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SECURING ANIMAL AGRICULTURE AMIDST GLOBAL CHALLENGES

EFFECTS OF FERMENTED KARAYA GUM TREE (*Sterculia setigera*) SEED MEAL ON GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF RABBITS

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ABSTRACT
Effects of dietary inclusion of fermented Karaya gum tree (Sterculia setigera) seed meal was studied using weaned rabbits in a twelve weeks experiment. Three experimental diets were compounded in which control diet (1) had 0 % fermented Sterculia setigeraseed meal (FSSM) while diets 2 and 3 had 5 % and 10 % FSSM respectively. Thirty-six crossbred rabbits of average weight of 525 (± 1.0) g were allocated to the three dietary treatments in complete randomized design experiment with twelve animals per treatment. Each treatment had triplicate with four rabbits per replicate. At the end of the twelve weeks feeding trial, one week digestibility trial was conducted. Final body weight, total weight gain and average daily weight gain were significantly ($P<0.05$) higher in treatment fed diet with 5 % FSSM while daily and total feed intakes were significantly ($P<0.05$) higher in 10 % FSSM. Feed conversion ratio was also significantly ($P<0.05$) better (lower) in 5 % FSSM. Apparent nutrient digestibility for all the nutrients were significantly ($P<0.05$) higher in diets with 5 % FSSM. The results had indicated that FSSM had no negative effects on growth performance and apparent nutrient digestibility of rabbits and can therefore be included in rabbit diets up to 5% level.

Keywords: Fermented *Sterculia setigera*, Performance, Nutrient digestibility,

INTRODUCTION
The increasing demand, competition between man and livestock and high cost of conventional feed ingredients had necessitated the search for alternative feed ingredients for livestock feed. The use of unconventional feedstuff in animal feeds had been recommended (Rabiu *et al*., 2021). Such unconventional ingredients include seeds of tropical legumes, shrubs and trees that are readily available and not completed for in man's dietary needs (Uchegbu *et al*., 2008). However, the utilization of these tropical seeds in livestock feed is subjected to some inherent constraints, of particular importance are problems associated with anti-nutritional factors (Wafer *et al*., 2021). Different traditional processing methods such as roasting, cooking, soaking and fermentation were reported to reduce anti-nutritional factors and raise nutrients bioavailability (Ragab *et al*., 2010). Processing methods such as cooking, toasting, fermentation and soaking have been reported to reduce the anti-nutritional factors in seeds (Antevy *et al*., 2017). Fermentation is one of the oldest forms of feed processing and preservation and also has the capability to improve nutrients and functional properties of the feedstuff (Wafer *et al*., 2021). One of the non-conventional feedstuffs focused in this study is Karaya gum tree (*Sterculia stigera*) seed. The seeds have been reported to contain some anti-nutritional factors. The study therefore adopted fermentation as a method of processing. This study examined utilization of fermented seed meal by weaned rabbits.

MATERIALS AND METHODS
This research work was carried out at the rabbitry unit of Federal College of Wildlife Management, New Bussa, Niger State, Nigeria, with Latitude N 9° 49' 10.36" and Longitude E 4°34'49.15" (GPS, 2021). The seeds of *Sterculia setigera* were collected at maturity within New Bussa and its environs. They were cleaned and air dried. Ten (10) kg of the seeds were poured into twenty five litres plastic bucket containing ten litres of water at room temperature. The container with the contents was covered and the seeds were fermented for nine days. Thereafter, the seeds were washed, air dried and milled with hammer mill for inclusion in the diets. Three diets were compounded with diet 1(Control) having 0 % fermented *Sterculia* seed meal (FSSM) and diets 2 and 3 had 5 % and 10 % FSSM respectively (Table1). Thirty- six cross bred weaned rabbits with average initial weight of 525 (± 1.0) g were used for the experiment. Each treatment had triplicates with four animals per replicate in wooden/wire hutches. The rabbits were allocated to the treatment diets in a completely randomized design. The experiment lasted for twelve weeks after two weeks adjustment period. Feed and water were given *ad libitum*.

Feed intake and weight gains were determined using weighing scale over the feeding trial period which was followed by a week digestibility trial. Fermented Sterculia seed meal, feed and faecal samples were analyzed for nutrient composition according to Association of Official Analytical Chemists (AOAC, 2000) method. Data collected were subjected to statistical analysis using statistical analysis system (SAS, 2000) package. Where means were significant, they were separated using Duncan's Multiple Range Test as contained in the package.

RESULTS AND DISCUSSION

The gross composition of the diets is in Table 1 while the nutrient composition of the raw seeds, fermented seed meal and the diets are presented in Table 2. The results of proximate composition had shown that increase in fermentation period had effect on the nutrients of the seeds. The growth performance of the rabbits fed diets containing fermented *Sterculia* seed meal (FSSM) is presented in Table 3. All the growth performance characteristics measured were significant ($P<0.05$) between the treatment groups. Final body weight (FBW), total weight gain (TWG) and average daily body gain (ADG) were significantly ($P<0.05$) higher in treatment with 5 % FSSM than the control and diet with 10 % FSSM. Similarly, feed conversion ratio (FCR) was significantly ($P<0.05$) better (lower) in 5 % FSSM group than in 0 % and 10 % FSSM groups. However, daily feed intake (DFI) and total feed intake (TFI) were in the reverse order. Although there were numerical differences in the growth parameters between the control (0 % FSSM) and the 10 % FSSM group, the values were not statistically ($P<0.05$) different with the exception of TFI. Increase in feed intake with corresponding increase in FSSM in the diets could be due to the aroma and palatability of the FSSM. This observation is in line with Egbewande and Olorede (2003) and Yusuf *et al.* (2021). The higher total feed intake (5510) g without the corresponding higher weight gain (1560) g in treatment with 10 % FSSM when compared to 5 % FSSM (TFI,5418 g and TWG, 1680 g) might be due to the residual effects of the anti-nutritional factors (ANFs) since fermentation did not completely remove the ANFs. This agreed with Ani *et al.* (2008) who stated that phytate is known to reduce bio-availability of minerals and causes growth inhibition and that tannin had been shown to bind to exogenous and endogenous proteins including enzymes of the digestive tracts thus, affecting the utilization of protein. Nutrient digestibility of the rabbits fed diets with fermented *Steculia* seed meal (FSSM) is presented in Table 4. There were significant ($P<0.05$) differences across the treatment groups for all the parameters. Diet containing 5 % FSSM had higher digestibility for all the nutrients followed by the control (0 % FSSM). 10 % FSSM had lower digestibility than 0 % FSSM and 5 % FSSM. However, the digestibility of the nutrients was relatively high (>70 %) even at 10 % inclusion level. This indicates better utilization of the nutrients in the feeds. The decrease in digestibility with increase in FSSM could be as a result of residual effects of ANFs in the FSSM and possibly due to leaching of water soluble vitamins during fermentation. Okudu *et al.* (2017) had reported significant ($P<0.05$) decrease in all vitamins in sample soaked in water.

CONCLUSION

The result of this research work is evident that fermented *Sterculia setigera* seed meal can be incorporated in the rabbit diet without negative effects on growth performance and apparent nutrient digestibility.

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Table1. Composition of the Experimental Diets

Composition (%)	Diets		
	1 (0 % FSSM)	2 (5 % FSSM)	3 (10 % FSSM)
Maize	42.00	37.00	32.00
Fermented *Sterculia setigera*	0.00	5.00	10.00
Soya bean Cake	14.50	13.50	12.50
Full fat soya bean	15.00	14.00	14.00
Rice offal	24.00	26.00	27.00
Bone meal	3.50	3.50	3.50
Vitamin / premix	0.30	0.30	0.30
Lysine	0.20	0.20	0.20
Methionine	0.20	0.20	0.20

Salt	0.30	0.30	0.30
Total	**100.00**	**100.00**	**100.00**
Calculated composition:			
% Crude protein	17.19	17.21	17.32
% crude fiber	12.34	12.40	12.51
M.E. (Kcal/kg)	2607	2613	2642

FSSM = Fermented ***Sterculia setigera*** **Seed Meal** M.E. = Metabolisable Energy

Table2. Proximate Composition of Raw, Fermented *Sterculia setigera* Seed Meal and Experimental Diets

Parameters (%)	Raw SSM	FSSM	Diet		
			1 (0% FSSM)	2 (5% FSSM)	3 (10%FSSM)
Dry matter	93.17	92.06	93.89	93.14	93.18
Crude fibre	6.76	7.68	11.96	12.06	12.19
Crude protein	18.72	19.43	16.75	16.72	16.99
Ash	2.56	5.33	11.77	11.32	11.47
Ether extract	18.90	18.08	6.56	7.19	7.40
Nitrogen Free Extract	46.23	41.54	46.85	45.85	45.13

FSSM = Fermented ***Sterculia setigera*** **Seed Meal, SSM = *Sterculia setigera* Seed Meal**

Table3. Performance of Rabbits Fed Diets Containing Fermented *Sterculia setigera* (FSSM) Seed Meal

Parameters	Diets			SEM
	1 (0 % FSSM)	2 (5 % FSSM)	3 (10 % FSSM)	
Initial body weight (g)	525.00	524.80	525.00	0.12
Final body weight (g)	2065.00^{b}	2205.00^{a}	2085.00^{b}	13.67
Total weight gain (g)	1540.00^{b}	1680.20^{a}	1560.00^{b}	13.65
Average daily gain (g)	18.33^{b}	20.00^{a}	18.57^{ab}	0.16
Daily feed intake (g)	62.11^{b}	65.70^{a}	65.60^{a}	0.49
Total feed intake (g)	5217.24^{c}	5518.80^{a}	5510.40^{b}	232.83
Feed Conversion Ratio	3.39^{ab}	3.34^{a}	3.53^{b}	0.04

$^{a, b, c}$ Means on the same row with different superscripts were significantly (P<0.05) different

FSSM = Fermented ***Sterculia setigera*** **Seed Meal, SEM = Standard error of mean**

Table4. Nutrient Digestibility of Rabbits Fed Diets Containing Fermented *Sterculia setigera* Seed Meal

Parameters (%)	Diets			SEM
	1 (0 % FSSM)	2 (5 % FSSM)	3 (10 % FSSM)	
Dry matter	79.50^{b}	80.63^{a}	63.81^{c}	0.97
Crude fibre	79.93^{b}	80.64^{a}	64.92^{c}	0.98

Crude protein	79.93^{b}	80.63^{a}	58.64^{c}	0.98
Ash	79.94^{b}	80.65^{a}	50.19^{c}	0.98
Ether extract	79.93^{b}	80.63^{a}	60.69^{c}	0.98
Nitrogen Free Extract	79.93^{b}	80.63^{a}	59.27^{c}	0.98

$^{a, b, c}$ Means on the same row with different superscripts were significantly ($P<0.05$) different

FSSM = Fermented ***Sterculia setigera*** **Seed Meal, SEM = Standard error of mean**