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NUTRITIONAL EVALUATION OF PROCESSED *AFZELIA AFRICANA* SEED MEAL ON GROWTH PERFORMANCE AND NUTRIENT DIGESTIBILITY OF RABBITS

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ABSTRACT

The study was carried out to evaluate the potentials of Afzelia africana seed (AAS) on growth performance and nutrient digestibility of rabbits. AAS were collected in New Bussa. The seeds were washed and air-dried before processing. They were divided into three portions. One portion was ground raw and two portions were separately toasted at a temperature of 40^0C for 30 minutes. The toasted seeds were milled for inclusion in the diets. One of the toasted portions was toasted for the second time after milling at 40^0C for 30 minutes. Four experimental diets were formulated. Diet 1 contained 0 % AASM while diets 2, 3 and 4 contained raw, toasted and re-toasted AASM at 20 % levels of inclusion. Twenty-four crossbred rabbits with initial weight of 650 g were used. The animals were divided into four treatments of six rabbits per treatment. Each treatment had triplicates of two animals housed in wire/wooden hutches. They were allocated to the four dietary treatments in a completely randomized design for twelve weeks feeding trial. Feed intake and weight gains were determined. At the end of the feeding trial, digestibility trial was conducted. Final weight, total weight gain, mean weight gain, total feed intake and feed conversion ratio were significantly ($P<0.05$) different between the treatments. Although animals on diet 1 showed superior weight gain, those on diet 4 performed better than animals on diets 2 and 3. It is thus concluded that re-toasted AASM can be used in the diet of rabbits.

Keywords: Processed *Afzelia africana* Seed; Performance; Digestibility

INTRODUCTION

High cost of animal products and by-products is one of the major constraints to the supply and consumption of adequate animal protein in most developing countries of the world today, Nigeria inclusive. There has been a wide spread and marked inadequacy of protein intake of animal origin (both in quantity and quality) among Nigerians and other developing countries. This situation has led to malnutrition among the low-income group that constitutes the majority in these nations. The rapid increase in the population of the world has resulted in a huge increase in the demand for animal protein which is essentially higher in quality than that of plant protein (FAO, 2006). In Nigeria also, the demand for meat has increased tremendously in recent time which has led to low protein intake both in quantity and quality. The low protein intake both in quantity and quality is due to the fact that livestock production is not keeping pace with the rise in human population (Cribb, 2010). The unwanted trend is of great concern and requires intensified effort to overcome. Production of animal protein from cattle, goat, sheep, pig and poultry requires much capital, time, space and their feeding compete with man for certain ingredients. As an alternative, production of meat from rabbits is more suitable as their feeding does not compete much with man for ingredients (Yusuf *et al*., 2011). In addition, rabbits have a lot of advantages that include early maturity, short generation interval with relatively short gestation period. It equally has high protein and low cholesterol compared to cattle, sheep, swine, goat and poultry (Okon and Olawoyin, 2007; Yusuf *et al*., 2011). Despite these advantages among others, availability and high cost of conventional feed ingredients are some of the constraints to rabbit production. Feed alone accounts for about 70 – 80 % of the total cost of production in intensive livestock production (Shaahu *et al*., 2022). The use of non-conventional feed ingredients is an alternative to reduce cost of feed. There are many wild seeds that are not competed for by man and animals that have the potential to be used in feeding animals but inadequate information on their nutrient and anti-nutrient composition, proper method of processing and ease of collection had limit their utilization as feed ingredients. Some of such seeds have been reported to contain anti-nutritional factors. Processing methods such as cooking, toasting, fermentation and soaking reduce anti-nutritional factors in seeds (Wafer *et al*., 2021). *Afzelia africana* seed is one of the wild seeds that is available and not competed for by man and could be used to reduce cost of feeding rabbits. This study was therefore carried out to evaluate the nutritional potentials of both raw and processed *Afzelia africana* seeds as ingredient in rabbit feed.

MATERIALS AND METHODS

EXPERIMENTAL SITE AND LOCATION

This experiment was conducted at the rabbit unit of Teaching and Research Farm of the Department of Animal Production Technology, Federal College of Wildlife Management, New Bussa, Niger State, Nigeria. The farm is located on Latitude N $9^0$49.36’ and Longitude E $4^0$34.15’ (GPS, 2022).

COLLECTION AND PREPARATION OF THE SEEDS

Afzelia africana seeds (AAS) were collected from the wild in New Bussa and its environs. The seeds were washed with clean water, to be free from dirt and unwanted particles, and properly air-dried before processing. They were divided into three portions. One portion was ground raw while the other two portions were separately toasted in an aluminium frying pan on open fire (prepared with dried woods) at a temperature of about 40^0C for 30 minutes. The toasted seeds were milled with hammer mill for inclusion in the diets. One of the toasted portions was toasted for the second time after milling at about 40^0C for another 30 minutes.

EXPERIMENTAL DIETS, DESIGN AND MANAGEMENT OF THE ANIMALS

Four experimental diets were formulated (Table 1) with diet 1 (control) containing 0 % *Afzelia africana* seed meal (AASM) while diets 2, 3 and 4 contained raw, toasted and re-toasted AASM at 20 % levels of inclusion. Twenty-four crossbred, male grower rabbits between 7 and 8 weeks, with an average initial weight of 650 g were used for the experiment. The animals were divided into four (4) treatment groups of six rabbits per treatment. Each treatment had triplicates of two rabbits per replicate housed in wire/wooden hutches in well ventilated pen. They were allocated to the four dietary treatments in a completely randomized design for twelve weeks feeding trial. The animals were given prophylactic treatment before commencement of the experiment by injecting them with Ivermectin subcutaneously, against ecto and endo-parasites, and giving them Embazin in drinking water for two days. They were given two weeks for adaptation before data were collected for ten weeks. Feed and clean water were served *ad-libitum*. Feed intake and weight gains were determined over the twelve weeks period. Daily feed intake was determined by subtracting the leftover feed from the feed served. Weight gain was determined by subtracting the weight of the animal of the previous week from the preceding week. These were followed by one week digestibility period. Two animals from each replicate were randomly selected and transferred to metabolism cages for digestibility trial. They were allowed two days adjustment period and faecal samples were collected for five days. The faecal samples collected were properly dried to constant weight, weighed and stored in plastic bags for proximate composition.

Table 1: Composition of the Experimental Diets

Ingredients (%)	Diets			
	1	2	3	4
Maize bran	77.32	70.21	71.32	69.89
Groundnut cake	17.18	4.29	3.18	4.61
Raw AASM	0.00	20.00	0.00	0.00
Toasted AASM	0.00	0.00	20.00	0.00
Re-toasted AASM	0.00	0.00	0.00	20.00
Blood meal	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00
Vitamin / premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis				
% Crude protein	17.00	16.96	16.98	16.91
% Crude fiber	11.91	11.96	12.04	12.08
M. E. (kcal/kg)	2696	2688	2678	2670

AASM = *Afzelia africana* seed meal, M. E. = Metabolizable energy

LABORATORY ANALYSIS

Samples of raw, toasted and re-toasted *Afzelia africana* seed meals, feeds and faeces were taken to the Central Laboratory of National Institute for Fresh Water Fisheries Research, New Bussa, Niger State, for proximate analysis. Proximate composition was determined according to association of official analytical chemists (AOAC, 1990) method.

STATISTICAL ANALYSIS

All data collected were subjected to analysis of variance (ANOVA) using statistical analysis system package (SAS, 2002) while means were separated by Duncan's Multiple Range Test as contained in the package.

RESULTS AND DISCUSSION

The results of proximate analysis of the raw, toasted and re-toasted *Afzelia africana* seed meals, and the experimental diets are presented in Table 2. The results had shown that toasting and re-toasting had effect on the nutrient composition of the seeds. From the results obtained, the dry matter (DM)

increased with increase in processing (toasting). This could be due to the fact that the seed particles would have been exposed to heat after milling which would have caused moisture to evaporate from the milled seeds thereby increased the DM content of the seeds. Toasting for the second time would have caused more moisture to evaporate, hence increased the DM of the seeds. Ether extract (EE) decreased with increase in processing (toasting). This could also be due to the same reason already advanced. Exposure of the seeds to heat would have caused the oil to evaporate thereby resulting in decreased EE of the seeds. This agreed with the observation of Akinmutimi *et al*. (2003) who stated that the reduced EE observed in processed sword bean could be due to lipid-containing compounds that would have been burnt off during the toasting process.

Table 2: Proximate Composition of Raw, Processed *Afzelia africana* Seeds, and Experimental Diets

Parameters (%)	Raw AASM (%)	Toasted AASM	RTAASM (%)	Diets			
				1	2	3	4
Dry matter	93.17	91.18	92.43	93.89	93.14	93.18	93.24
Crude fibre	6.76	5.86	6.08	11.96	12.06	12.19	12.27
Crude protein	18.72	18.02	17.93	16.75	16.72	16.99	16.87
Ash	2.56	5.68	6.42	11.77	11.32	11.47	11.54
Ether extract	18.90	16.35	15.24	6.56	7.19	7.40	7.32
Nitrogen free extract	46.23	45.27	46.76	46.85	45.85	45.13	45.24

AASM = *Afzelia africana* seed meal, RTAASM = Re-toasted *Afzelia africana* seed meal

The crude protein (CP) content followed the same trend with DM and EE which could be ascribed to the effect of heat that would have affected the seeds. The reduction in CP could be attributed to possible denaturing of protein by heat. It could also be due to solubilization of nutrients. This agrees with Taiwo *et al*. (2003) who stated that the lower values for CP obtained in mucuna seed meal could be due to effect processing as solubilization of nutrient could have taken place. The crude fibre (CF), ash and nitrogen free extract (NFE) had no set pattern. The CP and the CF of the diets are within the recommended levels for growing rabbits. 16 % CP is recommended for growth (Bibi-Farouk *et al.*, 2011) while 12 % CF is recommended better performance of rabbit. Performance of the rabbits fed diets containing raw and processed *Afzelia africana* seed meal is presented in Table 3.

Table 3: Performance of Rabbits Fed Diets with Raw and Processed *Afzelia africana* Seed Meal

Parameters	Diets				SEM	LOS
	1	2	3	4		
Initial body weight (g)	650.00	650.00	651.00	650.00		NS
Final body weight (g)	2111.60^{a}	1929.80^{c}	2053.00^{b}	2094.80^{a}	12.61	*
Total weight gain (g)	1461.60^{a}	1279.80^{d}	1402.00^{c}	1444.80^{b}	13.65	*
Average daily gain (g)	17.40^{a}	15.80^{c}	16.70^{b}	17.20^{a}	0.13	*
Daily feed intake (g)	60.50^{b}	58.40^{c}	61.20^{ab}	62.00^{a}	0.42	*
Total feed intake (g)	5082.00^{c}	4905.60^{d}	5140.80^{b}	5208.00^{a}	212.82	*
Feed conversion ratio	3.50^{a}	3.83^{c}	3.67^{b}	3.60^{a}	0.04	*

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

The initial weights of the rabbits were 650g while the final weights ranged from 1929.8g to 2111.6g. Average daily weight gains were between 15.8 g and 17.4 g. Highest daily and total weight gains were recorded in treatment 1 (control) while the least were recorded in treatment fed diet with raw *Afzelia africana* seed meal. The values were significantly (P<0.05) different between the treatments. The lower total and daily gains recorded especially in treatments fed diets

containing *Afzelia* seed meal could be due to the effect of anti-nutritional factors in the test seeds. Daily and total gains increased with processing indicating that processing was effective and had improve the performance of the animals. The performance increased with increase in the processing. Treatment with re- toasted seed meal is comparable to the control. However, the weight gains were lower than (P<0.05) that of the control. This could probably be due to the residual effect of anti- nutritional factors in the seed. Ukachukwu and Szabo (2003) and Ezeagu *et al.* (2003) had reported the presence of residual anti-nutritional factors in processed mucuna seed meal and had attributed decreased feed intake and subsequent growth depression to the anti- nutritional factors. Similarly, Ani *et al*. (2008) had stated that phytate is known to reduce bio-availability of minerals and causes growth inhibition. Daily feed intake and total feed intake also differed significantly (P<0.05) between the treatments with the highest total and daily intake in treatment fed diet with re toasted *Afzelia* seed meal while the least were recorded in treatment containing raw seed meal. Increased feed intake in the diet with processed seed meal could be due to palatability of the feed and aroma emanating from the processed seeds which would have attracted the animals to consume more feed.

Feed conversion ratio differed significantly (P<0.05) across the treatment groups with the lower value recorded in treatment 1 (control) followed by treatment with re-toasted seed meal (treatment 4). Lower feed conversion ratio indicates better utilization of the feed. However, non-significance between treatment1 and 4 indicates that diet 4 is comparable to diet 1. Nutrients digestibility of the rabbits feed diet containing processed *Afzelia africana* seed meal is presented in Table 4. From the results obtained, all the nutrients in the diets were relatively (more than 50%) digested. Digestibility differed significantly (P<0.05) between the treatments. Digestibility increased with processing indicating that toasting and re- toasting were effective in processing of *Afzelia* seed. The observed differences in digestibility among the treatments might have resulted from the activities of anti- nutritional factors. The lower nutrient digestibility might have been caused by the interference of anti- nutritional factors with digestive enzymes, affecting the biological utilization of some of the nutrients in the diets or could be due to high lignin and cellulose fraction of the fibre content of AAS. This is in line with Agbo (2003) who stated that processed ingredients make them highly digestible compared to unprocessed ingredients.

Table 4: Nutrient Digestibility of Rabbits Fed Diets Containing Raw and Processed *Afzelia africana* Seed Meal

Parameters (%)	Diets				SEM	LOS
	1	2	3	4		
Dry matter	60.41^{c}	57.02^{d}	63.81^{b}	64.21^{a}	0.48	*
Crude fibre	64.50^{b}	61.47^{c}	64.92^{b}	66.37^{a}	0.02	*
Crude protein	58.12^{b}	54.17^{c}	58.64 ^{b}	60.15^{a}	0.19	*
Ash	52.67^{a}	51.37^{b}	50.19^{c}	53.58^{a}	0.46	*
Ether extract	61.18	60.88	60.69	61.26	0.08	NS
Nitrogen free extract	57.78^{b}	56.13^{c}	59.27^{ab}	61.09^{a}	0.31	*

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

SEM = Standard error of mean, LOS = Level of significant, NS = Not significant, *= Sig

CONCLUSION AND RECOMMENDATIONS

The result obtained in this study is evident that re-toasted *Afzelia africana* seed meal can be included in the diet of rabbit without negative effect on performance and nutrient digestibility. Utilization of this seed in rabbit diet will reduce dependency on conventional feed ingredients, competition between man, industries and livestock and cost of production of animals and animal products. It is evident from this study that re-toasted *Afzelia africana* can be included up to 20% of the total feed without deleterious effect on performance and nutrient digestibility.

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