

WATER INTAKE, PERFORMANCE AND BIOECONOMICS OF RED SOKOTO GOATS FED DIETS CONTAINING GRADED LEVELS OF YAM(*Dioscorea Spp*) PEELS AS SUPPLEMENT TO SHEA BUTTER(*Vitellaria Paradoxa*) LEAVES

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ABSTRACT

The study investigated water intake performance and feed Bio economics of Red sokoto bucks fed diet containing graded level of yam peel meal (YPM) and shea butter leaves. The experiment was carried out at the Small Ruminant Unit of the Teaching and Research Farm, Department of Animal Science, Federal University of Kashere Gombe state, Nigeria. Sixteen red Sokoto bucks with initial weight range 9-10kg were allocated into four treatments of four bucks each. The bucks were fed concentrate diets containing yam peel meal (YPM) and Shea butter leaves. Concentrate diets at 250g/goat/day and Shea butter leaves at 500g/goat/day for treatment one, two, three and four respectively. for a duration of fifty days. Water was served ad-libitum. The experimental design was a completely randomized design. Data were analyzed using one way analysis of variance. The results from growth Performance revealed that final live weight gain (FWG), Total weight gain (TWG), Daily weight gain (DWG), Total Forage intake (TFI), Daily forage intake (DFI), Total feed Intake (TFI) and Daily feed Intake (DFI) were significantly different ($P < 0.05$) in treatment one as compared to other treatments. Bio economics analysis as observed from the result in the combination of yam peel meal and Shea butter leaves in the diet of red sokoto bucks resulted in a positive and net benefit returns of ₦21,000 and ₦17,500 as compared to treatment three (T3) and treatment four (T4). Water intake parameters (total water intake, daily water intake, water intake/dry matter, and water intake/live weight) differed significantly ($p < 0.05$) across treatments, with the highest intake observed in T3 (10% YPM). The study concludes that inclusion of YPM can support growth, enhance water intake at reduced feed cost in Red Sokoto bucks. It is recommended that YPM be included at approximately 10% in goat diets, with adequate provision of water to optimize productivity.

Keywords : Bio Economics , Performance, Red Sokoto goats, Yam Peel Meal, Shea butter Leaves, Water Intake,

1.0

INTRODUCTION

The Nigerian goats population is estimated to be around 15 million animals, with the red Sokoto breed making up a significant portion of that number (Ibrahim *et al.*, 2019). The red Sokoto goats are medium-sized breed, with mature males weighing around 80–100 kg and females weighing 60–80 kg. They have long, thin bodies with slender limbs. Their coat is usually reddish-brown, but can also be grey, or black. The ears are long and drooping, and the tail is usually docked. The hooves are hard and well-suited for rugged terrain. Behaviorally, the red Sokoto goats are known

for being curious, active, and adaptable (Umar *et al.*, 2020). However, goats populations are particularly concentrated in the northern parts of Nigeria, where traditional pastoralist communities have long reared goats as part of their livelihood (Adamu *et al.*, 2018). Majority of the ruminants in tropical Africa are raised on native pastures and crop residue (Tchinda *et al.*, 1993). During the dry season the natural pastures and crop residue available for ruminants after crop harvest are usually fibrous and devoid of most essential nutrients including protein, energy, minerals and vitamins which are required for increased rumen microbial fermentation and improved performance (Onwuka *et al.*, 1987). Most crop residues have generally been identified to have low nitrogen content; low intake and poor digestion. Supplementation with concentrate mixture including cereal bran and oil seed meal, have resulted in increased intakes in intensive production systems and have been the subject of several excellent reviews including that of Bangani *et al.* (2013). Unfortunately, these supplements are often not fed due to their scarcity and their high cost (Nouala *et al.*, 2006). The cost of conventional feed ingredients such as maize, soya beans etc has been on the increase from year to year, leading to increase in the price of animal protein. Also, the competition amongst man, animals and industry for some of these feed ingredients has further worsened the situation (Adejinmi *et al.*, 2007). The search for alternative feed stuffs that are readily available, viable, and cheap and not in high demand for alternative use has become imperative to enhance profitable production. A number of agricultural byproducts abound in Nigeria some of which are indeed a menace and constitute pollutants in urban settings like (Oluremiet *et al.*, 2007). Given the role of water in the animal body it is expedient to evaluate its intake in relation to feed intake. Yam peels are by products obtained from yam and are readily available in all parts of Nigeria at little or no cost. It constitutes environmental hazard where it is not properly utilized. This study therefore evaluated the use of , yam peel meals as supplement to shea butter as an alternative feed source in bucks production.

2.0

MATERIALS AND METHODS

2.1 Study Area

The study was conducted at the Sheep and Goat unit, Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Federal University of Kashere in Gombe State, Nigeria, situated at latitude 9°54'46"N and longitude 11°0'27"E (GOGIS, 2021) 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 30-32°C and it experiences a relative humidity of 17-90% (National Geospatial Intelligence Agency, 2012).

2.2 Experimental Animals

Sixteen (16) Red Sokoto bucks aged between 7-8 months were sourced from within Kashere market and its environs. They were brought to the Teaching and Research Farm, Department of Animal Science, Federal University of Kashere and were housed in individual pens for one week for acclimatization. The animals were treated with Ivermectin for endo and ecto parasites control at 0.3ml each and oxytetracycline hydrochloride and multivitamin injection at 2.0ml each to take care of scouring and nasal discharge and to provide a common health status.

2.3 Experimental Design

The bucks were randomly allocated into four (4) treatments, Each treatment had four (4) replicates. Treatment one (T1) 0.00% level of Yam peel meals; treatment two (T2) 5.00% level of yam peel meals; treatment three (T3) 10.00% level of yam peel meals and Treatment four (T4) 15.00% level

of yam peel meals. The concentrate offered and the goats were weighed daily while the left over was also weighed and subtracted from the initial quantity served to determine the feed intake of the animal. The experiment lasted for fifty (50) days after an adjustment period of 7 days

2.4 Experimental Diets

The diets consists of Yam peel meals (YPM), Maize Offal (MO), Sweet potato peels (SPP), Cassava peel meals (CPM), Groundnut Cake (GNC), Egg shell meals (ESM), and table salt. These components were thoroughly mixed after pounding and grinding. Each treatment had (4) goats; each goat was fed 250g of the concentrate per day, and Shea butter leaves at 500g per goat per day of which the Shea butter leaves were fed first, then the concentrate four hours later, the Goats were served water *Ad-libitum*. The bucks were fed the experimental diets for 50 days,

Table 1: Composition of Experimental Diets

Feed Composition	T1	T2	T3	T4
Yam peel	0	10.81	21.62	32.45
Maize Offals	32.45	21.62	10.81	0.00
Sweet Potato Peels	18.37	18.37	18.37	18.37
Cassava Peels	8.10	8.10	8.10	8.10
Grounnut Cake	37.84	37.84	37.84	37.84
Egg Sheel Meal	1.08	1.08	1.08	1.08
Table Salt	2.16	2.16	2.16	2.16
Calculated nutrients composition				
Crude protein	19.29	18.22	18.21	17.67
Crude fibre.	7.62	7.60	7.60	7.60
MEKcal/kg	2926.54	2779.45	2738.83	2649.14

(T) Means= treatment

2.5 Growth Performance

The animals were weighed on weekly basis to determine their growth performance and at the end of the experiment, the initial weight was subtracted from the final live weight to determine the weight gained by the animals using weighing scale.

2.5.1 Daily Feed Intake

The feeds offered to the bucks were weighed daily, and the leftovers were also weighed to determine the daily feed intake. The bucks were weighed weekly in the morning (between 7:00 and 9:00 AM) before feeding. The data obtained were used to calculate the Feed Conversion Ratio (FCR).

2.5.2 Daily Water Intake

The daily water intake was determined by serving the goats a known volume of water and subtracting the left over from the initial volume of water served.

2.6 Feed Bio Economics

1. Cost of concentrate (₦/kg); price of the concentrate diet per kilogram
2. Cost of concentrate consumed (₦/g); the cost of the total concentrate diet consumed by the animals at the end of the experiment.
3. Cost of forage (₦/kg); the price of the forage in kilogram

4. Cost of forage consumed (₦/g); the cost of the forage consumed by the animals for the period of the experiment.
5. Actual cost of total feed intake (₦/g); cost of concentrate consumed plus the cost of forage consumed for the period of the experiment.
6. Benefit/live weight gain (₦); the total weight gain multiply by cost of a kilogram of goat meat(chevon).
7. Cost-benefit ratio; Actual cost of total feed intake divided by Benefit/live weight gain

2.7 Statistical Analysis

The data obtained from the experiments were subjected to a one-way analysis of variance (ANOVA) procedures (Morris, 1999). Means with significant differences were separated using Least Significant Differences (LSD) with the aids of Statistical analysis system (SAS) version 9.1, (2025 edition).

3.0 Table 2: Proximate Composition of Experimental Diets, Yam Peel Meals and Shea Butter Leaves

Nutrients	T1	T2	T3	T4	Yam Peel meals	Shea butter leaves
Dry matter	92.50	90.70	92.80	93.30	91.50	67.30
Crude protein	18.60	18.00	17.95	17.80	7.20	10.10
Crude fibre	7.80	7.85	7.85	7.70	12.80	13.90
Ether extra	4.80	4.40	4.50	4.33	2.20	10.50
Ash	4.50	4.80	5.61	5.40	8.84	3.00
NFE	56.80	57.60	56.80	58.07	60.45	29.99
Total	100.00	100.00	100.00	100.00	100.00	100.00
MEKcal/kg	3060.04	3034.72	3012.75	3038.68	2757.90	2277.05

4.0 RESULTS AND DISCUSSIONS

3.1 Water Intake Analysis

The water intake records of the experimental goats is prested in Table 3

The total water intake (TWI), daily water intake (DWI), water intake/dry matter (WI/DM), and water intake/live weight gain (WI/LWG) were all significantly ($p < 0.05$) different. Across the treatment, the water intake values, though significant, did not follow the same trend as the dry matter intake. Thus, this was not in line with the report of Okagbareet *al.* (2004), who stated that water intake was largely determined by the dry matter intake. But support the findings of Taiwo *et al.* (2005), who reported that more water was consumed as feed intake increased. Therefore, the lack of similar trend in water intake could suggest that yam Peels contained substances capable of increasing water intake.

Table 3: Water Intake Records of Red Sokoto Bucks Fed Diets Containing Graded Level of Yam Peel Meal as a Supplement to Shea Butter Leaves.

Parameters	T1	T2	T3	T4	SEM
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Total water intake(ml)	20850 ^b	18849 ^b	27144 ^a	22890 ^{ab}	1,452.07
Daily water intake(ml)	417 ^b	376.99 ^b	542.88 ^a	457.80 ^{ab}	29.04
Water intake/Live weight gain(ml/g)	1.54 ^b	1.485 ^b	2.3425 ^a	1.795 ^b	0.15
Water intake/Dry Matter(ml/g)	0.83 ^b	1.02 ^{ab}	1.26 ^{ab}	1.44 ^a	0.19

Means within the row with different superscript are significantly difference (p<0.05)
SEM , Standard Error of Means

3.2 Growth Performance

Table 4 presents the Performance of Red Sokoto Bucks fed yam Peel Meal (YPM) and Shea butter Leaves. Results showed that final weight (FW), Total weight gain (TWG), Daily weight gain (DWG), Total Forage Intake (TFI), Daily Forage intake (DFI), Total Feed Intake (TFI), Daily Feed Intake (DFI) were Significantly(P<0.05) different in treatment one (T1) as compared to other treatments. The high rate of feed utilization in treatment one compared to other treatments could have been attributable to low fibre content in the Feed. Dry matter intake is an important factor in the utilization of feed and a critical determinant of energy and performance in small ruminant (Abdu *et al.*, 2015). It appears that the concentrate diet was probably more palatable and acceptable to the bucks. The variation observed in total Forage intake (TFI) and total feed Intake which is significantly different (P< 0.05) in treatment one and treatment two. The intake differences could be as a result of improvement in the protein status of the feed which enhances rumen microorganism profile and encourage a more rapid and thorough digestion of ingesta leading to assimilation. Hassan *et al.* (2016). Lanyasunya *et al.* (2007) reported that increase in intake is attributed to increase in nitrogen in the diet and available fermentable fiber. If a basal diet has a low nitrogen content as to constrain rumen microbial activity, the addition of forage and concentrate diet will increase the nitrogen content of the total diet, which in turn will likely increase the rate of degradation of basal diet in the rumen and so increase feed Intake.They further suggested that beneficial effect of the incorporation of highly digestible feed substances and otherwise digestible basal diet could enhance better performance. Olafadehon *et al.* (2014).

Table 4: Performance of Red Sokoto Bucks Fed Diet Containing Graded Levels of Yam Peel Meals and Shea Butter leaves

Parameters	T1	T2	T3	T4	SEM
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Initial weight (kg)	10.50	10.25	10.00	10.50	0.31
Final weight (kg)	13.50 ^a	12.75 ^{ab}	11.75 ^b	12.75 ^{ab}	0.53
Total weight gain (kg)	3.00 ^a	2.50 ^{ab}	1.75 ^b	2.25 ^{ab}	0.37
Daily weight gain (kg)	0.06 ^a	0.05 ^{ab}	0.035 ^b	0.04 ^{ab}	0.01
Total forage intake (g)	21528 ^a	20954 ^a	18682 ^b	17318 ^b	654.66
Daily forage intake (g)	430.58 ^a	408.03 ^{ab}	373.63 ^{bc}	346.30 ^c	15.81
Total concentrate intake (g)	11369 ^a	10648 ^a	29597 ^a	7934 ^a	10,306.93
Daily concentrate intake (g)	227.38 ^a	212.95 ^a	207.35 ^a	158.70 ^b	8.69
Total feed intake (g)	32897 ^a	31602 ^a	28279 ^b	25252 ^c	895.03
Daily feed intake (g)	657.93 ^a	632.08 ^a	545.58 ^b	505.08 ^b	19.26
Feed conversion ratio	0.09	0.08	0.06	0.09	0.02

Means within row with different superscript are significantly different (P<0.05)

SEM , Standard Error of Means

3.3 Bio economics Analysis of Red Sokoto Bucks fed graded level of Yam Peel Meal (YPM) and Shea butter leaves.

The result from this study showed that the combination of Yam peel meal and Shea butter leaves in the diet of red sokoto bucks resulted in a favourable cost benefit ratio as presented in table 5. Higher income returns of ₦21,000 and ₦17,500 in treatment 1 and two compared to treatment 3 and 4. This was as a result of low inclusion of yam peel meal and shea butter leaves. This agree with the report of Yusufali (2005); Kabiriziet *al.* (2006) and Hassan *et al.* (2016). That inclusion of Yam peel meal and shea butter leaves in the diet of red sokoto bucks resulted in high profit margin in treatment one and two compare to other treatments. The study shows that inclusion level of yam peel meal and shea butter can increase the income of small holder farmers. The cost of forage consumed, actual cost of total feed intake, Benefit/ live weight gain were significant (P<0.05) for treatment one and two. The cost benefit ratio of 0.31-0.33 were better than 0.54-0.36 for treatment Three and four. This report was in agreement with Ocheja *et al.* (2020).

Table 5: Bio economics of Red Sokoto Bucks Fed Graded Level of Yam Peel Meal and Shea Butter Leaves

Means in the same row with different superscripts are significantly different (P<0.05),

SEM , Standard Error of Means

Parameters	T1	T2	T3	T4	SEM
Cost of Supplement (₦/kg)	381.40 ^a	372.03 ^b	363.50 ^c	354.50 ^d	1.38
Cost of Supplement Consumed (₦/g)	4331.70 ^a	3948.60 ^{ab}	3483.70 ^b	2808.70 ^c	194.70
Cost of Forage (₦/kg)	100.00	100.00	100.00	100.00	
Cost of forage consumed (₦/g)	2152.75 ^a	2095.00 ^a	1868.20 ^b	1731.75 ^b	65.47
Actual cost of total feed intake (₦/g)	6476.90 ^a	5556.50 ^{ab}	5358.70 ^{bc}	4541.70 ^c	307.27
Benefit/Live weight gain (₦)	21000 ^a	17500 ^{ab}	12250 ^b	15750 ^{ab}	2,575.93
Cost of benefit ratio	0.31	0.33	0.54	0.36	0.09

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Treatment 3 (20% inclusion level) showed the best results in terms of performance and cost benefit

The water intake increased with the feed intake

4.2 Recommendations

- I. Yam peels can be included in supplement concentrate diets for Red Sokoto goats at 20% level of inclusion for optimum performance at reasonable feed cost
- II. Further research may be carried out using other classes and breeds of goats as well as other species of ruminants

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