NUTRIENT DIGESTIBILITY OF WEANER RABBITS FED DIFFERENTLY PROCESSED *DELONIX REGIA* (FLAMBOYANT) SEED MEAL

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ABSTRACT
This study was conducted to assess the nutrient digestiblity of mix-bred rabbits to diets containing differently processed Delonix regia seed meal (DRSM). Processed forms of Delonix regia seeds were; fermentation, boiling and toasting and their proximate composition were determined. Thirty-two (32) matured rabbits comprising of 16 Bucks and 16 Does of six to seven months of age with average weight of 1,460±0.02 procured from reputable farms in Akwa Ibom State were divided into four treatment groups with eight replicate each and alloted to four (4) dietary treatments. The Delonix regia seed meal were included at 0, 15, 15 and 15% untreated, fermented, boiled and toasted in diets 1, 2, 3 and 4, respectively. The study lasted for 12 weeks. All data collected in the course of the experiment were statistically analyzed using one way Analysis of Variance (ANOVA) in a Completely Randomized Design (CRD) and Duncan's new multiple range test, was used for mean separation. There were significant differences ($p<0.05$) in Proximate Composition and Nutrient Digestibility parameters measured across dietary treatments with respect to Moisture, Ash, Crude fibre, Ether Extract, Crude protein, Dry Matter and NFE. The study revealed that inclusion level of Toasted Delonix regia seed meal (TDRSM) at 15% brought about a positive result in terms of nutrient utilization of rabbits. It was recommended that Delonix regia seed meal should be toasted before it is included in diets meant for rabbits.
Key word: *Delonix regia,* digestibility, rabbit, proximate composition

INTRODUCTION

The demand for meat may not be met by traditional livestocks (cattle, sheep, goats) due to their long reproductive and productive cycles thereby encouraging the emergence of micro livestocks like "rabbits". The need to improve rabbit production in Nigeria for increased supply of animal protein is no longer in doubt due to high cost of beef and pork (Bamgbose *et al.*, 2004). In order to maximize food production and meet protein requirement in Nigeria, viable options need to be explored and evaluated (Owen *et al*., 2008). Rabbit production is an inevitable way of alleviating animal protein deficiency in Nigeria (Ajala and Balogun, 2004). Rabbits with its numerous potentials can provide the needed animal protein to humans. The advantages of rabbits projected include: short gestation length, short generation interval, early sexual maturity and high prolificacy (Evans et al., 2022).

Rabbits are monogastric animals in the family leporidae of the order lagomorpha). Rabbits have been kept as livestock since ancient times for their meat, wool and fur. In modern times, rabbits are utilized in specific research as experimental animals. Rabbits' meat is normally regarded as white meat (Iwena, 2012). Their meat is low in fat and cholesterol (Biobaku and Dosunmu, 2003), thus making the flesh a desirable one for diabetes, hypertensive and middle age people. Rabbits have the capacity to convert feed of very low quality to meat (Oyedeji *et al*., 2017). The growing population in Nigeria and other developing countries are faced with the problem of low protein intake (Ahamefule *et al*., 2005). It is estimated that an average Nigerian consumes about 10g of animals' protein per day which is grossly lower than the 35g per day recommended by Food and Agricultural Organization (FAO, 2008). This low protein intake has aggravated the problem of malnutrition especially among children and adult as well (Ahamefule *et al*.,2000). This problem is further intensified by the current food crisis and population explosion especially in developing countries (Food and Agricultural Organization, 2008). These issues have increased greatly the competition in the use of cereal grains between humans and the livestock industries. Feed takes about 80% of the total cost of production in a livestock enterprise (Mengesha, 2011). Good and cheap animals' feed makes livestock production more viable throughout the world (Google Earth, 2019). There is need to source for relatively inexpensive, easily processed and readily available feedstuff aside from conventional cereal grains (Sol *et al*., 2016). In order to avoid scarcity that may eventually increase the total cost of production, conventional feedstuffs should be supplemented or replaced with unconventional feedstuffs. One of such unconventional feedstuff is "*Delonix regia*".

The main use of Delonix regia is ornamental. It is mostly planted in avenues and parks for its magnificent flowering and as a shade tree for cows or other tree species in plantations. *Delonix regia* leaves provide forage for livestock and the seed meal can be fed to farm animals. Rabbits with its numerous potentials can effectively utilize Delonix regia seed meal, thereby increasing the protein intake of the populace. The aim of the study was to evaluate the apparent digestibility coefficient of rabbits fed different forms of processed *Delinox regia* seed meal.

MATERIALS AND METHODS

Location of the Experiment

The experiment was conducted at Akwa Ibom State University Obio Akpa Campus Rabbitry Unit. The area lies between latitude 4°30 N and longitude 7°30 E (Sluk-Ak .,1989).

Collection and Processing of Test Materials

Mature pods of *Delonix regia* was harvested from its tree along Idoro road in Uyo. The seeds were removed from the pods then washed with running tap water to eliminate contaminants that can affect the quality of the seeds. The seeds were apportioned into three for it to be subjected to different processing methods so as to eliminate anti- nutritional factors such as; Trypsin inhibitor, Phytate. (fermentation, toasting and boiling) Fermentation was done for 48hours, toasting was carried out for 30 minutes and boiling was done at 100ºC.

Experimental Animals and their Management

A total of thirty-two (32) rabbits comprising of 16 bucks and 16 does of 6-7 months were procured from reputable farms in Akwa Ibom State. Before the arrival of the rabbits, the rabbitry was washed and fumigated and the surroundings was cleared as well. Hutches, feeders, drinkers, disinfectants and buckets were provided. On arrival, the rabbits were given anti-stress (Vitalyte) and acclimatized for one week. They were fed with commercial diets throughout the acclimatization period anddewormed with Albendazole via drinking water. Thereafter, they were weighed individually and randomly allotted into four dietary treatments with 8 replicates per treatment. Feed formulation was done in which 15% of Delonix regia seed meal was incorporated.

Experimental Diets

Four experimental diets were formulated in which the diets had Delonix regia seed meal included at 0% for treatment 1 and at 15% for treatments 2, 3 and 4 respectively in a completely randomized design. Diet 1, served as control; Diet 2, as fermented; Diet 3, as boiled and Diet 4, served as toasted Delonix regia seed meal. The rabbits were fed 150g of concentrate and forages comprising of calopo and centrosema daily.

Table .1: Gross Composition of Experimental Rabbit Diets

Ingredients	T1 0% Control	T2 15% FDRSM	T3 15% BDRSM	T4 15% TDRSM
Yellow maize	44.10	34.10	34.10	34.10
Soybean meal	15.00	10.00	10.00	10.00
Crayfish dust	3.00	3.00	3.00	3.00
Delonix regia seed meal	0.00	15.00	15.00	15.00
Rice husk	17.00	17.00	17.00	17.00
Palm Kernel Cake	3.00	3.00	3.00	3.00
Wheat offal	14.00	14.00	14.00	14.00
Bone meal	2.00	2.00	2.00	2.00
Vit. Min. premix	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20
Salt	0.25	0.25	0.25	0.25
Palm oil	1.00	1.00	1.00	1.00
Total	100.00	100.00	100.00	100.00
Calculated nutrients:				
% Crude protein	15.75	15.68	15.68	15.68
% Crude fibre	8.20	8.59	8.59	8.59
ME (Kcal/kg)	2527.98	2323.80	2323.80	2323.80

DRSM: *Delonix regia* seed meal; FDRSM: Fermented *Delonix regia* seed meal; BDRSM: Boiled *Delonix regia* seed meal; TDRSM:Toasted *Delonix regia* seed meal

Data Collection

Digestibility Trial

A direct method (*in vivo*) was used in the trial. The digestibility trial was carried out in ninth week and lasted for 7 days. Four rabbits (2 bucks and 2 does) selected from each treatments group were transferred into individual metabolic cages provided with facilities for the collection of faeces and urine. The rabbits were fed weighed amounts (250g) of experimental diets in addition to 150g of forage and water was provided *ad-libitum*. Faeces were collected in the morning before feeding and giving the rabbits water. The faeces were weighed for each animal. Leftovers of diets offered to the rabbits were collected after 24 hours, then weighed and used to determine the voluntary intake of feed. Samples of each diet was taken for dry matter determination and Chemical Composition analysis. At the end of the 7- days, samples collected were subjected to analysis. Percentage digestibility was obtained as follows:

$$\frac{\text{Quantity of nutrient in feed - Quantity of nutrient retained in faeces}}{\text{Quantity nutrient in feed}} \times 100$$

Analytical Procedure for feed and faeces

All feed and faecal samples were analysed for proximate components using Associaton of Official Analytical Collaboration (AOAC) 2000 method.

Statistical Analysis

After the experiment was carried out, all data gathered was organized, tabulated and analyzed statistically using One way Analysis of Variance (ANOVA) in a completely Randomized Design (CRD). Significant means were separated using Duncan's new multiple range test (Duncan, 2008).

RESULTS AND DISCUSSION

Proximate Composition of Experimental Rabbit Diets

The values for moisture content were 9.33, 9.88,10.22 and 10.45%, for T1, T2, T3 and T4 respectively. There were significant difference ($p<0.05$) among the treatments with T4 having the highestmoisture value. The values obtained for ash content were 10.20%, 10.09%, 10.10% and 9.86% for T1, T2, T3 and T4 respectively. There were significant differences ($p<0.05$) among the treatments. The highest value for ash was obtained in T1 while the least value was obtained in T4. The ash content in all the treatments were slightly higher than the value of 9.07 percent reported by Alamowor *et al*..(2009) for poultry birds fed cocoa pod husk. The crude fibre values were 5.44%, 5.20%, 5.60% and 5.88% for T1, T2, T3 and T4 respectively.T4 recorded the highest value among the treatments. The treatments were significantly ($p <0.05$) different. The range of values realized in this work is comparatively higher than the values reported by Onu and Madubuike (2006) with Crude fibre of 1.48 and 1.49 in raw and cooked wild cocoyam respectively. Fibre function as diluents (Oke et al., 2007) and fibre also enhances proper bowel movement in ruminants. The values obtained for EE were 4.09%, 3.97%, 4.55% and 4.54% for T1, T2 , T3 and T4 respectively. There were significant ($p<0.05$) difference among the treatments. The result from this study is higher than 0.1 % reported by Gomes et al. (2005). The result obtained for CP were 21.21%,21.11%,23.42% and 25.48% for T1, T2,T3 and T4 respectively with the highestvalue obtained in T4 and least value recorded in T2. The values obtained in this study for CP is higher than the values(13.38-15.71) obtained by Olufayo and Falola (2018). Also, the values obtained for CP were comparably higher than the values obtained by Onu and Madubuike (2006) which were 7.21 and 7.15 in raw and cooked cocoyam respectively. The CP content (21.11-25.48) of the experimental diets was higher than the recommended level (16-20%) for rabbits. The high CP levels were apparently due to the high crude protein content of the test ingredient (Delonix regia seed meal) used in this study. Protein plays an important role on supplying adequate amount of required amino acids for biological body function and synthesis. CP deficiency retards growth and accumulate fluids in the body (Mounts, 2000). The values for DM were 90.65%, 90.10%, 89.76% and 89.49% for T1, T2, T3 and T4 respectively. There were significant differences ($p<0.05$) among the treatments. The result of the DM realized from all the treatments (BDRSM-TDRSM) is comparatively higher than the DM of African Yam Bean seed of range 85.55-89.10% reported by Anya (2012). The result obtained was comparatively lower than those reported by Onu and Madubuike (2006) with 92.69 and 90.70 DM in raw and cooked cocoyam respectively. The values obtained for NFE were 49.72%, 49.69%, 46.05% and 43.65% for T1, T2, T3 and T4 respectively. There were significant differences ($P<0.05$)among the treatments but T1 and T2 were similar. The

range of values (43.65-49.72) obtained in this work was comparatively lower than the values obtained by Onu and Madubuike (2006) with NFE of 81.58 and 82.02 in raw and cooked wild

Table 2: Proximate Composition of Experimental Rabbit Diets Use insert table option to prepare tables (as done for table 3) to avoid the figures scattering during formatting

PARAMETERS (%)	T1 (0%)	T_2 (15% FDRSM)	T_3 (15% BDRSM)	T_4 (15% TDRSM) ±SEM
Moisture	9.33[d]	9.88[c]	10.22[b]	10.45[a] 0.10
Ash	10.20[a]	10.09[c]	10.10[b]	9.86[d] 0.03
CF	5.44[c]	5.20[d]	5.60[b]	5.88[a] 0.06
EE	4.09[c]	3.97[d]	4.55[a]	4.54[b] 0.06
CP	21.21[c]	21.11[d]	23.42[b]	25.48[a] 0.46
DM	90.65[a]	90.10[b]	89.76[c]	89.49[d] 0.11
NFE	49.72[a]	49.69[a]	46.05[b]	43.65[c] 0.66

[abcd] Means along the same row with different superscript are significantly different ($p<0.05$). FDRSM-Fermented *Delonix regia* seed meal, BDRSM- Boiled *Delonix regia* seed meal, TDRSM- Toasted *Delonix regia* seed meal, SEM-Standard Error of Mean.

Nutrient digestibility of rabbits fed differently processed *Delonix regia* seed meal

The result obtained for moisture contents were 0.20 ,2.21, 2.43 and 0.47% for T1,T2,T3 and T4, respectively. There were significant differences($p<0.05$) among the treatments. T3 values had the highest value followed by T2, T4 and T1 which had the least numerical value. The ash value obtained in the study were 79.42, 69.30, 77.24 and 80.74% for T1,T2,T3 and T4, respectively. There were significant differences ($p<0.05$) among the treatment.T4 had the highest value while T2 had the least value. The range of values (69.30 -80.74) obtained for CP digestibility in this work were comparably higher than the values (27.19-49.01) reported by Ewuola *et al*., 2011. T4 value is higher than the range of values (71.77-76.37) obtained by Evans *et al*., (2023). The values obtained for CF were 79.81,75.04,76.82 and 69.43% for T1,T2,T3 and T4, respectively. The treatments were($p<0.05$) different. T1 had the highest value followed by T3,T2 and the least value was obtained T4. The range of values (69.43-79.81) realized in this work is comparatively higher than the values reported by

Table 3: Nutrient Digestibility of Rabbits fed differently processed *Delonix regia* seed meal.

PARAMETERS (%)	T1 (0%)	T2 (15% FDRSM)	T3 (15% BDRSM)	T4 (15% TDRSM)	SEM
Moisture	0.20[d]	2.21[b]	2.43[a]	0.47[c]	0.25
Ash	79.42[b]	69.30[d]	77.24[c]	80.74[a]	1.14
CF	79.81[a]	75.04[c]	76.82[b]	69.43[d]	0.97
EE	24.38[d]	32.15[a]	25.43[c]	29.66[b]	0.81
CP (%)	89.15[b]	87.68[d]	88.49[c]	90.97[a]	0.31
DM (%)	0.10[d]	0.23[b]	0.29[a]	0.19[c]	0.28
NFE (%)	65.04[c]	62.22[d]	74.37[b]	83.86[a]	2.19

[abcd] Means along the same row with different superscript are significantly different ($p<0.05$).
FDRSM-Fermented *Delonix regia* sed meal
BDRSM- Boiled *Delonix regia* seed meal
TDRSM- Toasted *Delonix regia* seed meal
SEM-Standard Error of Mean

Ewuola et al. (2011) for rabbits fed diets containing prebiotics, probiotics and synbiotics The values for EE were 24.38,32.15,25.43 and 29.66% for T1,T2,T3 and T4, respectively.T1 had the least value which was significantly ($p>0.05$) lower than T2,T3 and T4. The range of values (24.38- 32.15) obtained for EE digestibility in this study is comparably lower than the values (65.94-74.64) reported by Evans et al. (2023) for rabbits fed diets containing sundried cassava peel. The crude protein values were 89.15, 87.68, 88.49 and 90.97% for T1, T2, T3 and T4, respectively. CP value was significantly ($p<0.05$) higher in T4 but significantly ($p>0.05$) lower in T2. The values obtained in this study for CP digestibility (87.68-90.97) is higher than the values (69.91-75.93) obtained by Ewuola *et al*..(2011)

for rabbits fed diets containing prebiotics, probiotics and synbiotics. The CP digestibility value in the study is also comparatively higher than the values (78.30-80.36) obtained by Evans *et al*. (2023) for rabbits fed sundried cassava peel meal based diet. The DM values were 0.01%, 0.23%, 0.29% and 0.09% for T1, T2, T3 and T4 respectively. The digestiblity of dry matter in this study was statistically different in all dietary groups. DM values were significantly ($p<0.05$) higher in rabbits fed BDRSM and FDRSM compared to those fed TDRSM and the control diet. The values obtained for NFE were 65.04%, 62.22%, 74.37% and 83.86% for T1, T2, T3 and T4 respectively. There were significant ($p<0.05$) difference among the treatments. T4 was significantly ($p<0.05$) higher than T1, T2 and T3. The result of NFE realized in this study is comparatively higher than the NFE of prebiotics, probiotics and synbiotics of range 41.44-73.32% reported by (Ewuola et al., 2011).
Table 3: Nutrient Digestibility of Rabbits fed differently processed *Delonix regia* seed meal.

CONCLUSION

It was revealed that inclusion level of 15% for fermented, boiled and toasted DRSM brought about a positive result in terms of nutrient utilization of rabbits.

RECOMMENDATION

Based on the outcome of this study, it is therefore recommended that: *Delonix regia* seed meal should be toasted before it can be included in diets meant for rabbits.

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