

## Effect of feeding African Locust Bean (*Parkia biglobosa*) fruit pulp diets on growth performance and nutrient digestibility of weaner rabbits

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### Abstract

A total of forty five weaner rabbits aged 5 to 6 weeks, with average initial weights of  $700.00 \pm 0.05$  g, were used to determine the effect of feeding *Parkia biglobosa* fruit pulp (PBFP) diets on growth performance and nutrient digestibility of weaner rabbits. They were randomly assigned to five treatments consisting of 0, 10, 20, 30 and 40 % dietary inclusion levels of *Parkia biglobosa* fruit pulp, to form Treatments T1, T2, T3, T4 and T5 respectively, in a completely randomized design experiment. The feeding trial lasted for 12 weeks to determine: feed intake, weight gain and feed conversion ratio. At the end of the 11<sup>th</sup> week of the experiment, a nutrient digestibility trial was carried out using two rabbits from each replicate that were randomly selected and transferred to specially constructed metabolism cages. Faecal collection was carried out for five days using the total collection method. Results showed that there were significant ( $P < 0.05$ ) differences in final body weight, body weight gain, total feed intake, feed conversion ratio and mortality among the treatments. Growth performance was significantly ( $P < 0.05$ ) improved for up to 20 % dietary inclusion level of PBFP, and significantly ( $P < 0.05$ ) declined as the level of PBFP increased across the diets. The apparent nutrient digestibility was significant ( $P < 0.05$ ) for dry matter, crude fibre and ether extract; but not significant ( $P > 0.05$ ) for crude protein, ash and nitrogen free extract as well as for total digestible nutrients among the treatments. Hence, inclusion of PBFP in the diets of weaner rabbits at 20 % level gave the best results in terms of growth performance and apparent nutrient digestibility

**Keywords:** *Parkia biglobosa* fruit pulp, growth performance, nutrient digestibility, weaner rabbits

### Introduction

Feed constitute about 70-80 % of the total cost of livestock production (Kellems and Church, 2010), resulting in a growing demand for maize for both human and livestock consumption. This has pushed its market price to a high level thereby affecting the production of farm animals, particularly the non-ruminants. This also has pushed the market prices of livestock out of reach of the ordinary Nigerians. There is therefore an urgent need to find alternatives to maize in livestock feeds to reduce the current pressure on maize as a staple food for man (Uchegbu and Udedibie, 1998). One alternative feed ingredient that is receiving attention is the African locust bean (*Parkia biglobosa*)

pulp. The fruit pulp is obtained in large quantities from the African locust bean tree as a waste by-product in the processing of African Locust Bean seasoning called *Dadawa* or *Iru*. The fruit pulp is sweet to taste when ripe, which indicates the presence of natural sugar and thus a potential energy source (Uwaegbute, 1996). Hassan and Umar (2005) reported that the *Parkia* fruit pulp has poor amino acid content with a score of 1/8. Other authors revealed that the fruit pulp is used in the rural Africa during emergencies when grain stores are empty, which is an indication of its edibility and non-toxicity (Owoyele *et al.*, 1987; Akoma *et al.*, 2001). The carbohydrate of the fruit was found to be 67.30 % (Gernah *et al.*, 2007) which is

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much higher than 49.49 % reported for the seed (Fetuga *et al.*, 1974). Though protein and fats also provide energy, carbohydrates are much cheaper and more easily digested and absorbed (Fox and Cameron, 1989). According to Kwari and Igwebuikwe (2002), the fruit pulp contain 6.70 % crude protein, 3.10 % ether extract, 8.10 % crude fibre, 58.00 % nitrogen free extract and 3.00 % ash; with metabolizable energy value of 3,079.14 Kcal/kg. Bello *et al.* (2008) also reported that the African Locust Bean fruit pulp contain 5.68 % crude protein, 18.00 % ether extract, 12.00 % crude fibre, 4.00 % ash and 68.75 % nitrogen free extract; with metabolizable energy value of 3,476.42 Kcal/kg. Rabbit is one of the micro livestock that its efficient production can help bridge the gap in animal protein supply-demand deficit. They are highly prolific, have low cholesterol in their meat and are good feed converters. However, the problems of feed shortage and high cost of feed ingredients, especially maize, are some of the factors limiting rabbit production (Obun *et al.*, 2010). This research study therefore aimed at evaluating the effect of feeding African locust bean fruit pulp diets on the growth performance and nutrient digestibility of weaner rabbits.

### **Materials and methods**

#### ***Experimental location***

The experiment was carried out at the Rabbitry Unit of Niger State Ministry of Livestock and Fisheries, Bosso, Minna, Niger State. Minna is Located between latitude 9° 33' North and longitude 6°33' East, with an annual rainfall of between 1200-1300mm (FUTMIN, 2012).

#### ***Experimental diets***

*Parkia biglobosa* fruit pulp was purchased from Zonkwa Market in Zango Kataf Local Government Area of Kaduna State. The fruit pulp is a by-product of the industrial

processing of African locust bean seeds which is used in the production of local food seasoning called *Dadawa* or *Iru*. Foreign particles were removed from the pulp and further sun dried for a few days, before being incorporated into the experimental diets at 0, 10, 20, 30 and 40 % dietary inclusion levels to form Treatments T1, T2, T3, T4 and T5 respectively. The composition of the experimental diets is shown in Table 1.

#### ***Management of the experimental animals***

A total of 45 weaner rabbits of mixed sexes and aged between 5-6 weeks, with average initial weights of 700.00 ± 0.05 g, were randomly allotted to five treatments of three replicates per treatment and three rabbits per replicate in a completely randomized design (CRD) model.

The rabbits were housed in individual wooden cages of height 60 cm, length 45 cm and width 40 cm, under an intensive system of management. Prior to the arrival of the rabbits, the cages were washed and disinfected with MORIGAD<sup>®</sup> disinfectant. On arrival, the animals were acclimatized for one week, during which time they were given preventive treatments for coccidiosis as well as internal and external parasites; and then fed the Control Diet (T1). The rabbits were then fed the experimental diets *ad libitum* for 12 weeks. Data were collected on growth performance (feed intake and weight gain).

#### ***Determination of apparent nutrient digestibility***

At the end of the 11<sup>th</sup> week of the feeding trial, a nutrient digestibility trial was carried out using two animals per replicate, housed in specially constructed metabolism cages. Known quantities of feed were fed to the animals in each replicate in the morning and left over collected the following morning for five days. Using the total collection method, faecal droppings were collected daily in

**Table 1: Composition of the experimental diets fed to weaner rabbits**

Ingredients (%)	T 1 (0%)	T 2 (10%)	T 3 (20%)	T 4 (30%)	T 5 (40%)
Maize	49.80	39.80	29.80	19.80	09.80
Groundnut cake	25.55	25.55	25.55	25.55	25.55
African Locust Bean pulp	0.00	10.00	20.00	30.00	40.00
Rice husk	19.00	19.00	19.00	19.00	19.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Bone Meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.30	0.30	0.30	0.30	0.30
Methionine	0.80	0.80	0.80	0.80	0.80
Salt	0.30	0.30	0.30	0.30	0.30
*Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
<b>Calculated analysis</b>					
ME (Kcal/Kg)	2701	2668	2635	2602	2571
Crude Protein	18.01	18.25	18.49	18.72	18.80
Crude Fibre	10.36	11.09	11.82	12.55	13.28
Protein: calorie	1:149	1:146	1:143	1:139	1:137
Calcium	1.40	1.45	1.47	1.49	1.51
Phosphorous	1.03	1.03	0.99	0.99	0.79
Lysine	0.87	0.88	.088	0.88	0.89
Methionine	1.01	1.00	0.98	0.97	0.96

\* The premix supplied the following nutrients kg<sup>-1</sup>: Vitamin A, 500 IU; Vitamin D<sub>2</sub>, 1500 IU; Vitamin E 3, IU; Vitamin K, 2 mg; Riboflavin, 3 mg; Pantothenic, acid 6 mg; Niacin, 15 mg; Vitamin B<sub>12</sub>, 0.8 mg; Chlorine, 3 mg; Folic acid, 4 mg; Manganese, 8 mg; Zinc, 0.5 mg; Iodine, 1.0 mg; Cobalt, 1.2 mg.

T1 = 0 % dietary inclusion level of *Parkia biglobosa* fruit pulp ME = Metabolizable energy

T2 = 10 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T3 = 20 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T4 = 30 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T5 = 40 % dietary inclusion level of *Parkia biglobosa* fruit pulp

aluminium foils, weighed, preserved with boric acid and oven dried at 80 °C for 24 hours. At the end of the experiment, the dry matter, crude protein, crude fibre, ether extract, nitrogen free extract and ash content of the experimental diets, collected faecal samples and PBFP were determined using the procedures of AOAC (2000).

#### Statistical analysis

Data collected were subjected to analysis of

variance (ANOVA) using Statistical Analysis System (SAS). Where treatment means were significant (P<0.05), Duncan's Multiple Range Test was used to separate the means (Duncan, 1955).

#### Results and discussion

The results of the proximate and phytochemical composition of *Parkia biglobosa* fruit pulp are presented in Tables 2 and 3.

**Table 2: Proximate composition of *Parkia biglobosa* fruit pulp**

Nutrient	Composition (%)
Dry matter	95.00
Crude protein	11.38
Crude fibre	10.00
Ether extract	4.50
Ash	4.08
Nitrogen free extract	65.12

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**Table 3: Anti-nutritional factors present in *Parkia biglobosa* fruit pulp**

Parameter	Composition
Oxalate (mg/100g)	145.00
Phytic acid (mg/100g)	215.00
Tannins (mg/100g)	4.11
Saponin (mg/100g)	Negligible
Cyanide (mg/100g)	Negligible

The result obtained show high crude protein content for *Parkia* fruit pulp (11.38 %). This high crude protein content is higher than 6.70 % reported by Kwari and Igwebuike (2002); 6.62 mg/100 g (0.00662 g/100 g) reported by Alabi *et al.* (2005); 5.25 g/100 g reported by Bello *et al.* (2008) and 4.81 % (4.81 g/100 g) reported by Hassan and Umar (2005). The differences could be due to variation in the soils in which they were grown, the differences in fertility of the soil or differences in geographical locations. The crude fibre content was 10.00 % which is comparable to 12.00 g/100 g (12.00 %) reported by Bello *et al.* (2008); but lower than 18.00 g/100 g (18.00 %) reported by Kwari and Igwebuike (2002) and 30.65 mg/100 g (0.03065/100 g) reported by Alabi *et al.* (2005). According to Shiwoya and Musa (2006), low fibre content of feed could stimulate feed intake as well as enhance the quality and digestibility of feed. The ether extract content was 4.50 % which is higher than the 1.80 % reported by Gernah *et al.* (2007) and significantly lower than 18 % reported by Bello *et al.* (2008). It is however comparable to 3.00 % reported by Kwari and Igwebuike (2002). The low fat content of *Parkia* fruit pulp has the ability to give a long shelf life to the fruit pulp during storage under the right temperature without spoilage by rancidity. The ash content of *Parkia* pulp was 4.00 % which agrees with 4.00 g/100 g reported by Bello *et al.* (2008) and 4.18 % reported by Gernah *et al.* (2007). The nitrogen free extract of *Parkia* fruit pulp was 65.12% which is

higher than 58.00 % reported by Kwari and Igwebuike (2002) but close to 67.30 % reported by Gernah *et al.* (2007) and 68.75 % reported by Bello *et al.* (2008).

The anti-nutritional factors in *Parkia* fruit pulp was 145 mg/100 g oxalate. This result disagreed with the value obtained by Bello *et al.* (2008) who reported 0.93 g/100 g (930 mg/100 g); however; Alabi *et al.* (2005) obtained 3.40 mg/100 g. The phytic acid content was 215.10 mg/100 g which differed from 0.20 mg/g obtained by Bello *et al.* (2008) and 60.00 mg/100 g reported by Gernah *et al.* (2007), respectively. Tannin content was 4.11 mg/100 g which is significantly lower ( $P < 0.05$ ) than 1.08 mg/100 g (108 mg/100 g) reported by Bello *et al.* (2008) and 81.00 mg/100 g by Gernah *et al.* (2007). These differences could be as a result of the different environments in which they were grown, as well as differences in soil profile and soil fertility. Table 4 shows the growth performance of rabbits fed varying levels of *Parkia biglobosa* fruit pulp diets. The initial body weight showed no significant ( $P > 0.05$ ) different across the treatments groups but there were significant ( $P < 0.05$ ) differences in final body weight, total body weight gain, total feed intake, feed conversion ratio (FCR) and mortality among the treatments. Feed intake was significantly ( $P < 0.05$ ) increased as the level of PBFP increased up to 20 % inclusion level and reduced as the level of PBFP increased further. The rabbits fed 30 % and 40 % PBFP consumed less feed compared to those fed the Control Diet. The decrease in

feed intake across the dietary treatments could probably be due to increase in the fibre level and the level of the anti-nutritional factors affecting both the palatability and the utilization of the feed. Kwari and Igwebuikwe (2002) also reported a decrease in feed intake with increase in the dietary inclusion level of PBFP in broiler chickens.

The final body weight of rabbits fed 20 % PBFP were significantly ( $P<0.05$ ) higher than those fed the other treatment diets, except the Control Diet; while the total body weight gain of rabbits fed 20 % PBFP were significantly ( $P<0.05$ ) higher than those fed the other treatment diets. Hence, maximum body weight gain was obtained at 20 %

dietary inclusion level of PBFP. Body weight gain in this study was between 441.70 – 811.00 g with an average daily weight gain of 6.5-12.00 g/day. This result is lower than the values obtained by Obun *et al.* (2010), who reported daily weight gain of between 16.32-16.59 g/day and total body weight gain of between 914-929 g in grower rabbits fed *Daetarium microcarpum* fruit pulp meal (DFPM), for a period of 12 weeks, at 0, 5, 10 and 15 % dietary inclusion levels. FCR was between 6.49 and 7.86 with the control diet having the best FCR of 6.49. This result differed from the findings of Ogunsipe and Agbede (2010) who reported FCR of 7.21-9.15 when rabbits were fed unripe plantain peels.

**Table 4: Growth performance of rabbits fed varying levels of *Parkia biglobosa* fruit pulp diets**

Parameters	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	SEM	P-Value
Initial body weight (g)	750.00	733.33	761.11	733.33	733.33	12.92	0.9592
Final body weight (g)	1430.56 <sup>ab</sup>	1400.00 <sup>b</sup>	1544.00 <sup>a</sup>	1206.11 <sup>c</sup>	1175.00 <sup>c</sup>	40.89	0.0006
Total body weight gain (g)	680.60 <sup>b</sup>	638.90 <sup>b</sup>	811.10 <sup>a</sup>	467.10 <sup>c</sup>	441.70 <sup>c</sup>	200.42	0.028
Total feed intake (g)	3995.00 <sup>b</sup>	4334.40 <sup>b</sup>	5636.40 <sup>a</sup>	3129.80 <sup>c</sup>	3222.80 <sup>c</sup>	250.58	0.0001
FCR	6.49 <sup>a</sup>	6.84 <sup>a</sup>	6.96 <sup>a</sup>	6.74 <sup>a</sup>	7.86 <sup>b</sup>	0.35	0.083
Mortality (%)	0.67 <sup>b</sup>	0.00 <sup>c</sup>	0.00 <sup>c</sup>	0.67 <sup>b</sup>	1.00 <sup>a</sup>	0.13	0.0245

<sup>ab</sup>Means with different superscripts in the same row were significantly ( $P<0.05$ ) different

T1 = 0 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T2 = 10 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T3 = 20 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T4 = 30 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T5 = 40 % dietary inclusion level of *Parkia biglobosa* fruit pulp

FCR = Feed conversion ratio

SEM = Standard error of the means

There were significant ( $P<0.05$ ) differences in dry matter, crude fibre and ether extract digestibility, and in total digestible nutrient (TDN), among rabbits fed diets containing various levels of PBFP (Table 5). Crude protein, ash and nitrogen free extracts

(NFE) digestibilities showed no significant ( $P>0.05$ ) differences among the dietary treatments. This result agrees with the findings of Jiya *et al.* (2010) when they fed weaner rabbits with tallow seed meal as a replacement for palm kernel cake.

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**Table 5: Apparent nutrient digestibility of rabbits fed varying levels of *Parkia biglobosa* fruit pulp diets**

Parameters	T1 (0%)	T2 (10%)	T3 (20%)	T4 (30%)	T5 (40%)	SEM	P-Value
Dry matter	85.67 <sup>a</sup>	84.88 <sup>a</sup>	89.49 <sup>a</sup>	64.15 <sup>b</sup>	81.16 <sup>a</sup>	2.55	0.0003
Crude protein	81.88	82.36	88.99	82.88	80.88	1.37	0.3905
Crude fibre	76.67 <sup>ab</sup>	75.04 <sup>ab</sup>	76.19 <sup>a</sup>	69.55 <sup>b</sup>	68.36 <sup>b</sup>	2.40	0.1078
Ether extract	92.11 <sup>ab</sup>	91.68 <sup>ab</sup>	94.15 <sup>a</sup>	76.26 <sup>c</sup>	84.34 <sup>bc</sup>	2.04	0.0043
Ash	69.37	65.49	77.75	64.15	63.37	2.29	0.2658
NFE	92.59	92.96	94.05	92.34	88.61	0.81	0.2832
TDN	73.34 <sup>a</sup>	73.02 <sup>a</sup>	73.74 <sup>a</sup>	69.05 <sup>b</sup>	68.64 <sup>b</sup>	0.93	0.2127

<sup>abc</sup>Means with different superscripts in the same row were significantly (P<0.05) different

T1 = 0 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T2 = 10 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T3 = 20 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T4 = 30 % dietary inclusion level of *Parkia biglobosa* fruit pulp

T5 = 40 % dietary inclusion level of *Parkia biglobosa* fruit pulp

NFE = Nitrogen free extracts; TDN = Total digestible nutrient

### Conclusion

Feed intake and body weight gain were enhanced as the dietary inclusion level of *Parkia biglobosa* fruit pulp (PBFP) increased up to 20 %, and reduced as the level of PBFP increased to 40 %. Similarly, total digestible nutrient (TDN) were statistically similar in rabbits fed 0, 10 and 20 % dietary inclusion levels of PBFP, beyond which it declined. Hence, it is recommended to rabbit farmers, animal nutritionists and feed millers to use *Parkia biglobosa* fruit pulp as a feed resource in compounding the diets of rabbits up to 20 % inclusion level, since this point gave optimum performance in terms of feed intake, body weight gain and apparent nutrient digestibility.

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Received: 24<sup>th</sup> November, 2017

Accepted: 2<sup>nd</sup> March, 2018