GROWTH PERFORMANCE AND DIGESTIBILITY OF WEST AFRICAN DWARF (WAD) BUCKS FED GRADED LEVELS OF TOASTED BAOBAB (*ADANSONIA DIGITATA*) SEED MEAL

[1*]Yakubu, R N, [1]Gulukun E Z, [1]Ashom S A, [2] Dastu, A J and Gyang, I Y
[1]Department of Animal Production Technology, Plateau State College of Agriculture, Garkawa
[2]Department of Animal Health Technology, Plateau State College of Agriculture, Garkawa
**Corresponding author's email:* roseyakubu2013@gmail.com

ABSTRACT
Dietary crude protein, fibre and carbohydrate are of great importance due to their significance in animal production. High cost of conventional feedstuff sources necessitated search for suitable alternatives to reduce cost of production. This study was carried out to investigate the effect of graded levels of processed Baobab seed meal (BSM) to replace full fat soyabean meal (FFSB) though Baobab seed not considered a conventional legume seed. A total of sixteen (16) West African dwarf (WAD) grower bucks of 5-7 months were used to investigate the growth performance and nutrient digestibility. The WAD bucks were allotted into four dietary treatments of one buck segregated into four replicates of one buck each. Data obtained were subjected to analysis of variance in a completely randomized design. Total weight gain (2.51kg/buck) was reduced (P<0.05) in bucks fed diets supplemented with 75% BSM in comparison to 0% BSM (3.84 kg/ buck). It was concluded that inclusion of 25 % and 75 % BSM did not adversely affect nutrient digestibility instead 50 % BSM improved growth performance and nutrient digestibility.
Keywords: Baobab seed, bucks, growth performance, nutrient digestibility, WAD

INTRODUCTION

Different breeds of goats are available and each is adapted to particular environmental conditions and has different nutritional requirements. Studies on dietary energy and crude protein requirement of tropical breeds of goat have been made to determine their nutrient requirements for growth and maintenance (Onwuka and Akinsoyinu, 1985) . West African Dwarf goats found within Nigeria, are commonly raised extensively with low productivity from the goats as the feed they consume are inadequate both in quality and quantity to meet their nutritional requirements. Nutritional factors especially dietary energy and crude protein are the main determinants for growth and meat production in goats.

Adansonia digitata (baobab tree) is a drought and fire resistant tree that is found in most parts of Africa, including the deserts (FAO, 1988). It is an indigenous leguminous plant which is cheap, readily available in the northern parts of Nigeria and its products utilized for nutritional and medicinal purposes (Nkafamiya *et al*., 2007). *Adansonia digitata* seed contains anti-nutritional factors such as oxalates (10%), phytates (2%), saponins (3-7%) and tannins (9-12%) which if not properly processed might limit its utilization in livestock feeding. These levels of the anti-nutritional factors are below the toxic level for most livestock species if properly treated (Nkafamiya *et al*., 2007). While these anti-nutritional factors may not pose a challenge to ruminants because of the presence and activities of microbes in the rumen, better utilization may be achieved if the seeds are processed (Ikyume *et al*., 2018; Gurbuz and Alarson, 2017)).

This research seeks to evaluate the effect of processing on the utilization of baobab seed meal by Indigenous WAD goats.

MATERIALS AND METHODS

Site

The study was conducted on a private farm in North Bank within Makurdi metropolis of Benue State. Makurdi is located between latitude 7 ^{0} 68' N and longitude 8 ^{0} 62'E. The flood plain is between 106m to 113m above sea level, the area is warm with a minimum temperature range of 17.3^{0}C to 24.5^{0}C and a maximum temperature range of 29.8^{0}C to 35.6^{0}C. During the dry hot season between February and March, temperature may reach 40^{0}C, and rainfall is between 1500 mm to 1800 mm (TAC, 2009) .

Collection and Preparation of Baobab Seeds

Adansonia digitata (baobab) seed pods were collected directly from farmers located in Amper, Kanke L.G.A in Plateau State. The baobab seed pods were crushed to remove the seeds and pulp together. The seed and pulp were soaked in water for one hour to soften the pulp and easy removal of the pulp, after which the seeds were thoroughly washed and sun-dried.

The dried baobab seeds were toasted using a cast iron pan set over heat and stirred properly to ensure uniform toasting. When it turned dark brown, it was allowed to cool then crushed using a cereal grinding machine to give the Baobab Seed Meal (BSM) and the BSM was then put in air-tight container for Proximate Analysis, Qualitative and Crude fibre fractions analysis. Other ingredients used included *burkutu* spent grain, maize offal, full-fat soya bean meal, bone ash and common salt.

Fresh *Gmelina* leaves and stalk were harvested within the experimental site and used as the basal diet.

Experimental Animals

A total of sixteen (16) grower West African bucks of 5-7 months of age were purchased from Makurdi metropolis and environs. The goats were quarantined on arrival and vaccinated against Pestes des petite ruminants (PPR). Ivermectin was administered to control both endo and ecto-parasites, before the feeding trial began.

Feeding and management

The experimental house was a high walled building with wide windows and high roof for cross ventilation. The house was divided into pens and each pen was divided into individual compartments. The floor made of concrete was covered with wood shavings to serve as litter and beddings. Feed troughs and drinkers were kept in each compartment which were cleaned daily and the litter materials changed forth-nightly or as the need arose to ensure good sanitation. A week to arrival of the animals, the animal house was thoroughly washed with detergent and disinfectant and allowed to dry before introducing wood shavings to each compartment, the drinking troughs and feeders were also thoroughly washed and sun-dried before placing them in the individual compartment. On arrival, all the animals were weighed and randomly distributed into four treatments of four replicates each. The animals were allowed a period of fourteen days to acclimatize to the feed and environment before data collection commenced. The animals were fed with concentrates and later fed with *Gmelina arborea*. The feeding was done at different times to reduce feed wastage and encourage intake by the animals. Mineral supplements were provided for each animal in form of mineral blocks. Fresh clean water was provided to the experimental animals *ad libitum* daily.

Experimental diets

Four experimental diets were compounded to contain 0%, 25%, 50% and 75% toasted baobab seed meal and designated as T1, T2, T3 and T4 respectively. Diet 1 (T1) was the control without baobab seed meal.

Experimental design

The design for the experiment was the completely randomized design in which there were four treatments and four replicates.

Feed intake

This was determined by subtracting the weight of left-over feed from total weight of feed supplied. Feed intake = weight of feed served minus weight of leftover feed.

Body Weight Gain (BWG)

Each goat was weighed at the beginning of the experiment and thereafter at weekly intervals using weighing scale. BWG was determined by subtracting the initial live weight from the final live weight of the animals on weekly basis.

Nutrient digestibility

The digestibility trial was conducted at the end of the feeding or growth trial. In the digestion trial, each goat was fitted with fecal collection bags for 4 days of acclimatization period with fecal collection bags prior to the actual collection of feces for 7 consecutive days. Feces voided was thoroughly mixed, ground in a hammer mill, weighed and recorded every morning and 20% of the representative samples was pooled over the collection period for each animal. The result obtained was used to calculate the moisture and dry matter content of the faecal samples. The samples were stored in air tight containers and sent for proximate analysis at the National Animal Production and Research Institute Shika, Zaria. The apparent nutrient digestibility was calculated using the formula below:

$$\text{Apparent Nutrient Digestibility} = \frac{\text{Nutrient consumed} - \text{Nutrient Voided}}{\text{Nutrient Consumed}} \times 100$$

Chemical analysis

Feed samples of the experimental diets T1, T2, T3, T4, baobab seed meal (BSM), maize offal, *burkutu* spent grains (BSG), full-fat soybean meal and the faecal samples were analysed for their proximate nutrient compositions as described by (AOAC,1995). Crude fibre fractions of baobab seed meals and faecal samples were analysed. The baobab seed meals were screened for phyto-nutrients (oxalates, phytic acid, saponin and tannin) and qualitative determination were done using the procedure outlined by (Harbone, 1989; Trease and Evans, 1989 and Sofowora,1993).

Statistical analysis

Data obtained was subjected to one-way analysis of variance using the Minitab – 2016 (Minitab, 2016) Statistical package, and means were separated using least significant difference (LSD).

Table 1: Gross Composition of Experimental Diets

INGREDIENTS	Experimental Diets			
	T_1 (0%)	**T_2 (25%)**	**T_3 (50%)**	**T_4 (75%)**
M.O	71.49	71.49	71.49	71.49
FFSBM	20.51	15.38	10.25	5.13
BSM	0.00	5.13	10.25	15.38
BSG	5.00	5.00	5.00	5.00
Bone ash	2.00	2.00	2.00	2.00
Common Salt	1.00	1.00	1.00	1.00
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis (%)				
Crude Protein	17.00	16.50	15.99	15.49
Crude Fibre	9.97	10.48	10.99	11.50
Ether Extract	5.95	6.59	7.23	7.88
Nitrogen-free Extract	67.08	66.43	65.79	65.13
Ash	3.88	3.98	4.08	4.18
ME (MJ /kg)	14.49	14.54	14.58	14.63

BSG: Burkutu spent grain, M.O: Maize offal, BSM: Baobab seed meal, FFSBM: Full-fat Soya-bean meal and M.E: Metabolizable energy.

Metabolizable energy was calculated according to the formula of Panzenga (1985).

RESULTS AND DISCUSSION

Results show no significant (P>0.05) differences in feed Intake and feed conversion ratio of WAD bucks (Table 2) though weight gain varied significantly (P<0.05) among dietary treatments with bucks in the control recording the highest weight gain (3.84 kg) which indicates that diets containing BSM were different from the control diets. The weight gain (2.51- 3.84 kg) obtained in this study is higher than the weight gain (2.09 kg – 3.26 kg) reported by {4} for fermented Baobab seed meal used to replace palm kernel cake and the range (2.35 kg – 2.52 kg) reported by Illori *et al.* (2013) for baobab whole fruit and pulp meal as supplement to wheat offal. Though there is a difference in the control diet, the diets containing BSM were adequate for growth of the goats. Feed intake varied significantly (P<0.05) from 29.50 kg to 31.50 kg across the dietary treatment groups and this may suggest difference in acceptability and palatability of the feed by the goats. The observed differences in weight gains could be due to voluntary dry matter intake, efficiency of feed intake and the physiological state of the animals (Ahamefule *et al*., 2007). Feed intake has been observed to be governed by dietary crude protein, palatability and other factors like gut fill in WAD goats fed cassava peel based diets (Ukanwoko and Onuoha, 2011). Feed conversion ratio was not significant as reported by (Ikyume *et al*., 2018) for fermented baobab seed meal fed WAD goats.

The dry matter and nutrient digestibility of WAD bucks fed experimental diets presented in Table 3 show Significant (P<0.05) differences in all the parameters except for Nitrogen free extract and Ash digestibility. The DM digestibility values (81.98% - 85.75%) are within the range (67.36% -89.04%)

reported by (Osakwe and Udeogu, 2007) which gave a great potential for improvement in DM digestibility of weaned goats. The difference clearly shows that incorporation of BSM in the diets did not reduce DM digestibility except diet 2 (25%) that was slightly above the control diet digestibility.

Table 2: Performance of WAD Goats fed Experimental Diets

	Experimental Diets				
Parameters	(0%)	(25%)	(50%)	(75%)	SEM
Initial body weight (kg)	6.23	6.30	6.30	6.30	-
Final body weight (kg)	10.10^{a}	9.78^{a}	9.33^{ab}	8.81^{b}	0.69*
Total weight gain (kg)	3.84^{a}	3.48^{a}	3.03^{ab}	2.51^{b}	0.48*
Mean daily weight gain (kg)	0.046^{a}	0.037^{ab}	0.036^{ab}	0.029^{b}	5.17*
Total concentrate intake (kg)	8.78	8.57	8.42	8.56	0.30ns
Total forage intake (kg)	22.72^{a}	22.02^{a}	21.08^{ab}	21.15^{ab}	0.54*
Mean daily feed intake (kg)	0.375	0.364	0.354	0.353	8.43ns
Total feed intake (kg)	31.50	30.59	29.71	29.50	0.72ns
Feed conversion ratio	33.13	34.08	35.60	42.52	5.72ns

a, b – Means within the same row bearing different superscripts differ significantly (P<0.05)
*** - Significant ; ns - Not significant; SEM – Standard error of mean**

Significant effect (P<0.05) of CP digestibility was also observed in steers fed baobab seed meal which produced high rumen microbes that supplied nitrogen in the rumen (Chingala *et al*., 2018) A significant effect (P<0.05) was observed in the Crude Fibre digestibility and this may be due to the ability of rumen microbes to effectively digest the nature of fibre in the diets containing BSM. (Olatunji *et al*., 2007) also reported significant (P<0.05) variation for WAD goats fed varying forage/concentrate ratio feeding system. High digestibility of nutrients showed that BSM did not have negative effect on the rumen microbes, thus, enabling the high population of micro-organisms to break down the feed nutrients.

Table 3: Nutrient Digestibility of WAD goats fed Experimental Diets.

	Experimental Diets				
Nutrient (%)	(0%)	(25%)	(50%)	(75%)	SEM
Dry Matter	85.25 ^{ab}	85.75 ^{a}	83.95 ^{ab}	81.98 ^{b}	1.19*
Organic Matter	79.79 ^{ab}	80.08 ^{a}	78.43 ^{ab}	76.83^{b}	1.05*
ADF	59.61^{a}	52.13^{a}	48.79^{ab}	37.80^{b}	3.88*
ADL	47.37^{a}	34.70^{a}	18.20^{b}	16.93^{b}	4.49*
NDF	73.86^{ab}	76.36^{a}	73.07^{ab}	67.19^{b}	2.30*
Cellulose	56.80^{ab}	63.75^{a}	55.11^{ab}	47.41^{b}	4.41*
Hemicellulose	84.40	91.21	91.02	86.34	2.63 ns
Crude Protein	82.70^{a}	85.12^{a}	83.86^{a}	76.37^{b}	1.56*
Crude Fibre	76.27^{a}	76.41^{a}	72.44^{ab}	68.02^{b}	2.29*
NFE	86.11	85.64	83.62	83.40	1.16ns
Ether Extract	86.58^{ab}	89.33^{a}	88.21^{ab}	85.04^{b}	1.27*
Ash	73.16	75.43	73.56	69.69	2.25ns

a,b-means within the same row bearing different superscripts differ significantly
ADF-acid detergent fibre; ADL- acid detergent lignin ; NDF- nitrogen detergent fibre
NFE – nitrogen-free extract ; SEM - Standard error of mean; *-Significant; ns - Not significant

CONCLUSION

The study showed that processed Baobab seed meal can be included in feeding West African dwarf goats as it enhanced growth performance and nutrient digestibility.

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