The annual rainfall ranges from 1400-1500 mm while the ambient temperature is about 25°C with the highest in March and April. The average altitude is 420 meters above sea level [12].

Feed preparation and management of experimental animals

Twenty growing West African Dwarf bucks were used for the study. The animals were housed individually and vaccinated with Tissue Culture Rinderpest vaccine against *Peste du petit ruminant* (PPR). The goats were also given prophylactic treatments using antibiotics. The *Panicum maximum* used for this experiment was harvested from with in Kogi State University campus, Anyigba and wilted in the sun for 24 hours to reduce the moisture content before feeding. The concentrate feed components were Bambara nut offal, millet spent grains, bone meal and table salt (Table 1). These ingredients were mixed together to formulate the diet. The goats were allotted in a Completely Randomized Design (CRD) into four treatments with five goats per treatment. Each goat was fed 100 g of the supplement diet ratios 100:0%, 50:50%, 33:67% and 0:100% (Bambara nut offal: millet spent grains) for T1, T2, T3 and T4 respectively per day. In addition to this *Panicum maximum* was fed at 250g per goat per day served one hour after the corresponding treatment was served.

Feeds served to the goats were weighed daily and the left over was also weighed and subtracted from the quantity of feed served to determine daily feed intake. The goats were weighed at the beginning and end of the experiment, which duration included preliminary feeding for a 7-day acclimatization period followed by 63 days of the experiment for data collection.

Table 1: Ingredient composition of the experimental diets (% Dry matter).

Ingredients	Percentage DM Composition			
	T_1	T_2	T_3	T_4
Bambara Nut Offal	96.0	48.0	32.0	0.0
Millet Spent Grains	0.0	48.00	64.00	96.00
Table salt	1.0	1.0	1.0	1.0
Bone meal	3.0	3.0	3.0	3.0
Total	100	100	100	100
Calculated nutrient content (% DM)				
Crude protein	20.10	18.95	19.65	18.80
Crude fibre	17.30	16.90	17.10	16.80
ME (Kcal/kg DM)	2780	2790	2830	2850

Blood sample collection

The blood samples for serological studies were collected in sample bottles from the jugular vein of each goat using needles and syringes. The blood samples for serological analysis were put in plain sample bottles containing no anticoagulant. The blood samples were centrifuged thus allowing the clear serum to be separated from the packed cells for testing. The serum was analyzed for creatinine, urea, alkaline phosphate cholesterol and blood sugar according to the methods described by Baker and Silverton [13].

Organ weights determination

At the end of the feeding trial, three goats were slaughtered from each treatment, bled, eviscerated, and dressed. The liver, heart, spleen, kidney and lungs were cut off, weighed and the weights presented as a percentage of the slaughter weight.

Proximate analysis of feed samples

Samples of *Panicum maximum* and the supplement diets were analyzed for their proximate composition using standard procedure according to AOAC [1].

Experimental design and statistical analysis

The experimental design was a completely randomized design (CRD). Data were analyzed using a one-way analysis of variance (ANOVA). Where significant differences between treatment means occur, they were separated using least significant differ-

ence (LSD) with the aid of SPSS version 23, 2015 edition [25].

Results and discussion

Proximate composition of *Panicum maximum* and concentrate diets

The proximate composition of *Panicum maximum* and concentrate diet is summarized in Table 2.

The experimental diets were formulated to contain crude protein values ranging from 18.33 - 20.11%, which is in excess of 10.5% of P maximum and 12 – 18% recommended for growing ruminants in the tropics [14]. This was however compensated for by the concentrate. The protein, energy and crude fibre values of the concentrate were within recommended values for growing goats in the tropics [15]. Ether extracts values also fall within the values of 5 - 6% recommended for ruminants by Maithison *et al* [16].

Table 2: Proximate composition of the experimental diets and *Panicum maximum* (% DM).

Nutrients	Treatments				*P. maximum*
	T1	T2	T3	T4	
Crude protein	20.11	19.55	18.39	18.75	10.50
Crude fibre	16.40	16.80	16.62	16.52	19.50
NFE	53.53	50.00	52.95	51.70	42.20
Ether extract	5.80	5.75	6.03	6.05	7.00
Ash	7.62	8.30	7.40	7.60	20.80
Dry matter	94.72	94.45	95.55	94.30	56.80

Feed intake of the goats

The feed intake of the experimental goats is presented in Table 3. The daily supplement intake of 100 g (T1–T4), and total daily feed intake of 330.70–344.50 g were not significantly (P>0.05) different. The values were higher than 75.33–94.43 g and 253.00–399.87 g reported by Oyibo et al. [10] who fed browse plants supplemented with a concentrate diet to West African dwarf goats, and 130.74–210.37 g total daily feed intake reported by Arigbede et al., [17] who fed cassava leaf-based diets to West African dwarf goats. Okolo et al. [5], however reported lower values of 74.74–135.00 g and 337.74– 407.00 g than data from this current study. These discrepancies could be due to the nutrient content and type of concentrates and browse plants fed to the goats. The daily forage intake did not follow any particular trend and was not significantly (P>0.05) different. The values ranged from 230.70–244.50 g, the values were lower than 263–272 g reported by Okolo et al. [5].

Table 3: Mean feed intake of West African dwarf goats fed Bambara nut offal and millet spent grains based concentrate with *Panicum maximum* as forage.

Parameters	Treatments				SEM
	T1	T2	T3	T4	
Daily supplement intake (g)	100	100	100	100	-
Daily forage intake (g)	244.50a	230.70b	233.75b	235.67	6.85
Total daily feed intake (g)	344.50	330.70	333.75	335.67	12.78

a,b: Treatment means on the same row with different superscripts differ significantly (P<0.05). SEM: Standard Error of Mean.

Serum biochemical profile of experimental goats

The serum biochemical profile of the experimental goats is summarized in Table 4. The values for blood sugar, creatinine, urea, cholesterol and alkaline phosphate were not significant (p>005). All the biochemical parameters evaluated were within normal ranges reported for goats [18]. Normal values for alkaline phosphate range from 42- .77.5 IUl^{-1} [19]. Higher creatinine values suggest muscular wastage [20].

Abnormally high alkaline phosphate is indicative of bone disease, liver disease and/or bile obstruction meaning that the goats were free from these conditions. Variations could also be due to feed collection and handling of blood samples, genetic, environment, sex and age of animals. Normal urea values indicate that the protein was well utilized, it also indicates that the quality of protein fed was high [10,18,21].

Table 4: Mean serum biochemical profile of West African Dwarf goats fed Bambara nut offal and millet spent grains based concentrate with *Panicum maximum* hay as forage.

Parameters	Treatments				SEM
	T1	T2	T3	T4	
Blood Sugar $(mgdl)^{-1}$	39.94	38.69	39.05	38.54	1.08
Creatinine $(moll^{-1})$	18.99	18.07	1 7.96	18.54	0.97
Urea $(mmoll^{-1})$	1.29	1.32	1.31	1.33	0.34
Alkaline phosphate IUl^{-1}	57.94	58.12	58.53	57.67	0.06
Cholesterol $(Mmoll^{-1})$	4.91	4.73	4.76	4.84	0.38

SEM: Standard Error of Means.

Organ weights of the experimental goats

The results for organ weights of the experimental goats are shown in Table 5. All the organ weights determined were not significantly (P<0.05) different but fell within normal weights for goats. This indicates that the concentrate diets and *Panicum maximum* were safe for the goats. This result corroborates that obtained by Ocheja *et al*. [3] in which supplement diets containing graded levels of cashew nut shell were fed to growing West African dwarf goats, and that of Okpanachi *et al*. [21] for West African dwarf goats fed graded levels of sun-dried cashew pulp meal-based diets. Internal organs like the heart and liver will atrophy and as such vary in weight, depending on the inclusion level, if the diets contain such anti-nutritional substances that are harmful. The normal weight for the heart showed that the kidneys, which are excretory organs, were not overburdened. This shows that the excretory organs of the goats were not impaired by the experimental diets at the inclusion levels fed in this experiment [11]. This result was however at variance with that reported by Ozung and Anya [22], who reported significantly (P<0.05) different values in the weights of the organs when fed West African dwarf goats were fed cassava peels meal based diets with African yam bean concentrate. Odoemedem *et al*. [23] also obtained significant (P<0.05) differences in the mean values of the weights of internal organs in West African dwarf bucks fed *Panicum maximum* supplemented with concentrate diets containing Bambara nut meal. The observed discrepancies could be attributed to differences in the concentrates and the type and nature of the forages fed to the goats, thus leading to variations in the nutritional compositions of the concentrate diets.

Table 5: Mean organ weights of the West African dwarf goats fed Bambara nut offal and millet spent grains based concentrate with *Panicum maximum* as forage.

Organs	Treatments				SEM
	T1	T2	T3	T4	
Liver	1.58	1.57	1.55	1.60	0.09^{NS}
Spleen	0.16	0.14	0.15	0.16	0.07^{NS}
Heart	0.62	0.59	0.57	0.58	0.09^{NS}
Lungs	1.33	1.30	1.31	1.30	0.12^{NS}
Kidney	0.64	0.59	0.61	0.62	0.06^{NS}

SEM: Standard Error of Means.

Conclusion and recommendations

Bambara nut offal and millet spent grains based concentrate with *Panicum maximum* as forage had no adverse effect on growing WAD goat at 100% of either and any ratios in between and showed no significant (P>0.05) difference on the mean organ weights and serum biochemical profile. Thus any ratio mix of Bambara nut offal and millet spent grains can be fed with *Panicum maximum* without any adverse consequences on West African dwarf goats. However, further research should be conducted using other breeds and classes of goats such pregnant and lactating ewes, which have more serious physiological needs and require to be placed on a higher nutritional pedestal.

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