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NUTIREINT INTAKE AND DIGESTIBILITY OF RED SOKOTO GOATS FED CRAB GRASS (*DIGITARIA HORIZONTALIS*), SUPPLEMENTED WITH DIETS CONTAINING GRADED LEVELS OF BOABAD (*ADANSONIA DIGITATA)*SEED MEAL

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ABSTRACT

The study evaluated the nutrient intake and digestibility of Red Sokoto goats fed diets containing graded levels of Boabad (Adansonia digitata) seed meal . Sixteen growing Red Sokoto goats aged between 7 to 9 months, with a weight range of 6.8 - 7.5Kg were , randomly allotted into four (4) treatments of 4 goats each, Four concentrate diets were formulated containing 0, 5, 10, and 15 % boabad seed meal,The goats were fed 500g Digitaria horizontalis (Crab grass) at 8 AM and followed 1 hour later with the concentrate at 200g/goat/day The goats were fitted with harnesses for feacal collection in the Last 2 weeks of the experiment. Samples of the feed and feaccal collection were analysed for their proximate composition using the methods outlined by AOAC,(2000), the fibre was further anaylsed in to its fractions using the method of Van Soest et al, (1991). The nutrient intake and digestibility values were calculated from the proximate values ant feed intake of the goats, ,Data were analysed using the statistical package , SPSS, version 23,(2015), treatment means that were significant were separated using least significant differences (LSD) contained in the same statistical package.The experiment was conducted at the Small Ruminants Unit of the livestoclk Teaching and Research Farm, Department of Animal Science, Federal University, Kashere, Gombe state, Nigeria. The nutrient intake by the animals were adequate. Dry matter digestibility values ranged from 39.96 – 48.46% and were significantly different It was concluded that inclusion of boabad seed meal in supplement diets for Red sokoto goats up to 15% level of inclusion had no adverse effects on the nutrient intake, and feed digestibility of the goats. Cocked boabad seed meal can be included in supplement diets for Red Sokoto goats up to 15% level of inclusion .Further research should explore other processing methods for Boabad seeds

Keywords: Nutreint Intake, Digestibility, Red Sokoto Goats, Crab Grass, Supplement, Boabad Seed Meal

1.0 INTRODUCTION

There has been an increased competition for feed ingredients that are used in manufacturing animal feed since some of these ingredients are also used as human food (Gadzirayi *et al.,* 2012). The population of the world is expected to increase by about 29% from the current 7 billion to 9 billion in 2050 (Meissner *et al.,* 2013). . Ocheja *et al* (2023) reported that the production of meat and milk by ruminants require high levels of protein and energy , this is also true for by products such as skin, fats, fibre etc (Abalaka *et al*,.2021)

Hence, there is great need to look for alternatives that can compensate the high demands for such ingredients. Some multipurpose trees have nutritional properties that can be beneficial if incorporated in livestock feed. Utilising some of these properties to their full potential can result to sustainable livestock production (Melesse *et al.,* 2011). One such example is the baobab tree it has been used for many traditional purposes but little has been said about its potential as an animal feed resource (Osman, 2004). The continued search for unconventional feed resources in livestock production has identified the use of baobab seed meal for ruminant feeding. Baobab seed is a less popular feed with higher energy and protein values (Mwale, *et al* 2004). It also has high concentrations of oxalates, phytates, saponins (Nkafamiya, *et al* 2007), amylase and trypsin inhibitors, and tannins (Iboeli, and Salami 1997). Therefore, its utilization could probably solve the problem of feed shortages especially in the critical period of the year (dry season). Processing has been suggested to enhance their use as feed ingredient (Longvah., *et al* 2000) and this is necessary to achieve optimum utilization.

It is one such tree that can grow for years and capable of adapting to harsh conditions. Feed constitutes about 70% of the entire production and of the total cost; up to 95% is required to meet the protein and energy requirements (Gadzirayi *et al*., 2012; Mohanta, 2012). Voluntary intake, feed digestibility and animal performance can be improved by using alternative low quality multipurpose trees (Melesse *et al.,* 2011). Seed and leaf meals function as protein sources and aid in providing some essential vitamins, minerals, oxycaretenoids as well as bioactive compounds that function at cellular level (Melesse *et al.,* 2013). African baobab seeds have been shown to be a superb source of protein, with most of the essential and non-essential amino acids (De Caluwé *et al.,* 2010). From previous reports the baobab seed cake is a potential low-cost and locally available protein source for livestock feeding (Chimvuramahwe *et al.,* 2011)

The high cost of conventional protein sources has made their incorporation in small ruminant diets uneconomical, hence the increased focus on their replacement by researchers.

Use of less popular protein sources such as baobab seed has been reported to give less cost/kg weight gain (Ikyume *et al* 2018).

> *Adansoniadigitata* (baobab tree) is a drought and fire-resistant tree that is found in most parts of Africa, including the deserts FAO (2019).
> It is an indigenous leguminous plant that is cheap, readily available in the northern parts of Nigeria and its products are utilized for nutritional and medicinal purposes (Nkafamiya, *et al* 2007)

Therefore, its utilization could probably solve the problem of feed shortages especially in the critical period of the year (long dry season).

The study was therefore designed

1. To determine the nutrient intake of Red Sokoto goats fed diets containing graded levels of cooked baobab seed meal
2 To determine the dry matter and nutrient digestibility of Red Sokoto goats fed boabad seed meal based diets

2.0 MATERIALS AND METHODS

2.1 Experimental site

The study was conducted at the Livestock Unit, Teaching and Research farm of Federal College of Horticulture Dadin-kowa ,Gombe, Gombe State, Nigeria.. Dadin-kowa, YamaltuDeba Local Government Area is located in the savannah zone of North- Eastern Nigeria, on latitude 11^0.30N and longitude 100^0 20E and on altitude of 240m above sea level (GPS 2015), The is characterized by short rainy season (4-5 months) with annual rainfall of 760mm to 1100mm, and long dry season (6-7 months). The ambient temperature could be as low as 24^0C during the dry cold season (October-January) and as high as 44^0C during the dry hot season (February-May). (UBRBDA 2022).

2.2 Experimental Animals.

A total of sixteen (16) red Sokoto goats aged between 7-9 months with an average weight ranges of 6.8 to 7.5kg, was used. The animals were purchased within Dadin kowa, kwadon and kuri town markets, and randomly allocated into four (4) treatments and each treatment was replicated 4 times. The animals was treated with Ivermectin for endo and ecto parasites control at 0.3ml each and oxytetracycline, hydrochloride and procaine penicillin at 2.0ml each to take care of scouring and nasal discharge and to provide a common health status.

2.3 Procurement, Processing of Baobab Seed and Experimental Feed

The seeds were washed with clean water and cooked in hot water at 100 degree Celsius for 1 hour and sun dried, ground into meal using milling machine, and used to replace groundnut cake at varying inclusion levels. Concentrate diet contained Maize offal(MO), Rice offal (RO), Groundnut cake(GNC), Egg shell meal (ESM),wood ash (Ash), Common salt and Cooked baobab seed meal, at different inclusion levels respectively.

2.4 Experimental Procedure

The goats were weighed on arrival and randomly distributed into four (4) treatment groups, each treatment has four (4) goats, and each goat was served 500g of forages at 8:00am followed by the concentrate at 200g/day at 02:00pm. Forages was tied in small bundles and suspended from the top of each compartment within the reach of the animals. This reduced feed wastage and encourage intake by the animals. The concentrate and the forages offered to the goats was weighed daily and the left over was also weighed and subtracted from the quantity of feed that was served to determine the feed intake of the animals. The experiment lased for sixty-three (63) days (9 weeks) after two weeks of adjustment period.

.The nutrient intake was calculated from the proximate composition of the concentrate and forages as well as the feed intake records. Concentrate diets was formulated at 0, 5, 10, and 15% of cooked Baobab seed meal and replaced groundnut cake (GNC) as supplement feed to *digitaria horizantalis*(Crab grass).

Table 1: Ration Composition

INGREDIENT	Treatments			
	1(0%)	2(5%)	3(10%)	4(15%)
Maize offal	50.00	50.00	50.00	50.00
Rice bran	17.00	17.00	17.00	17.00
Groundnut cake	30.00	25.00	20.00	15.00
Cooked baobab seed	0.00	5.00	10.00	15.00
Egg shell Meal	2.00	2.00	2.00	2.00
Wood ash	0.50	0.50	0.50	0.50
Table salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated	Nutrient	Content		
Crude protein	17.57	17.64	17.60	17.58
Fiber	13.50	14.0	14.50	15.00
Metabolisable energy (ME kcal/kg Diet)	2,840.71	2,829.04	2,817.37	2,805.70

2.4. Data Collection

2.4.1 Feed Intake

Feed intake of the experimental animals was obtained by weighing the quantities of supplemental concentrate and *digitaria horizantalis*(crab grass) offered daily at 08:00am and at 02:00pm respectively, the leftover was weighed to obtain the voluntary feed intake by subtracting the left over from the initial feed given. (Ocheja,, 2020)

2.5 Nutrient Intake.

This was calculated by multiplying the feed intake by the proximate values for each of the nutrients

2.6 Determination of Dry Matter intake and Nutrient Digestibility

In the last 2 weeks of the experiment the animals were fitted with harnesses for fecal collection. The collection lasted for 1 week after an adjustment period of 1 week, the fecal samples was packed, dried and analyzed for their proximate composition Using standard procedure (AOAC 2000), and there after the proximate composition was used to compute dry matter (g/day) and nutrient digestibility using the formula below.

$$\text{Digestibility (\%)} = \frac{\text{Nutrients in feeds} - \text{Nutrients in feaces}}{\text{Nutrient in feeds}} \times 100$$

.2.7 Chemical Analysis

Samples of the Baobab seed meal, concentrate diets, forages and feaces were analyzed for their proximate composition. According to the method of AOAC (2000). The concentrate and the forage were further analysed for their fibre fraction composition using the method of Van Soest *et al*, 1991

2.8 Experimental design and Statistical Analysis

The experimental design was complete randomized design (CRD). Data obtained from the study was subjected to a one way analysis of variance (ANOVA) using SPSS version 23(2015), and treatment means that are significantly different were separated using least significant difference (LSD) using the same statistical package

3.0 RESULTS AND DISCUSSION

Table 2: Proximate Composition, Fiber Fraction of Experimental Diet and Boabad Seed Meal

NUTRIENT (%)	Treatment				
	1(0%)	2(5%)	3(10%)	4(15%)	CBSM
Crude proteins	17.58	17.02	17.51	17.57	17.28
Crude fiber	14.68	13.50	14.00	14.90	12.92
Nitrogen free extracts	44.90	43.61	45.66	45.74	45.50
Ether extracts	2.74	3.07	3.48	3.53	12.50
Ash	11.05	11.40	11.91	11.70	5.88
Dry matter	90.48	91.47	92.56	89.95	90.43
Moisture	9.57	8.53	7.44	10.05	9.57
Carbohydrate	62.22	62.12	68.88	62.82	63.58
Acid detergent fiber	17.25	18.05	17.58	17.50	17.45
Neutral detergent fiber	30.41	30.20	29.10	29.37	30.06
Cellulose	10.31	10.52	10.41	10.43	11.04
Hemicellulose	13.57	12.45	12.20	12.35	13.17
Lignin	6.20	6.22	.6.35	6.40	6.54

CBS = Cooked baobab seed meals

The proximate composition of the concentrate diets and fiber fraction are summarized in Table 2: the concentrate diet had similar crude protein and energy values across the treatments. Crude Protein content of 17% was adequate for growing goats in the tropics and also above the critical crude protein requirement of 8% reported by Lakpini *et al.,* 2002. Crude fibre content of the concentrate and test ingredient was within the range of 12.68 % to 14.90 % across the treatment which is similar to 12% crude fibre recommended for different physiological stages maintenance, pregnancy, lactation and growth . The maintenance requirement for energy remain the same for most goat except dairy kids they required 21% crude fibre .

Ether extract was indicated as 3.07, 3.48 and 3.53% for T2, T3 and T4 respectively were within the recommended values (Maithison *et al.*, 1997). Hemicellulose values ranged from 12.20 - 13.57 % across the treatment including the test ingredient. Acid detergent fibre (ADF) and neutral detergent fibre (NDF) ranges from 17.25 - 18.05% and 29.10 - 30.41 across the treatments. All the above values did not follow any definite pattern

Table 3: Nutrient Intake (g/day/W$^{0.75}$/DM) of Red Sokoto Goat Fed Graded Levels of Cooked Baobab *(Adonsonia digitata)* Seed Meals

PARAMETERS	Treatment				
	1	2	3	4	SEM
Dry matter	79.50	78.25	77.75	75.50	4.44
Crude protein	13.35	12.63	12.70	12.18	0.78
Crude fiber	10.53	10.63	10.67	10.60	0.64
Ether extras	1.37^{c}	1.74^{b}	1.76^{a}	1.51^{b}	0.09
Nitro free extra	50.86	50.38	50.58	47.30	2.81

a,b,c = Means on the same row with different superscripts differ significantly (P<0.05).
SEM = Standard error of the Means.

The nutrient intake g/dayW $^{0.75}$ of the experimental goats is presented in Table 3. The daily dry matter intake were not significanctly (P<0.05) different across the treatment means, the values ranged from 75.50 to 79.50 g/day/W $^{0.75}$. T1 had the highest value at 0 % inclusion levels, the values decreased with the increase in levels of inclusion of cooked baobab seed meals. The result obtained is higher than 42.18 – 51.85 g/day/W $^{0.75}$ reported by Ocheja *et al*., (2018) for growing West African dwarf goats fed bamboo leaf and supplementary diets with graded levels of steam-treated cashew nut shell, but lower than 165.58 – 174.30 g/day/W $^{0.75}$ reported by Adenkola *et al.*, (2009) for weaned West African dwarf goats fed natural pasture supplemented with graded levels of a mixture of bambara nut waste and dried *burukutu* spent grains at (50;50). The crude protein intake and crude fibre intake were not significanctly (P>0.05) different. There values ranged from 12.18 to 13.35 g/day W $^{0.75}$ to 10.53 to 10.67 g/day/W $^{0.75,}$. significant (P<0.05) difference was observed in daily ether extract intake across the treatment, the values ranged from 1.37 to 1.76 g/day W $^{0.75}$. The lowest ether extract intake was 1.37g/day W $^{0.75}$ at control levels but increased with the increase of inclusion levels of cooked baobab seed meals. This can be attributed to the high ether extract content of boabad seeds.

Table 4: Dry Matter and Nutrient Digestibility (%) of Red Sokoto Goat Fed Graded Levels of Cooked Baobab *(Adonsonia digitata)* Seed Meals

PARAMETERS	Treatment				
	1(0%)	2(5%)	3(10%)	4(15%)	SEM
Dry matter	45.83[a]	39.96[b]	46.91[a]	48.46[a]	11.79
Crude protein	45.4	40.0	46.9	48.5	3.92
Crude fiber	62.2[a]	51.8[b]	55.0[b]	55.8[b]	3.56
Ether extra	5.05	6.51	5.73	6.10	1.08
	57.8[b]	43.0[c]	65.0[a]	68.6[a]	3.42

a,b = Means on the same row with different superscripts differ significantly (P<0.05).
SEM = Standard error of the Means.

The dry matter and nutrient digestibility of the experimental goats is presented in Table 4. The dry matter digestibility values showed significant (p<0.05) difference the values ranged from 39.96 – 48.46 %, . Higher digestibility value of DM and CP than other diets and no significant (p>0.05) difference was observed in CP digestibility similar to the report of Illori *et al*.(,2013) in a research on Acceptability and Nutrient Digestibility of West African Dwarf Goat Fed Different Dietary Inclusion of Baobab (*Adansoniadigitata*). Crude fibre and nitrogen free extracts were significantly (P<0.05) different across the treatment, values ranged from 51.8 - 62.2 % and 43.00 to 68.60 %. With is similar to values obtained by Ahmed *et al* (2020) for yearling West African dwarf goats fed cashew nut shell based diets as supplement to bamboo leaves. While no significant (P>0.05) difference was observed in ether extract digestibility.. Significant (p<0.05) difference was reported by Illori (*et al* 2013*)*

daily forage intake values of 389.4 – 422.2g and concentrate intake of 102.0 – 118.3 in this study were higher than 297.70-312.50 g/day reported by (Oloche *et al.,* 2018) for West Africa dwarf goats fed diets containing treated and untreated sweet orange *(Citrus sinensis*) peels with gamba grass as the basal diet and 294.41 - 313.70 g/day reported by (Idowu *et al.,* 2019) for West African dwarf goats fed unripe plantain peels as supplement for maize offal, . similar values of mean daily feed intake of 441.40-482.00 g/day were however reported by (Oloche *et al.,* 2019) for Kano brown goats fed *Gmelina aborea* leaves and supplemented with diets containing water soaked sweet orange peels. No significance (p>0.05) was obtained in total feed intake , values ranged from 125.27 – 132.02 $g/W^{0.75}$ and feed conversion ratio 0.04 – 0.06. The trend of the feed

conversion ratio was similar to that reported by Okolo *et a*l., 2012 for WAD cashew nut shell based diets..

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

Inclusion of boabad seed meal in supplement diets for Red sokoto goats up to 15% level of inclusion had no adverse effects on nutrient intake and digestibility of the goats.

4.2 Recommendations

Cocked boabad seed meal can be included in supplement diets for Red Sokoto goats up to 15% level of inclusion

Further research using other breeds of goats as well as other species of ruminants such as sheep and cattle is recommended.

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