Research Article ISSN: 2393 – 9540

International Journal of Nutrition and Agriculture Research

Journal home page: www.ijnar.com

ACCEPTABILITY, DIGESTIBILITY AND NITROGEN UTILIZATION OF BAOBAB *(ADANSONIA DIGITATA L.)* FRUIT MEAL SUPPLEMENT BY RED SOKOTO GOATS

Okunlola D. O*[1], Amuda A. J[2], Shittu M. D[3]

[1*]Department of Animal Nutrition and Biotechnology, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State, Nigeria.

[2]Department of Animal Production and Health, Federal University, Wukari, P.M.B 1020, Taraba State, Nigeria.

[3]Department of Animal Production and Health, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State, Nigeria.

ABSTRACT

A total of thirty two (32) Red Sokoto goats comprising of 10 males and 22 femalesweighing between (10 - 12kg) were used for acceptability experiment in a cafeteria feeding technique. Three (3) diets containing baobab whole fruit (WF), baobab pulp (BP) only and baobab pulp and seed (BPS) meals were introduced to Red Sokoto goats (RSG) in three different wooden feed troughs.Pulp and seed meal recorded a significantly higher values of 85.2kg for average feed intake and a CoP value of 1.5 thus making it the preferred portion of Baobab fruit to the experimental animals. Twelve (12) Red Sokoto goats were randomly selected and used for digestibility nitrogen utilization study in replicate of three (3) animals per treatment housed in individual metabolic cages and fed graded levels of baobab pulp-seed meal diet (Bb-0, Bb-10, Bb-20 and Bb-30) for fourteen days (14 days) in a Completely Randomized Experimental design. The results was significant ($P<0.05$). The digestibility values for dry matter ranged from 65.5% to 75.4%, crude protein CP range was 70.00% to 85.50%., crude fibre (CF) digestibility values ranged from 41.4% to 64.5%. N-intake, feacal-N, urinary-N, N-retained ranged from 8.8 - 15.6, 2.67, 1.8 - 2.3 and 4.3 - 9.6 respectively.N-intake was significantly ($P < 0.05$) highest (15.6) in animals fed dietary treatment Bb -30 and lowest (8.8) in animals without baobab fruit inclusion in the diet (Bb-0).

KEYWORDS

Red Sokoto goats, Baobab fruit, Acceptability and Digestibility.

Author for Correspondence:

Okunlola D O,

Department of Animal Nutrition and Biotechnology,

Ladoke Akintola University of Technology,

P.M.B. 4000, Ogbomoso, Oyo State, Nigeria.

Email: davidolanrewaju_2008@yahoo.co.uk

INTRODUCTION

The beneficial roles of livestock in production of meat, milk, fibre and skin in alleviation of poverty, malnutrition and conserving natural resources has not been adequately exploited (Hugo *et al*., 2002)[1]. Part of the solution in Nigeria is an increase in the production of small ruminant animals, mainly sheep and goats which are found in most of the households in Southern Nigeria (Sumberg and Cassaday, 1985)[2].

Traditional ruminant livestock production in Africa is based predominantly on animals grazing natural pastures which are often of low nutritive value especially during the dry season. The nutritive value of the natural pastures varies according to season. The grasses grow rapidly during the wet season, later becoming fibrous, coarse, and highly lignified rendering it indigestible. This results in loss of palatability and ineffective utilization of the pastures by the animals.

Inadequate nutrition is one of the factors that generally affect livestock productivity. Despite the naturally endowed vegetations, there are still inadequate feeds and feedstuffs for livestock in Nigeria (Babayemi, 2007)[3]. Ruminants in the tropics are raised predominantly on grasses which are inherently poor in digestibility, nutritive value and unavailable in the off-season (Babayemi *et al*., 2009)[4]. The most important factors determining the profitability of any livestock enterprise is optimal level of feeding. The concept of ruminant animal production requires feeding animals on rich diet so that they can attain slaughter weight within short time usually 70 - 120 days (Madziga *et al*., 2012)[5]. Good nutrition is a prerequisite for good health, good reproduction, high milk yield, fast growth rate and a successful rearing system (Ochepo *et al*., 2009)[6]. Recent trends in animal nutrition have focused attention on the use of crop residues and agro-industrial by-products but these are low in protein, high in fibre and low in digestibility. Expensive concentrates and milling by-products are forcing farmers to rely more on upon crop by-products as sources of energy. Performance of animals fed crop residues is limited by poor intake, low nitrogen contents and poor digestibility. However, sheep and goats can play an active role in converting crop residues of no human dietary value to meat and milk of high nutritive value for man (Fajemisin *et al*., 2010)[7].

The search for alternative and locally available sources of energy and protein to enhance productivity of sheep and goats during the period of scarcity and dry season has placed attention on the used of post-harvest crop residues (Sodeinde *et al*., 2007)[8]. Although there is scarcity of natural pastures during the dry season, there is usually an abundance of Baobab fruits with potentials as feed supplement for small ruminants in the dry season.

After the preliminary study acceptability study of baobab fruit meal was carried on Red Sokoto goats to determine which part of baobab fruit is more acceptable to the experimental animals.

MATERIAL AND METHODS

Experimental sites

The research was carried out at the small ruminant unit of Ladoke Akintola University of Technology, Ogbomoso, Oyo state on longitude $4^o5'$ East of the Greenwich Meridian and latitude $8^o7'$ North of the Equator in the derived savannah zone of Nigeria with a mean annual rainfall of 1247mm and mean annual temperature of about 27^0C. Chemical analysis was carried out at the Department of Animal Science, University of Ibadan, and Main Laboratory, Department of Medical Laboratory Science, Achievers University, Owo, Ondo- State, Nigeria.

Collection and preparation of Baobab fruit

The baobab fruits were gathered from rural communities in Ogbomoso on longitude $4^o5'$ east of the Greenwich Meridian and latitude $8^o7'$ North of the Equator in the derived savannah zone of Nigeria. The fruits were picked from the ground because matured fruits would fall naturally from the parent tree. The outer covering of the fruits were carefully scraped with hard brush. This was done to avoid contamination with soil during processing. The scraped fruits were cracked to separate the pulp and the seeds. The samples were sun dried for 7 days. This was because availability and collection period for baobab fruit is usually in the dry season when the humidity was low and temperature was high. Due to the hard nature of the seed, the samples were milled before being blendedinto fine powder with a grinder and stored in a covered plastic container for laboratory analysis.

Chemical analysis

Chemical composition of the whole baobab fruit, pulp, seeds, pulp and seed mixture, experimental diets, faecal and urine samples were carried out according to the procedure of AOAC (2003)[9]. Neutral detergent fibre, acid detergent fibre and acid detergent lignin were determined according to Van Soest *et al.* (1991)[10]. Hemicellulose was calculated as the difference between NDF and ADF and cellulose as the difference between ADL and ADF (Rinne *et al*., 1997)[11].

ACCEPTABILITY STUDY

A total of Thirty two (32) Red Sokoto goats comprising of 10 males and 22 females weighing between (10 - 12kg) were used for the acceptability study. They aged between 7 - 8 months as dentition was used to estimate the age. The experimental animals were purchased from Famia village in Kebbi State of Nigeria. On arrival, animals were given a prophylactic treatment which consisted of oxytetracycline long acting antibiotic (1ml/10kg body weight of the animal) and vitamin B complex. They were also drenched with albendazole to control endoparasites and treated for mange and other ectoparasites using Ivomec(R). They were later vaccinated against *Pestes des petits ruminante* (PPR) using a tissue culture Rinderpest Vaccine. During the adaptation of six weeks, the animals were offered diets they were eaten from where they were purchased, but were introduced to the experimental diets two weeks before the end of adaptation period.

Animals were subjected to free choice feeding to evaluate acceptability of the baobab fruit meal prepared with whole baobab fruit, baobab pulp only and baobab pulp and seed respectively in a cafeteria feed preference study (Babayemi *et al*., 2006)[12]. The animalswere housed together in a group pen in the Small ruminant Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso with adequate ventilation. The floor of the house was made of concrete and there were wood shavings on the floor to serve as bedding and also for easy cleaning.

Feedingof Animals for acceptability study

Three (3) diets containing baobab whole fruit (WF), baobab pulp (BP) only and baobab pulp and seed (BPS) meals were introduced on a cafeteria basis to the Red Sokoto goats (RSG) in three different wooden feed troughs. Plastic bowls of same size were placed in the feed troughs to enable the experimental animals goats feed simultaneously in a convenient situation. The positioning of plastic feeders in a trough was changed daily to prevent bias by an animal from sticking permanently to a trough suchthat each animal had free access to each of the diets in the trough according to Babayemi *et al*., (2009)[4]. The feeding was allowed from 0800 to 1600 hours daily. The intake was measured by deducting the orts or remnants from the amount of feed offered. Preference to each diet was determined from the coefficient of preference (CoP) value; calculated from the ratio between intake of each individual silage divided by the average intake of the four silage types (Bamikole *et al,* 2004[13], Babayemi *et al*., 2009[4]).

Coefficient of preference (CoP) = Intake of individual meal

Mean intake of the three meal types

If CoP is <1, the material is poorly accepted and when >1, the material is well accepted. (Karbo *et al*., 1993[14], Bamikole *et al*., 2004[13]).

DIGESTIBILITY STUDY

Twelve (12) Red Sokoto goats were used for the study. The animals were allowed two weeks (2 wks) of adjustment/adaptation to their new environment (acclimatization) and the effect of the administered drugs to wear out. In a completely randomized experimental design (CRD) with three replicates of Red Sokoto goats per treatment, animals were randomly distributed to 4 treatments of baobab fruit meal supplements (Bb-0%, Bb-10%, Bb-20% and Bb-30%) in separate metabolic cages fitted with facilities for separate collection of faeces and urine (Akinsoyinu, 1974)[15].

Animal Feeding

The experiment lasted for fourteen days (14 days) in which the first seven (7) days was to adapt the animals to the new test diets. The experimental animals were offered the feed during a seven-day adaptation period prior to another seven days collection period. Feed was served at 5% body weight of the animals. Water and salt lick were provided to the animals *ad libitum* throughout the metabolic trial. Animals were weighed at the beginning and end of the digestibility trial. Feed refused was weighed at 0800 hours every morning and deducted from the total offered for intake determination prior to serving new feed daily.

Faecal collection

During the seven days of collection period, total faeces was collected, weighed daily and 10% of faeces collected was stored in the freezer at -4^{0}C. The faecal sample from each day's collection was bulked, mixed and dried in the oven at 105^{0}C. The samples were later milled in a laboratory hammer mill to pass 2mm sieve and put in a polythene bags for analysis.

Urine collection

Total urine from each animal was collected and measured daily, using a measuring cylinder and kept separately in labeled containers. Two drops of concentrated Tetraoxo-sulphate (VI) acid (H_2SO_4) was added to each container daily after collection of each sample to prevent microbial growth, organic matter decay and loss of nitrogen/nitrogen volatilization. Approximately, 10% of total urine samples were later pooled for the 7 days period and frozen at - 4^{0}C in a freezer till required for nitrogen analysis.

EXPERIMENTAL DESIGN

Completely Randomized Experimental Design.

RESULTS AND DISCUSSION

Table no 2 shows the acceptability of baobab fruit meal by Red Sokoto goats. The average feed intake for baobab whole fruit meal was 50.6kg with a corresponding Coefficient of Preference (CoP) of 0.9. Pulp only meal had a record value of 60.7kg and CoP of 1.1. Pulp and seed meal recorded a significantly higher values of 85.2kg for average feed intake and a CoP value of 1.5 thus making it (Baobab Pulp and seed meal) the preferred portion of the fruit for all the experimental diets. Hence its inclusion levels at0, 10, 20 and 30 % to make four (4) experimental diets tagged Baobab pulp and seed meal diets and designated Bb-0, Bb-10, Bb-20 and Bb-30, respectively.

The values for coefficient of preference recorded for baobab pulp meal (1.1) and baobab pulp and seed meal (1.5) in acceptability study is an indication of baobab fruit as a feed resource in ruminant nutrition. The poor acceptability of baobab whole fruit meal was due to the hard nature of the outer shell (epicarp). The epicarp is estimated as 45% while the endocarp (Fruit pulp and seeds) has 15% and 40%, respectively (Shukla *et al*., 2001)[16]. However, the acceptability of baobab pulp meal and baobab pulp and seed meal was due to the nutritive value of the pulp and seeds. The dry baobab fruit pulp has a refreshing taste and is very nutritious, with particularly high values for carbohydrates, energy, calcium, potassium (Okunlola, 2016)[17]. Pulp sweetness is provided by fructose and glucose contents. It contains sugars but no starch (Ajayi *et al*., 2003)[18]. Murray *et al.* (2001)[19] reported that baobab seed flour is an important source of energy and protein. It has a relatively low fat value (Igboeli *et al*., 1997)[20]. These nutritional qualities contributed to the acceptability of baobab pulp and seed meal by Red Sokoto goats.

However, though baobab pulp meal (BPM) and baobab pulp and seed meal (BPSM) recorded Coefficient of Preference (CoP) values greater than 1; the choice of baobab pulp and seed meal (BPSM) was due to the Energy value (EV) credited to baobab seed which makes it a preferred meal for optimum performance by the experimental animals.

Table No.5 presents the apparent digestibility (%) of dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE), nitrogen free extract (NFE), ash , neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL), hemicelluloses and cellulose in Red Sokoto goats fed baobab *(Adansonia digitata L.)* fruit meal based diet. The digestibility values for dry matter ranged from 65.5% to 75.4%.There was no significant difference ($P > 0.05$) in the apparent dry matter digestibility of 10% and 20% baobab inclusion levels. The same trend was recorded at 0% and 30% inclusion levels of baobab fruit despite the variation in values recorded. Bb-20 (20% baobab inclusion level) gave the highest value while diets A(0% Control) gave the least. The digestibility values for crude protein CP range was 70.00% to 85.50%. Dietary treatments Bb-10, Bb-20 and Bb-30 were statistically similar while diet Bb-0 was significantly different from others. The crude fibre (CF) digestibility values ranged from 41.4% to 64.5%. There was no significant difference (P > 0.05) between the treatments Bb-10 and Bb-30 means. Bb-0 and Bb-20 recorded a significant difference (P<0.05). Bb-20 had the highest value while Bb-0 had least value. The ether extract (EE) ranged from 61.5% to 66.6%. There was significant difference (P < 0.05) across the treatments.Bb-10 (10% inclusion) was significantly higher than Bb-0, Bb-20 and Bb-30. Digestibility values for ash range was 20.1 to 26.7%. There was no significant (P > 0.05) difference between Bb-10 and Bb-20. Control diet (Bb-0) recorded the least value (20.05) while the Bb-30 had the highest value. The two diets (Bb-0 and Bb-30) were significantly different (P<0.05). ADF and ADL were significantly different (P<0.05). The NDF digestibility values were significantly different (P<0.05) at Bb-0 and Bb-10 levels of inclusion. However Bb-20 and Bb-30 were not significantly different (P>0.05). For hemicelluloses, the value ranged from 57.9 (Bb-0) to 74.0 (Bb-30). There was significant (P < 0.05) difference at Bb-0 and Bb-10. Bb-20 and Bb-30 were not significantly different (P>0.05). Hemicellulose digestibility increased with the level of inclusion of baobab fruit in the supplement. The cellulose values ranged from 59.8% to 70.7%. The dietary treatment Bb-10 was significantly higher (P<0.05) than Bb-0, Bb-20 and Bb-30 supplements respectively. Generally, Bb-20 recorded highest digestibility values for all parameters.

The diet offered to goats in this study was based on partial grazing (1 hour/day) of *Panicum maximum* pasture and feeding of four experimental diets in which wheat offal was replaced by different levels of Baobab pulp and seed meal (BPSM) at 5% body weight. Addition of baobab fruit to the diet slightly reduced the crude protein and nitrogen free extract (NFE) content of the diets while fibre components, ether extract and ash slightly increased. Since protein and carbohydrate components of experimental diets reduced with addition of baobab fruit, it may be inferred that the effect of baobab on performance of the goats was mediated through increased dry matter (DM) intake, improved health in the animals and better utilization of nutrients due to the vitamins, antioxidant and medicinal entities in the fruit. Baobab fruit has been reported to be a rich source of vitamin C, antioxidants, minerals and medicinal substances (Nour *et al.,* 1980[21], Vertuani *et al.,* 2002[22], Kaboré *et al.,* 2011[23]). The belief among Fulani herdsmen in the southwest of Nigeria, that baobab fruit pulp enhances milk yield and milk flow in humans and cattle may be related to its medicinal and antioxidant properties.

Table No.6 presents the nitrogen utilization of Red Sokoto goats fed baobab *(Adansonia digitata L.)* fruit meal based diet. N-intake, feacal-N, urinary-N, N-retained ranged from 8.8 - 15.6, 2.67, 1.8 - 2.3 and 4.3 - 9.6 respectively. N-intake was significantly (P < 0.05) highest (15.6) in animals fed dietary treatment Bb -30 and lowest (8.8) in animals without baobab fruit inclusion in the diet (Bb-0) .No significant (P > 0.05) difference was observed for faecal-N in treatments Bb-0, Bb-10 and Bb-20. For urinary-N, there was significant (P < 0.05) difference between Bb-0, Bb-10 and Bb-20, Bb-30. The Animals on experimental diets Bb-0 and Bb-10 were not significantly (P > 0.05) different. So, also the animals on Bb-20 and Bb-30. However, % N-retained differs significantly in animals on Bb-20 and Bb-0. The least % N-retained (49.6) was recorded in animals on Bb-0. Animal on Bb-10 retained 54.3% while N-retained in animals on Bb-20 and Bb-30 were not statistically different. The N-intake, feacal-N, urinary-N and N-retained increased as the baobab fruit inclusion increases.

Apart from energy, nitrogen (N) is also one of the most limiting nutrient for ruminant animal production. The levels of N-retention may be as a result of the high digestibility of nutrients in all the experimental diets. The positive N-retention recorded in this study are indicative of animals gaining weight or conserving nitrogen during the period of experimentation. This therefore suggests that the diets could be adjudged adequate. However, the value of faecal and urine nitrogen recorded for animals on Bb-0 diet may be due to non-inclusion of baobab fruit in the diet. Moreover, when animals are not fasted, the excreted nitrogen in faeces are derived from structural nitrogen of dietary sources while those in urine are mostly derived from broken down microbial protein not utilised by the animals as well as absorbed excess NH_3 excreted as urea (Van Soest,1982)[24]. The results obtained from this study therefore justified the utilization of baobab fruit in the diets of the experimental animals and by extension confirmed its potentials as a feed resource in ruminant diet and nutrition.

Table No.1: Chemical Composition of Baobab fruit *(Adansonia digitata L.)* in the derived savannah zone of Nigeria

S.No	Parameters (%)	Whole fruit (WF)	Pulp only (PO)	Pulp and seed (PS)	Seed only (SO)	SEM
1	Dry matter	90.4^a	90.4^a	89.8^b	89.9^b	3.0
2	Crude protein	7.5^c	3.5^d	13.2^b	17.3^a	1.0
3	Crude fibre	23.0^a	8.0^d	12.0^c	16.0^b	1.0
4	Ether extract	15.0^b	11.0^c	9.0^d	22.0^a	1.0
5	Ash	6.0^b	6.0^b	7.6^a	7.8^a	0.1
6	Nitrogen free extract	48.5^c	71.5^a	58.2^b	36.9^d	1.8
7	Neutral detergent fibre	71.0^a	48.0^c	50.6^{ab}	65.8^b	2.1
8	Acid detergent fibre	41.0^a	30.5^b	26.0^c	16.5^d	1.1
9	Acid detergent lignin	26.6^a	10.5^b	10.0^b	8.5^c	0.9
10	Hemicellulose	30.0^c	31.5^b	24.6^d	35.3^a	1.0
11	Cellulose	14.4^a	6.0^c	16.0^a	12.0^b	0.8

[abcd] *Means within each row with different superscript are different ($P<0.05$)*

Source: Okunlola *et al.,* (2015)

Table No.2: Acceptability of baobab fruit meal by Red Sokoto goats

S.No	Diets	AVFI (kg)	COP
1	Whole fruit meal	50.6	0.9
2	Pulp only meal	60.7	1.1
3	Pulp and seed	85.2	**1.5**

Coefficient of preference of Baobab whole fruit, pulp only and Pulp + Seed meal

AVFI - Average feed intake, COP - Coefficient of preference.

Table No.3: Gross composition of the experimental diets

S.No	Ingredient (%)	Bb – 0	Bb – 10	Bb – 20	Bb – 30
1	Baobab pulp and seed	0.0	10.0	20.0	30.0
2	Wheat offal	63.0	53.0	43.0	33.0
3	Cassava peels	20.0	20.0	20.0	20.0
4	PKC	15.0	15.0	15.0	15.0
5	Premix	0.5	0.5	0.5	0.5
6	DCP	0.5	0.5	0.5	0.5
7	Salt	1.0	1.0	1.0	1.0
8	Total	100.0	100.0	100.0	100.0

Bb-0: diet without baobab meal, Bb-10: diet with 10% baobab meal, Bb-20: diet with 20% baobab meal, Bb-30: diet with 30% baobab meal, PKC–Palm kernel cake, DCP – Di-calcium phosphate.

Table No.4: Chemical composition of Guinea grass and Baobab pulp and seed meal diets

S.No	Constituent (%)	Guinea grass	Bb – 0	Bb – 10	Bb – 20	Bb – 30
1	Dry matter	24.6	88.5	88.1	87.9	87.0
2	Crude protein	6.4	14.5	14.1	13.7	13.3
3	Crude fibre	33.4	10.7	11.1	11.5	11.8
4	Ether extract	1.3	6.5	7.0	7.4	7.8
5	Ash	10.6	5.0	5.3	6.0	6.7
6	Nitrogen free extract	48.4	63.3	62.5	61.4	60.4
7	Neutral detergent fibre	64.5	41.5	43.6	45.5	46.9
8	Acid detergent fibre	35.8	18.2	19.8	20.8	22.1
9	Acid detergent lignin	13.8	8.8	10.0	10.7	10.8
10	Hemicellulose	28.7	23.3	23.8	24.7	24.8
11	Cellulose	22.0	9.5	9.8	10.1	11.3
12	M.E (kcal/kg)	-	2013.7	2172.2	2220.7	2320.2

Bb-0: diet without baobab meal, Bb-10: diet with 10% baobab meal, Bb-20: diet with 20% baobab meal, Bb-30: diet with 30% baobab meal.

Table No.5: Apparent digestibility (%) of Red Sokoto goats fed Baobab *(Adansonia digitata L.)* fruit meal in the diets

S.No	Percentage (%)	Bb – 0	Bb – 10	Bb – 20	Bb – 30	SEM
1	Dry matter	67.5^{b}	72.3^{a}	75.4^{a}	69.6^{b}	1.1
2	Crude protein	70.0^{b}	82.5^{a}	85.5^{a}	80.4^{a}	0.9
3	Crude fibre	41.4^{c}	53.6^{b}	64.5^{a}	50.3^{b}	2.0
4	Ether Extract	61.5^{c}	66.6^{a}	64.2^{ab}	62.0^{b}	1.7
5	Ash	20.1^{c}	23.5^{b}	22.5^{b}	26.7^{a}	5.6
6	Nitrogen free extract	62.1^{c}	77.0^{b}	82.3^{a}	80.9^{a}	1.8
7	Neutral detergent fibre	43.6^{b}	56.8^{a}	49.9^{ab}	48.5^{ab}	3.6
8	Acid detergent fibre	35.8^{c}	45.0^{a}	42.8^{b}	36.8^{c}	5.6
9	Acid detergent lignin	38.0^{c}	45.0^{b}	41.9^{ab}	47.3^{a}	5.7
10	Hemicellulose	57.9^{c}	68.9^{b}	72.5^{a}	74.0^{a}	1.8
11	Cellulose	59.8^{c}	70.7^{a}	69.6^{ab}	68.8^{ab}	5.8

^{abc} *Means within each row with different superscript are different (P<0.05*

Bb-0: diet without baobab meal, Bb-10: diet with 10% baobab meal, Bb-20: diet with 20% baobab meal, Bb-30: diet with 30% baobab meal.

Table No.6: Nitrogen utilization of Red Sokoto goats fedBaobab *(Adansonia digitata L.)* fruit meal in the diets

S.No	Parameters/Treatments	Bb-0	Bb-10	Bb-20	Bb-30	SEM
1	Nitrogen intake (g/day)	8.8^{d}	10.0^{c}	12.8^{b}	15.6^{a}	1.0
2	Faecal Nitrogen(g/day)	2.7^{b}	2.7^{b}	2.9^{b}	3.8^{a}	0.2
3	Urinary Nitrogen(g/day)	1.8^{b}	1.9^{b}	2.1^{a}	2.3^{a}	0.1
4	Nitrogen balance (g/day)	4.3^{d}	5.4^{c}	7.8^{b}	9.6^{a}	1.8
5	Nitrogen retention (%)	49.6^{b}	54.3^{ab}	61.2^{a}	61.4^{a}	3.2

^{abcd} *Means within each row with different superscript are different (P<0.05)*

Bb-0: diet without baobab meal, Bb-10: diet with 10% baobab meal, Bb-20: diet with 20% baobab meal, Bb-30: diet with 30% baobab meal.

CONCLUSION

The results obtained in the study shows that baobab pulp-seed is acceptable to Red Sokoto goats and as such could be used as feed resource and supplement in ruminant animal nutrition. The N-retention was enhanced thereby promoting high digestibility of nutrients in all the experimental diets. This suggests an indication of good growth and performance when baobab based diets are fed to ruminant animals especially, Red Sokoto goats. The results of the experiment also shows no deleterious effect(s) of Baobab pulp-seed in the diet of the experimental animals the effect of which could lead to raising animals of good health status for human consumption. However, the availability of baobab fruit during dry season will improve the quality of the declining nutritive value of available grass species, and by extension improve the performance of ruminants. Therefore the study justified the utilization of baobab fruit in the diets of the experimental animals and by extension confirmed its potentials as a feed resource in ruminant diet and nutrition.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to Department of Animal Nutrition and Biotechnology, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Oyo State, Nigeria for providing necessary facilities to carry out this research work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

BIBLIOGRAPHY

1. Hugo L, Johann G, Hiremagalur G, Mohammed J, Victor M, John M, Martin O and Mohammed S. Linking Natural Case Studies form East Africa, *Supplement to Lesis Magazine,* 2002, 17- 20.
2. Sumberg J E and Cassaday K. Sheep and goats in the humid West Africa. In: Sumberg J E and Cassaday K. (Eds) Sheep and goats in the humid West Africa, Proceedings of a workshop on Small ruminant production system in humid zone West Africa, Ibadan, Nigeria. 1984, 23-26. *ILCA Addis Ababa, Ethiopia,* 1985, 3-5.
3. Babayemi O J. *In vitro* fermentation Characteristics and acceptability by West African dwarf goats of some dry season forages, *African Journal of biotechnology,* 6(10), 2007, 1260-1265.
4. Babayemi O J. Silage dry matter intake and digestibility by African dwarf Sheep of guinea grass (*Panicum maximum* cv Ntchisi) harvested at 4 and 12 week regrowths, *African Journal of Biotechnology,* 8(16), 2009, 3988-39.
5. Madziga I I, Abdullahi B G and Alawa C B. I. A survey of the production and management practices of ruminant animals in Yobe State, Nigeria. Bitto, I.I., Kaankuk, F.G. and Attah, S. (Eds), Proceeding, *37th Annual Conference of Nig. Soc. for Anim. Prod.*, 2012, 576-578.
6. Ochepo G O, Okwori A I and Ibeawuchi J A. The effect of replacing cassava peel meal with discarded tiger nut (*Cyperus esculentus*) meal on feed intake, digestibility and nitrogen utilisation in Red sokoto goat, Umoh B I, Udedibie A B I, Solomon I P, Obasi O L, Okon B I and Udoh E J. (Eds), *Proceedings of the 34th Nigerian society for animal Production Conference*, 2009, 547-550.
7. Fajemisin A M, Fadiyimu A A and Mokan J A. Performance and nitrogen retention in West African Dwarf goats fed sundried *Musa sapientum* peels and *Gliricidia sepium, Journal of Applied Tropical Agriculture,* 15(Special issue 2), 2010, 88-91.
8. Sodeinde F G, Akinlade J A, Asaolu V O, Oladipo M A, Amao S R and Alalade J A. A Survey of some dry season feed materials for small ruminant in Ogbomoso, Nigeria, Journal *of Animal and Veterinary Advances,* 6(1), 2007, 142-145.
9. AOAC. Official methods of analysis of the association of official's analytical chemists, *Association of official analytical chemists, Arlington, Virginia*, 17th Edition, 2003.

10. Van Soest P J, Robertson J B and Lewis B A. Methods for dietary fibre-neutral detergent fibre, and non-starch polysaccharides in relation to animal nutrition, *Journal of Dairy Science,* 74(10), 1991, 3583-3597.
11. Rinne M, Jaakkola S and Huhtanem P. Grass maturity effects on cattle fed silage-based diets.1 Organic matter digestion, rumen fermentation and nitrogen utilisation, *Animal Feed Science Technology*, 67(1), 1997, 1-17.
12. Babayemi O J, Bamiloke M A and Omojola A B. Evaluation of nutritive value and free choice intake of two aquatic weeds (*Neophrolepis biserrata* and *Spirodela plyrhiza*) by West African dwarf goats, *Tropical and Subtropical Agro Ecosystem,* 6(1), 2006, 15-24.
13. Bamikole M A, Ikhatua U J, Ajulo M T and Oseji A C. Feed utilisation potential of West African dwarf goats fed different proportions of *Ficus thonningi* and *Panicum maximum*, *Proceedings of the 29th Annual Conference of Nigeria Society of Animal Production,* 29, 2004, 336-340.
14. Karbo N. Barnes P and Rudat H. An evaluation of browse forage preferences by sheep and goat in the Northern Savannah zone, Ghana. In: J. Ndikumanaan P. deLeeuw (eds), Proceedings of the 2nd African Feed Resource Network (AFRNETA) on Sustainable Feed Production and Utilisation Smallholder Livestock Enterprises in sub-Saharan African, *Harare, Zimbabwe,* 1993, 107-110.
15. Akinsoyinu A O. Studies on protein and energy utilization by WAD goats .Ph. D Thesis, University of Ibadan, Nigeria, 1974.
16. Shukla Y N, Dubey S, Jain S P and Kumar S. Chemistry, biology and uses of *Adansonia digitata* - a review, Journal of Medicinal and Aromatic Plant Sciences, 23, 2001, 429-434.
17. Okunlola D O. Growth and milk production of Red Sokoto goats fed Baobab *(Adansonia digitata L.)* fruit meal based diets. Ph.D Thesis, Department of Animal Science, University of Ibadan, Nigeria, 2016.
18. Ajayi I A, Dawodi F A, Oderinde R A. Fatty acid composition and metal content of *Adansonia digitata* seeds and seed oil, *La Rivista Italiana delle Sostanze Grasse,* 80(1), 2003, 41-43.
19. Murray S S, Schoeninger M J, Bunn H T, Pickering T R and Marlett J A. Nutritional Composition of Some Wild Plant Foods and Honey Used by Hadza Foragers of Tanzania, *Journal of Food Composition and Analysis*, 14, 2001, 3-13.
20. Igboeli L C, Addy E O H and Salami L I. Effects of some processing techniques on the antinutrient contents of baobab seeds (Adansonia digitata), Bioresource *Technology*, 59(1), 1997, 29-31.
21. Nour A A, Magboul B I and Kheiri N H. Chemical composition of baobab fruit *(Adansonia digitata L.), Tropical Sciences*, 22(4), 1980, 383-388.
22. Vertuani S, Braccioli E, Buzzoni V, Manfredini S. Antioxidant capacity of Adansonia digitata fruit pulp and leaves, *Acta Phytotherapeutica*, 2(5), 2002, 2-7.
23. Kabore D, Sawadogo-Lingani H, Diawara B, Compaore C S, Dicko M H and Jakobsen M. A review of baobab (*Adansonia digitata*) products: Effect of processing techniques, medicinal properties and uses, *Afr. J. Food. Sci.,* 5(16), 2011, 833-844.
24. Van Soest P J. Nutritional ecology of the ruminant, *O and B books Inc.Corvallis Oregon, USA.,* 2nd Edition, 1982, 234-248.

Please cite this article in press as: Okunlola D O *et al.* Acceptability, digestibility and nitrogen utilization of baobab *(adansonia digitata l.)* Fruit meal supplement by red sokoto goats, *International Journal of Nutrition and Agriculture Research*, 4(2), 2017, 96-104.