



## **Effect of Baobab (*Adansonia digitata*) Seed Meal on Performance Characteristics of Rabbit Does**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors NA and OAA designed the study. Authors ZOB and OTA anchored the field study, gathered the initial data and managed the literature search. Authors NA and OAA produced the initial draft and interpreted the data. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The study assessed the effect of baobab (*Adansonia digitata*) seed meal (BSM) on some growth and reproductive parameters of rabbit does. A total of 24 adult does (age range) were used, the rabbits were grouped into four treatments having six replicates with each replicate consisting of one doe. Treatment 1 (T1) served as the control, treatment 2 (T2) had 5% BSM, treatment 3 (T3) had 10% BSM and treatment 4 (T4) had 15% BSM. The study lasted for 10 weeks. The antinutritional factor content of the diet increased with BSM inclusion. Tannin, saponin and alkaloid content in the control diet was 0.27, 260.00 and 0.86 mg/100 g respectively, while the diet with 15% BSM (T4) had 0.0055 mg/g (tannin), 7.73 mg/g (saponin) and 0.022 mg/g (alkaloid). However, the pure BSM had 0.0017 mg/g (tannin), 130.00 mg/kg (saponin) and 0.03 mg/g (alkaloid). Feed intake and weight gain were significantly ( $P < 0.05$ ) higher for does in T2 compared to the control diet. Does on T2 converted their feed better compared to does on T3 and T4 with 16.93 and 16.95 respectively. The weight change during gestation revealed that does in T2 had a significant ( $P < 0.05$ ) weight increase of 150.00 g compared with the control with a weight change of 137.00g. However, a weight loss of -30.00 g was observed for does fed T4 (15% BSM). No

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significant ( $P>0.05$ ) difference was observed in the litter size of does fed different diets with means ranging from 5.33 to 6.00, although the highest birth weight of kindles was observed in T2 (5% BSM) but was not significantly ( $P>0.05$ ) different from kindles of other treatments. It is concluded from the result of this study that inclusion of 5% ADSM in the diet of does did not result in any significant weight loss. However, inclusion levels above 5% posed a threat to the growth performance and reproductive attributes of does.

**Keywords:** *Adansonia digitata*; does; performance; reproduction.

## 1. INTRODUCTION

Livestock production is a socio-economic activity that could lead to improved income and raise the quality of living of people in developing countries, particularly Nigerians [1]. Average consumption of animal protein in Nigeria is estimated at 4.5 g/head/day. This is lesser than the minimum requirement of 35 g/head/day recommended by Food and Agriculture Organisation [2]. There is need to place emphasis on animal protein sources that are easily managed, such as rabbits, in order to meet the increasing demand for animal protein in developing countries. Rabbit production requires smaller space, little capital and attention, unlike pig and poultry [3,4]. Rabbits are simple-stomached and their ceacum is capable of holding up to one-third of the digestive tracts volume and contains bacteria that will help the rabbit utilise undigested food.

Baobab is a well-adapted deciduous tree native to the arid parts of Central Africa and widely spread in the savannah regions in Nigeria [5]. The leaf, bark and fruit are used as food and for medicinal purposes in many parts of Africa [6] seed has a relatively thick shell, which is not readily separated from the kernel. The kernel is edible but the difficulties of decorticating seem to have limited its use as food/feed and consequently large quantities go into waste. Few reports have indicated the composition of the baobab fruit, pulp and leaves [7]. But reports on the nutritional and/or biochemical evaluation of the whole seed are scarcely available. The aim of the study was to assess the effect of baobab seed meal (BSM) on growth and reproductive parameters of rabbit does.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Site and Management of Animals

The research was carried out at a rabbit farm in Olororo, Akinyele Local Government Area of Oyo

State. The shed containing the rabbit hutches were constructed with wood and covered with roofing sheets. The hutches were constructed with chicken wire mesh and covered round with 8 mm wire mesh to exclude rodents and other pests. The experiment lasted for 10 weeks. A total of 24 (twenty-four) does were randomly assigned to four dietary treatments, six does per treatment with each animal standing as a replicate in a completely randomised design. The does were housed in individual cages. Water and pelletized feed were provided *ad-libitum* for the period of the experiment. There were four experimental diets consisting of 0 (control), 5, 10 and 15% BSM in T1, T2, T3 and T4 respectively (Table 1).

### 2.2 Data Collection

Feed was weighed out to the animals weekly and the residue was also weighed in order to estimate feed intake. Weekly weight of each rabbit was taken using a weighing scale and the weight change (gain or loss) was obtained. Feed conversion ratio (FCR) was calculated as a ratio of feed intake to weight gain. Litter size was recorded and weight of kindles at birth was also recorded.

### 2.3 Proximate Analysis

Proximate analysis of feed samples was carried out according to the method of AOAC [8] (Table 2).

### 2.4 Quantitative Chemical Analysis

Quantitative chemical analysis of feed samples was carried out using the procedures of AOAC [8], (Table 3).

### 2.5 Statistical Analysis

The data obtained were subjected to analysis of variance of SAS [9]. Significant means were separated using the same package.

**Table 1. Gross composition experimental diets (kg)**

Ingredients	T1	T2	T3	T4
Maize	25.00	25.00	25.00	25.00
Soya bean meal	13.00	13.00	13.00	13.00
Brewers dried grain	36.00	31.00	26.00	21.00
ADSM	0.00	5.00	10.00	15.00
Palm kernel cake	22.50	22.50	22.50	22.50
Oyster shell	1.00	1.00	1.00	1.00
DCP	1.40	1.40	1.40	1.40
Salt	0.20	0.20	0.20	0.20
Lysine	0.30	0.30	0.30	0.30
Methionine	0.30	0.30	0.30	0.30
Micromix grower	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00

T1= Diet 1= control (0% BSM), T2= Diet 2= 5% BSM, T3= Diet 3= 10% BSM, T4= Diet 4= 15% BSM, DCP= dicalcium phosphate, BSM= baobab seed meal

**Table 2. Proximate composition of pure BSM and experimental diets**

Parameters	Pure BSM	T1	T2	T3	T4
Moisture %	10.80	10.50	10.60	10.40	10.70
Crude Protein %	28.40	18.40	18.90	19.41	19.90
Crude Fat %	19.30	6.80	6.90	7.30	7.70
Crude Fibre %	8.85	11.25	10.25	9.25	8.25
Ash %	7.04	11.75	10.77	10.97	10.74
Metabolizable Energy (Kcal/kg)	3,778.69	2,960.45	3,030.46	3,147.24	3,156.35
Nitrogen free extract %	25.61	41.30	42.58	42.67	42.71

**Table 3. Quantitative chemical composition of BSM and experimental diets**

Antinutritional	Pure BSM	T1	T2	T3	T4
Tannin mg/100 g	0.17	0.27	0.38	0.39	0.55
Alkaloid mg/100	3.02	0.86	1.17	1.61	2.15
Saponin mg/100 g	130.00	260.00	412.50	602.50	772.50

## 2.6 Growth Performance of Rabbit does to ADSM

The growth response of does fed different levels of BSM is shown in Table 4. Significant ( $P < 0.05$ ) differences were observed in the performance attributes measured. Does on diet 2 had the highest significant mean value of 2430.00 g as final weight compared to those on diets 1, 3 and 4 (2280.00 g). The same trend was observed for the average weight change of the does with the highest significant mean observed in does on diet 2 (60 g/doe/week). The result also revealed that the feed intake of does on diet 1 (728.00 g/Doe/week) was significantly ( $P < 0.05$ ) lower likewise the feed conversion ratio compared to those on the BSM supplemented diets. However, does on diet 2 had the highest significant feed intake (790.00 g/doe/week) with a feed conversion ratio of (13.16) which implies better feed utilisation.

## 2.7 Effect of BSM on Reproduction Parameters

The effect of ADSM on some reproduction parameters is shown in Table 5. There were no significant differences among the treatments for all the parameters measured except for weight change at parturition.

## 3. DISCUSSION

### 3.1 Growth Response of Rabbit does to BSM

Tannin, saponin and alkaloid concentration observed in the control diet is a reflection of contributions of other feed ingredients used. However, the concentration of these antinutrients increased as inclusion level of BSM increased in the diets. Rabbits on T3 and T4 recorded the lowest weight gain, feed intake and FCR which

could be as a result of poor acceptability of the feed by the animals and high level of antinutritional factors like saponin and tannin present in BSM. Jenkins and Atwal [10] reported that saponin resulted in reduced growth, feed efficiency and interference with the absorption of dietary lipids, cholesterol, bile acids, vitamins A and E on chicks. According to Johnson et al. [11] tannins are responsible for an astringent taste of feed that induces lower intake due to reduced palatability. The poor performance observed could also be due to the lower fibre levels of 9.25% and 8.25% recorded for T3 and T4 respectively which is lower than 10-12% recommended by NRC [12] for growing and gestating rabbits.

A reduction in the body weight gain and higher mortality was also observed by Anjos [13], when scavenging chickens fed a diet containing 25% raw baobab seeds and 75% maize grain had a 60% lower body weight gain and a higher mortality than the group fed with a commercial diet.

### 3.2 Effect of BSM on Some Reproduction Parameters

Birth weight of kits was highest in T2 (41.13 g), and this may be due to the fact that it had the smallest litter size of 5.33, hence the more the number of kits the lesser their weight. But this may not be a setback as the potential for year-round production is another advantage of rabbits [14].

As observed in Fig. 1, weight change during pregnancy increased on a weekly basis in a progressive order in rabbits in T2 and T1 with values of T2 higher than T1. Weight change in T3 though increased but not a progressive order on a weekly basis, however, it was observed that rabbits in T4 loss weight (-3.00 kg) during pregnancy. Cheeke [15] reported that saponins can affect animal performance and metabolism in a number of ways as follows: erythrocyte haemolysis, reduction of blood and liver cholesterol, depression of growth rate, bloat (ruminants), inhibition of smooth muscle activity, enzyme inhibition and reduction in nutrient absorption. According to Liener and Kakade [16] tannins have the ability to form complex with vitamin B. Butler [17] reported that other adverse nutritional effects of tannins includes intestinal damage, interference with iron absorption and the possibility of tannins producing a carcinogenic effect.

This result may be compared with Raharjo et al. [18] who reported that the use of 54% alfalfa meal and 41% wheat meal which were the sole sources of protein and energy in a study with does and litters over several parities had a better reproduction and litter growth rate as compared with the control group fed a diet with 21% soyabean meal and the average weight gain of weanling rabbits from 4-8 weeks was 41 g per day on both diets. It may also be compared with the findings of Pote et al. [19] who observed a daily growth rate of 25 g over 4-week period.

**Table 4. Growth response of rabbit does to BSM**

Parameters	T1	T2	T3	T4	SEM
Initial live weight (g)	1830.00	1820.00	1830.00	1830.00	15.21
Final live weight (g)	2280.00	2430.00	2280.00	2280.00	18.25
Feed intake (g/doe/week)	728.00 <sup>c</sup>	790.00 <sup>a</sup>	762.00 <sup>b</sup>	763.00 <sup>b</sup>	35.00
Weight gain (g/doe/week)	45.00 <sup>b</sup>	60.00 <sup>a</sup>	45.00 <sup>b</sup>	45.00 <sup>b</sup>	26.00
FCR	16.70 <sup>b</sup>	13.16 <sup>c</sup>	16.93 <sup>a</sup>	16.95 <sup>a</sup>	8.21

*FCR = feed conversion ratio*

**Table 5. Effect of BSM on some reproduction parameters**

Parameters	T1	T2	T3	T4	SEM
Weight before pregnancy(g)	1870.00 <sup>c</sup>	2080.00 <sup>a</sup>	1970.00 <sup>b</sup>	2130.00 <sup>a</sup>	43.32
Weight at parturition (g)	2007.00 <sup>c</sup>	2230.00 <sup>a</sup>	2080.00 <sup>c</sup>	2100.00 <sup>b</sup>	21.45
Weight change during gestation (g)	137.00 <sup>a</sup>	150.00 <sup>a</sup>	110.00 <sup>b</sup>	-30.00 <sup>c</sup>	8.96
Litter size	6.00	5.33	5.67	5.67	2.10
Birth weight of kindles (g)	36.37	41.13	38.53	40.20	5.42

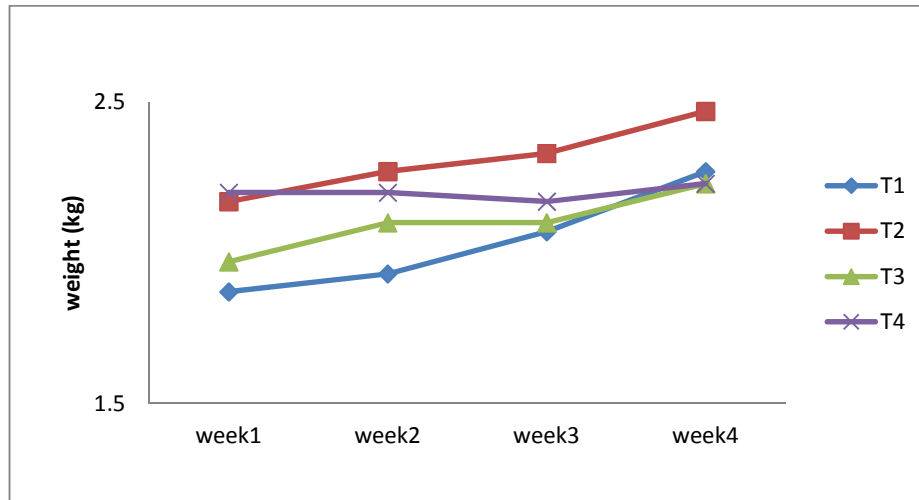


Fig. 1. Growth pattern of pregnant does fed different levels of BSM

#### 4. CONCLUSION AND RECOMMENDATION

The weight loss observed at 10% and 15% suggests that optimum growth and reproductive performance of does can be achieved at 5% BSM inclusion. However, in order to fully appreciate the effect of ADSM on growth response of rabbits, it is recommended that further study should be carried out on growing rabbits using varying levels of BSM. Also for the reproduction parameters observed, an inclusion level of 5% BSM is recommended, though the effect of ADSM on dry does and buck was not observed, it is recommended that further study should be carried out on dry does and bucks using varying levels of BSM. In view of the presence of several antinutritional factors present in *baobab*, further studies on processing methods that will improve the utilisation of this readily available ingredient by rabbits are recommended.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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