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GROWTH PERFORMANCE OF YANKASA RAMS FED RAW AND BOILED BOABAB (*Adansonia digitata*) SEED MEAL

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ABSTRACT

The investigation was conducted at International Institute of Tropical Agriculture (IITA) Teaching and Research station, Munjibur, Munjibir Local Government Area, Kano State over an 84-day period using twenty-five (25) Yankasa rams of similar weight that ranged between 14.40 to 14.97kg. The experimental animals were quarantined for two (2) weeks. They were grouped to achieve a mean weight that was not significantly different (P>0.05) across the groups and randomly allocated to treatments 1(0% raw and boiled baobab seed meal), 2 (10% raw baobab seed meal), 3 (20% raw baobab seed meal), 4 (10% boiled baobab seed meal and 5 (20% boiled baobab seed meal) in a Completely Randomised Design (CRD). Each treatment consisted of five (5) experimental animals with each of them serving as a replicate. Data collected were statistically analysed with SPSS package and then means separated with the use of Duncan Multiple range test. The Results indicated that inclusion of raw and boiled seed meal in the experimental diets did not have any negative impact on the proximate composition and crude fibre fraction of the diets. The total weight gain and daily weight gain did not show significant (P>0.05) difference across the treatment groups. However, the feed conversion ratio (FCR), cost of feed per kilogram and cost per kg live-weight gain were significantly better (P<0.05) in T3 and T5. However, T3 showed better prospect with FCR (11.08), cost of feed per kilogram (N233.70) and cost per kg live-weight gain (122.48). The study concluded that either raw baobab seed meal can be included in the diets of ram for up to 20%.

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INTRODUCTION

Livestock is a valuable constituent of the agricultural production system and plays a crucial role in the economy (Yakubu *et al.,* 2020). Aruwayo *et al.* (2016) put forward those ruminant animals constitute a remarkable portion of livestock production in Nigeria while Ibrahim *et al*. (2025) reported that ruminants are reared all over the world, offering key economic and social benefits. Small ruminants constitute a significant portion of the livestock produced in Nigeria. Small ruminants play essential role in reducing the wide gap in the provision of animal protein for human ingestion (Ahmed *et al.,* 2021). Aruwayo *et al*. (2024) also reported that small ruminant production performs a vital function in the production of meat, milk and proffer other numerous uses. For the rural poor, particularly landless, impoverished, and divorced women, sheep production is a growing source of jobs and money. For the impoverished in rural areas, it is also a useful instrument for reducing poverty (Ahmed *et al*., 2010). Because they are so helpful during religious and cultural celebrations, like the naming ceremony in Nigeria, they provide concrete roles in

sociocultural activities. One of the best methods to increase the availability of meat is through sheep production, which also helps smallholder farmers make money.

Although sheep can be found all over Nigeria, the northern region has the largest concentration. Yankasa is one of the important sheep breeds in Nigeria, In Nigeria, it is the most prevalent and abundant breed of sheep. Yankasa is one of the important sheep breeds in Nigeria, spread across a wide area & are the majority sheep breed in Nigeria (Umar, 2021)). They can survive in most regions of the country and owns the aptitude to live on low valued feed stuff. However, despite all the inherent potentials, the productivity of these animals has not been optimally harnessed. Scarcity of feeds and feedstuff have been deemed to be the major reason. Aruwayo *et al*. (2025) reported paucity of feeds, low nutrient value and poor digestibility of obtainable feed which result in erratic weight gain. The use of other readily available feed stuff as substitutes especially during periods of scarceness have been promoted. Baobab tree (*Adansonia digitata*) is one these credible alternatives. It is a resistant to shortage of water and fire with wide availability found in most part of Africa including the desert (FAO, 1988). This tree produces all year round in the savanna & derived savanna area of Nigeria. The seeds are not usually consumed & are not subjected to any other use in the forest & derived savanna region of Nigeria. Studies shows that Baobab seed is rich in protein (20-36%CP) and contains substantial amount of energy. Mwale *et al*. (2008) documented that these seeds provide some necessary fiber, vitamin, minerals & amino acid particularly lysine & methionine which are limited in most of the cereals but essential for livestock growth & development. This study investigated the nutritional qualities of raw and boiled baobab seed meal in Yankasa Rams

MATERIALS AND METHODS

Experimental site

The experiment was conducted at International Institute of Tropical Agriculture (IITA) Teaching and Research Farm. Kano station, Munjibur, Munjibir Local Government Area, Kano State with the following coordinate (12 08' N, 8 40 E). The total area of Kano State is roughly 49,119 km². The climate of Kano is tropical savanna (Köppen Aw). The city receives roughly 980 mm (38.6 in) of precipitation annually on average, with June through September seeing the most of it. Kano experiences extreme heat for the bulk of the year, with a peak in April, just like the great rest of Nigeria (Wikipedia, 2024).

Test ingredient preparation and diet formulation

The test ingredients were raw baobab seed meal and boiled baobab seed meal. The seeds were sorted, cleaned, washed, and dried for two days. The raw baobab seed meal was prepared by crushing the raw seed while the boiled seed meal was produced from the seed that boiled for one (1) hour and dried before crushing. Other feed ingredients are corn stalk, maize offal, cottonseed cake, bone meal and salt. Baobab seed used in the experiment was purchased from a local Factory in Kano State while other ingredients were purchased from Dawanau Market, Kano State.

Five experimental diets were formulated as shown in Table 1. Raw and boiled Baobab seed meal served as the test ingredients at inclusion levels of 0% (control) as T1 while T2, T3, T4 and T5 contained 10% raw baobab meal, 20% raw baobab meal, 10% boiled baobab seed meal and 20% boiled baobab seed meal respectively.

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

Ingredients	Treatments				
	T1 (Control)	T2 (10% RBSM)	T3 (20% RBSM)	T4 (10% BBSM)	T5 (20% BBSM)
Maize offal	18	45	68	45	68
Corn stalk	60	33	10	33	10
Cotton seed cake	20	10	0	10	0
Boabab seed meal	0	10	20	10	20
Bone meal	1	1	1	1	1
Salt	1	1	1	1	1

RBSM = Raw Boabab seed meal, BBSM = Boiled Boabab seed meal

Experimental Animals and their Management

Twenty (25) growing Yankasa rams of similar in weight were purchased from Larabar Abasawa Livestock Market in Gezawa Local Government Area in kano State. The rams were quarantined for two (2) weeks. They were dewormed with albendazole at the rate of 10mg/kg body weight., Levamisole and Ivemectin were administered to get rid of any possible endo and ecto-parasites respectively. The rams were grouped fed and managed intensively during the 2-week acclimatization period prior to the commencement of the experiment.

Experimental Design and feeding procedure

The research was laid out in a Completely Randomized Design (CRD) as outlined by Steel and Torrie (1980). Twenty-five (25) growing Yankasa rams were assigned to five (5) dietary treatments named as T1, T2, T3 T4 and T5 respectively with five (5) animals per treatment and each served as a replicate.

Growth performance

Daily feed intake: Each animal was offered the treatment diets *ad libitum* twice in a day at about 7am and 2pm in separate pen with 2m x 2m dimension. The left over from each animal was measured the following morning and deducted from the quantity offered to ascertain the daily feed intake. The average feed intake was determined by dividing the total feed intake by the number of fed. The feed conversion ratio was determined by dividing total feed intake by the total weight gain.

Total feed intake = Total feed offered – Leftover

Average feed intake = Total feed intake divided by period of the feeding trial

Live Weight Changes

The weight of the animals was taken at the onset of the experiment and allotted to the treatments with five (5) replicates whose average were not significantly different ($P<0.05$) from each other. They were then weighed at weekly intervals early in the morning before being served daily feed throughout the 12 weeks feeding trial. The weight obtained was used to calculate the total live-weight gain (TLWG) and the average live-weight gain (ADG).

Body weight gain = final body weight – initial body weight.

Average daily weight gain = total weight gain / no of days of the feeding trail

Digestibility Trial

Three (3) experimental animals were randomly picked from each of the treatments and allotted to individual metabolic cages for digestibility trial. The rams were allowed to spend 14 days to adjust to the condition of the metabolism crates, followed by 7 days for faeces and urine collection. During the 7-day digestibility study, the daily fecal output was quantified (amount of fresh matter); were sub-sampled daily and were oven dried at 105ºC for 24 hours for dry matter determination. The digestibility coefficient was calculated for the proximate composition and the crude fibre content.

The digestibility of the nutrients was computed as follows:

$$\text{Digestibility of nutrient} = \frac{\text{Nutrient in feed} - \text{Nutrient in faeces}}{\text{Nutrient in feed}} \times 100$$

Chemical Composition Analysis

The experimental diets and the feacal samples were analysed for proximate composition to determine crude protein (CP), crude fibre (CF), ether extracts (EE) and total ash according to (AOAC, 2005) and fibre fraction such as neutral detergent fibre (NDF), acid detergent fibre (ADF) was analysed according to Van Soest *et al*. (1991).

Data Analysis

Data generated from the experiment were subjected to Analysis of Variance (ANOVA) according to Steel and Torrie (1980) using SPSS 2007, and means were compared and separated using Duncan Multiple range test at $P<0.05$.

RESULTS AND DISCUSSION

Proximate Composition and Crude Fibre Fraction of Experimental Diets

Table 2 indicates the proximate composition and crude fibre fraction of experimental diets and test ingredient.

Table 4.1: Proximate composition and crude fibre fraction of experimental diets and test ingredient

Parameters	Treatments				
	T1	T2	T3	T4	T5
Dry matter	97.32	98.55	98.71	98.46	98.88
Crude protein	13.76	13.94	13.62	13.05	13.54
Crude fibre	22.53	21.81	21.35	20.31	21.73
Ether extract	4.71	5.79	5.68	6.77	7.03
Ash	3.58	5.13	4.58	4.42	4.43
Nitrogen free extract	57.76	54.33	54.80	55.45	53.27
Acid detergent fibre	35.52	32.71	29.54	31.78	28.74
Neutral detergent fibre	42.75	40.51	37.16	40.31	39.13

Table 2 shows outcome of the chemical analysis of the treatment diets. It is shown that the dry matter (DM) ranged from 97.32 to 98.88%, the crude protein values were within the range of 13.05 to 13.76%, crude fibre ranged from 19.35 to 22.53%, ether extract was within 4.71 to 7.03% values while nitrogen free extract fell between 53.57 and 55.76%. The crude fibre fraction was shown to consist of neutral detergent fibre of 39.13 to 42.75% and acid detergent fire of 39.13 to 42.75%. The results of the chemical composition of experimental diets obtained in this research as presented in Table 1 shows that the diets are adequate in nutrient for the experimental animals. The proximate composition of the diets in this study compares with the report of Adam *et al*. (2025). The dry matter value obtained is suitable for the needs of the rams because it contained adequate nutrients. The crude protein values are comparable with the average value of 13.26 reported by Aruwayo *et al.* (2022) but higher than 11.50% reported by Church (1978) as protein requirement for fattening lambs. The crude fibre range of 20.31 to 22.53% compares with those of estimated CF range of 22% to 25% by Ganovoski and Ivanov (1982) for ruminants., 23.93% by Aruwayo *et al.* (2009) and, Aruwayo and Muhammad (2018) of 20.11 - 25.45%. The crude fibre contained in the experimental diets was adequate for the optimal performance of the rumen microorganisms. The ether extract in the experimental diets was sufficient to satisfy the nutrient requirement of the sheep. It compares with the report of Aruwayo *et al*. (2024) of 4.93 - 5.02% in small ruminants. The nitrogen free extract of 53.27% to 57.76 % is in line with NRC (2007) range of 40 to 60% for growing sheep and ASAS (2015) of 40 to 60%. Neutral detergent fibre (29.25 to 42.75%) and acid detergent fibre of 28.74 to 35.52% fell within reference ranges of 25 to 40% by BSAS (2017) and 20 to 35% by ASAS (2015) respectively for sheep. It could be deduced that the nutrient composition of the research ration is sufficient for nutritional needs of the animals for all physiological requirements and growth.

Effect Growth Performance of Yankasa Sheep Fed Graded Level of Baobab Seed Meal diet.

Table 3 shows the effect of feeding graded level of baobab seed meal-based diets on growth performance of Yankasa sheep

Table 3: Effect of feeding graded level of baobab seed meal-based diets on growth performance of Yankasa sheep

Parameters	Treatments					
	T1	T2	T3	T4	T5	SEM
IW (kg)	14.40	14.60	14.93	14.86	14.97	1.62
FWG (kg)	17.55^{b}	18.30^{ab}	18.67^{ab}	18.59^{ab}	19.00^{a}	0.74
TWG	3.51	3.78	3.73	3.77	4.03	0.53
ADWG (g)	41.79	45.00	44.41	44.82	47.10	4.79
TFI (kg)	42.78	45.86	44.02	51.27	52.43	3.93
DFI(g)	509.30	546.00	524.00	610.30	624.10	57.40
FCR	12.19^{ab}	12.13^{ab}	11.08^{b}	13.60^{a}	13.60^{a}	0.65
Cost of feed (₦/kg)	456.70	346.00	233.70	246.00	233.90	56.01
Cost of feed consumed (₦/day)	233.70^{a}	188.91^{ab}	122.48^{c}	211.46^{a}	145.90^{bc}	20.16
CPLWG(₦/kg)	5566.00^{a}	4197.77^{b}	2721.27^{c}	4705.00^{ab}	3040.42^{c}	415.07

$^{a\,b\,c\,d\,e\,f}$ Means with the same super script are not differ significantly at (p>0.05) on FCR=feed conversion ratio TFI=total feed, TWG= total weight gain, ADWG=Average daily wight gain. , T2(10% RBSM)= 10% row baobab seed meal, T3(20% RBSM)= 20% row baobab seed meal , T4(10% CBSM) =10% cocked baobab seed meal ,T5(20% CBSM)= 20% cocked baobab seed meal.

The growth performance of Yankasa sheep fed graded levels of raw and boiled baobab seed meal diets is shown in Table 3. The initial weight obtained in this research were not significantly (P>0.05) different across the treatments and ranged from 14.43 to 14.97kg. There were no significant differences in total weight gain (TWG) as shown in Table 3 with T5(4·03 kg) and 3.78kg, 3.73kg and 3.80 kg for T1, T2 and T3 and T4 respectively. The average daily weight gain (ADWG) in the research did not show significant (P>0.05) differences too. The total feed intake and the dry matter intake values were statistically similar (P>0.05) across the treatments. The values of feed conversion ratio (FCR) were significantly (P>0.05) affected by the dietary treatments but T3 had the lowest value of 11.08 while T4 had highest (13.60). The cost of feed per kg of the experimental diets showed that T1 (N456.70) was statistically higher (P<0.05) than other treatments except T2. Cost of feed consumed per day as well as the cost of feed per liveweight gain decreased with baobab seed meal inclusion in the experimental diets. The significantly lowest (P<0.05) cost of feed per liveweight gain was found in T3(N2721.27) and then followed by T5 (N3040.42) while T1 had the highest (N5566.00).

The results of this study showed that including baobab seed meal whether raw or boiled did not impact any negative influence on the feed intake. Kabir *et al*. (2021) reported a similar trend when baobab seed meal was fed to Yankasa rams. The total and daily weight gain were not significantly different across the treatments. This is consistent with the report of Rahman *et al*. (2020) that there was no significant difference in live weight gain among treatments with rams fed baobab seed meal. However, Kabir *et al.* (2021) reported that that ram fed inclusion levels of baobab seed meal performed better in body weight gain than the control. The feed conversion ratio compared well in all the treatments although T3 was numerically better than others. Treatments with baobab inclusion recorded lower cost per kilogram with those with 20% of raw and boiled being the best. This trend was observed for the cost of feed consumed per day and cost of feed per live-weight gain. The comparable FCR observed across the treatments which also indicate T3 as the most promising corroborate Rahman *et al*. (2020) report of improved feed efficiency with the inclusion of boabob seed meal. Treatment 5 showing the highest weight gain aligns with Abubakar and Oyawoye (2018) report that higher levels of CBSM contribute to better weight gain in rams. The report of this study is also consistent with that of Kabir *et al*. (2021) of the ability of baobab seed meal to serve as alternative feed ingredients for sheep and reduce cost of meat production as shown in values of cost per liveweight gain which lower in the baobab seed meal-based diets. It is now evidenced that inclusion of both raw and boiled baobab can reduce the cost of feed and produce mutton at a cheaper cost.

Nutrient Digestibility of Yankasa Ram fed Graded Levels of Baobab Seed Meal-based Diets.

Table 4 indicates the nutrient digestibility of Yankasa ram fed graded levels of Baobab seed meal-based diets.

Table 4: Nutrient digestibility of graded level of Baobab Seed Meal-Based of experimental diets fed Yankasa sheep.

Parameters (%)	Treatments					
	T1	T2	T3	T4	T5	SE
DMD	54.35^{b}	54.13^{b}	61.03^{a}	59.46^{ab}	61.20^{a}	1.07
CPD	94.72^{a}	94.06^{a}	94.30^{a}	90.36^{b}	89.38^{b}	0.92
EED	89.47^{ab}	85.46^{bc}	91·49^{a}	90.78^{a}	84.19^{ab}	1.71
CFD	90.74^{ab}	90·64^{ab}	93.79^{ab}	80.74^{b}	84·31^{ab}	1.82
NFED	90.34^{ab}	90·25ab	93.45^{ab}	81.64^{b}	84·64^{ab}	1.83
ADFD	88.44^{a}	88.50^{a}	81.78^{b}	77.60^{c}	78.54^{c}	0.91
NDFD	83.18^{a}	75.10^{bc}	74.30^{c}	77.57^{bc}	79.83^{b}	1.36

$^{a\,b\,c\,d\,e\,f}$ Means with the same super script are not differ significantly at (p>0.05) on T2(10% RBSM) = 10% row baobab seed meal, T3(20% RBSM) = 20% row baobab seed meal, T4(10% CBSM) =10% cocked baobab seed meal, T5(20% CBSM) = 20% cocked baobab seed meal, DMD =.dry matter digestibility, CPD = crude protein digestibility, EED = ether extract digestibility, CFD = crude fibre digestibility, NFED = nitrogen free extract digestibility, ADFD = acid detergent fibre digestibility, NDFD = nitrogen detergent fibre digestibility.

The results obtained for the nutrient digestibility of graded level of raw and boiled baobab seed meal fed Yankasa rams as shown in Table 4 reveal that all the parameters differed significantly (P>0.05) across the treatments. The crude protein differed significantly (P<0.05) and ranged from 86.38 in T5 to 94.72% (T1). The result obtained for ether extract in the study were significantly different (P<0.05) with the highest value of 91.49 % in treatment 3 and lowest value of 74.19% in treatment 5. The animals on treatment treatments 3, 4,1 and 5 were not significantly (P>0.05) from each other and were different from treatment 2. However, treatments 1 and 2 were significantly similar (P>0.05). The crude fibre digestibility ranged from 80.74% in T4 to 93.79 % (T3). Acid detergent fibre of 88.44% and 88.50% in T1 and T2 respectively were not significantly different (P>0.05) from each other but are significantly higher (P<0.05) than T3 (81.78%), T4 (77.60%) and T5 (73.54%). However, T3 and T4 were statistically similar (P>0.05) but T4 and T5 were not significantly different (P>0.05) from each other. The neutral detergent fibre values showed significant difference (P<0.05) from each with T1 (81.18%) being similar to T2 (74.30%) and T3 (74.30%) but significantly higher (P<0.05) in T4 (67.57%) and T5(59.83%). The dry matter digestibility results obtained in this study revealed better digestibility in treatments T3 and T5 which contained 20% of raw and boiled baobab meal respectively. This implies that baobab meal did not suppress digestibility. The report of this study suggests that the inclusion of baobab seed meal positively affects dry matter intake and was corroborated by Eruvbetine *et al*. (2019) in their study on the nutritive value of baobab seed meal and kyume *et al*. (2020) in a study that involved feeding levels of baobab meal in small ruminants. The crude protein digestibility was observed to be comparable between the control and the test diets. This indicates that increasing levels of baobab seed meal positively impacted protein levels. This corroborates reports of Fanimo *et al.* (2003) and Sogunle *et al.* (2017). The ether extract of all the treatments exhibited similar digestibility. kyume *et al*. (2020) reported similar trend. The crude fibre digestibility obtained in the study revealed comparable values which could imply that feeding of raw and boiled baobab seed meal to sheep did not impact negative influence on it. Nitrogen detergent fibre and acid detergent fibre digestibility values were comparable across the treatments and therefore implying that inclusion of baobab seed meal in the experimental animals' meal were not of any negative impact. This is also in line with the report of Ikyume *et al*. (2020).

CONCLUSION

The proximate analysis and cell wall content of the diets were sufficient to fulfill nutritional requirement of the experimental diets. The growth performance indicators (weight gain and feed conversion ratio) and digestibility coefficient values of the Yankasa rams fed diets that comprised of the test ingredients performed better than the control. However, Treatment 3 and 5 that contained 20% raw baobab seed meal and 20% boiled seed meal respectively performed better than other treatments in cost per kilogram live-weight gain. However, T3 (20%) raw baobab seed meal is numerically lower than T5 (20%) boiled baobab seed meal. The study concluded that use of raw baobab seed meal produces cheaper meat and is therefore recommended in the diets of ram for up to 20%.

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