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Nutrient Composition of African Breadfruit (*Treculia africana*) Seed Hull and its Use in Diets for the African Giant Land Snail, *Archachatina marginata*

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Abstract: A feeding trial was conducted to evaluate the use of *Treculia africana* seed hull meal (TASHM) as replacement for maize in diets for the African giant land snail, *Archachatina marginata*. Seeds of *T. africana* were parboiled, dehulled, milled and used to replace maize at 0%, 15%, 30% and 45% (diets I, II, III and IV, respectively) in isoproteic diets (20% crude protein). Juvenile *A. marginata* (n = 36; 30±1.5 g) were randomly grouped into three snails per group for the three replicates of each diet treatment and stocked in cages. The diets were fed to snails once daily at 2% body weight per day for 70 days. Performance of snails was based on body weight gain, shell length, shell width, shell aperture increase and survival. No mortality was recorded. Mean body weight gain of the snails fed diet III was highly influenced ($p<0.05$) than the mean body weight gain of snails fed the other diets (I, II, and IV). Mean body weight gain of snails fed diets II and IV was similar ($p>0.05$) while the mean body weight gain of snails fed diet I had significant difference ($p<0.05$) with the snails fed diets II and IV. However, no significant difference ($p>0.05$) existed between the feed conversion ratio of the snails on the diets. The effect of the diets on the morphological parameters of snails did not differ significantly ($p>0.05$).

Key words: *Treculia africana,* maize, snails, tropical rainforest zone

Introduction

Archachatina marginata is an herbivorous land snail and a non-selective scavenger which dwells in the forest litters of the tropical rainforest zone in Nigeria (Adedire *et al*., 1999). Feed accounts for the highest proportion of the floating input. Survival and well being of any confirmed animal depend greatly on the availability of acceptable and balanced food material. In minimizing cost of feeding and providing steady food supply to the animals under captive rearing, locally available feedstuffs should be identified, harnessed and utilized. Farmers usually discard various locally available feedstuffs with great potentials for animal feed annually. Among these feedstuffs include cocoa pod hull, cowpea seed husk, cowpea seed hull, African breadfruit bract, and African breadfruit seed hull. For sustaining and achieving the goal of *A. marginata* farming in this part of the world the suggestion of Ademosun and Imevbore (1988) that consideration should be given to the use of several feedstuffs that are not normally competed for by other livestock has to be utilized. In this study the nutrient value of *T. africana* seed hull meal (TASHM) was evaluated for optimum yield of *A. marginata*.

Materials and Methods

Preparation of *T. africana* seed hull meal: African breadfruit seeds were manually separated from three freshly plucked African breadfruit heads of diameter 15 cm each. The seeds of approximately 6.5 kg were par boiled for 25 minutes, poured in a sieve of 7 mm to drain the hot water used in parboiling. The seeds were immediately de-hulled with grinding machine. The hull was then separated from the seed by winnowing. The hull was sun dried at 28°C for two days to moisture content of about 12% and milled into fine powder and was used to replace maize meal at 0%, 15%, 30%, and 45% in the experimental diets.

Diets preparation: The ingredients (Table 1) were processed and obtained in a powdered form and mixed thoroughly. Hot water was added in order to blend the mixture into paste and pelleted using Hobart A-200 pelleter. The diets were sun-dried at 28°C for three days and each separately packed in polyethylene bags and stored at ambient temperature.

Feeding trials: Proximate composition of TASHM and *A. marginata* were conducted using AOAC (1990) methods. Mineral content of TASHM were determined using an atomic absorption spectrophotometer at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. Juvenile *A. marginata* (n = 36; 30±1.5 g) were procured from nearby farms and transported to the domestication unit of the Department of Fisheries and Wildlife, Federal University of Technology, Akure; acclimated for three days and later distributed into triplicate wooden cages (60 cm x 45 cm x 45 cm). The wooden cages were raised 10 cm above the ground and the top covered with lids made of wood-framed chicken wire mesh. The cages were filled with loamy soil up to 15 cm thickness. The snails were fed at 2% body weight daily at 1800 h for 70 days. Individual weighing of the

Table 1: Ingredient and proximate composition (g/100g) of diets

Ingredients	Diet I	Diet II	Diet III	Diet IV
Groundnut cake (48% cp)	8.4	8.4	8.4	8.4
Blood meal (80% cp)	15.0	15.0	15.0	15.0
Maize meal (9% cp)	42.0	35.7	29.4	23.1
TASHM (6.1% cp)	0	9.6	19.0	28.5
Oyster shell	10.0	10.0	10.0	10.0
Maize offal	17.6	14.3	11.2	8.0
Palm oil	5.0	5.0	5.0	5.0
Vitamin premix	2.0	2.0	2.0	2.0
Proximate composition				
Moisture	7.5	8.1	7.9	7.6
Crude protein	20.9	21.0	20.7	21.2
Crude lipid	7.7	8.3	8.7	9.3
Crude fibre	1.9	2.2	2.8	3.0
Ash	12.6	11.5	11.3	12.3

Table 2: Proximate and mineral composition of TASHM

Proximate	(g/100g)
Moisture	15.3
Crude protein	6.1
Crude lipid	2.4
Crude fibre	36
Ash	5.2
Minerals (mg/kg)	
P	0.53
Na	40.79
K	0.58
Ca	0.87
Mg	0.17
Fe	561.94
Cl	0.17
Mn	49.77
Cu	53
Zn	34.59

Table 3: Growth, nutrient utilization and carcass composition of *A. marginata* fed different dietary levels of TASHM for 70 days

		Diet I	Diet II	Diet III	Diet IV
Initial weight (g)		34.5^{a}	34.5^{a}	34.5^{a}	34.6^{a}
Mean final weight (g)		78.6^{a}	87.3^{b}	108.5^{c}	85.3^{b}
Mean weight gain (g)		44.1^{a}	52.8^{b}	74.0^{c}	50.7^{b}
Daily weight gain (g)		0.63^{a}	0.75^{b}	1.06^{c}	0.73^{b}
Feed intake (g)		849.0	956.4	983.0	975.0
Initial mean shell length (cm)		6.6^{a}	6.6^{a}	6.6^{a}	6.6^{a}
Final mean shell length (cm)		8.0^{a}	8.1^{a}	8.6^{a}	8.1^{a}
Initial mean shell width (cm)		4.2^{a}	4.1^{a}	4.1^{a}	4.2^{a}
Final mean shell width (cm)		4.8^{a}	5.0^{a}	5.4^{a}	5.0^{a}
Initial mean shell aperture (cm)		4.7^{a}	4.7^{a}	4.7^{a}	4.7^{a}
Final mean shell aperture (cm)		5.3^{a}	5.5^{a}	5.9^{a}	5.7^{a}
Mortality %		0.0	0.0	0.0	0.0
FCR[1]		1.2^{a}	1.2^{a}	1.0^{a}	1.2^{a}
PER[2]		3.6	2.6	3.4	2.6
	initial	Diet I	Diet II	Diet III	Diet IV
Dry matter	94.1	88.9	88.5	90.1	89.7
Crude protein	45.6	58.0	66.4	67.7	62.9
Crude lipid	6.4	7.0	7.9	7.6	6.3
Ash	4.8	4.1	5.9	4.2	4.2

Values on the same row with similar alphabets are not significantly ($p>0.05$) different.

[1] Feed conversion ratio = dry weight of feed fed/snail weight gain

[2] Protein efficiency ratio = snail weight gain/protein fed

snails was carried out weekly using beam weighing balance. Diets were adjusted after weighing to accommodate weight changes. The diets treatments were control diet (diet I), 15% maize replacement (diet II), 30% maize replacement (diet III) and 45% maize replacement (diet IV).

Statistical analysis: Data obtained from the study were subjected to analysis of variance (ANOVA) test (Steel and Torrie, 1980). Where significant differences existed, treatment means were separated using Duncan Multiple Range Test (DMRT) (Duncan, 1955).

Results and Discussion

The proximate and mineral composition of TASHM are presented in Table 2, and showed that it is a good source of minerals especially iron (Fe) that is required for formation of haemoglobin in animals for resistance of foreign bodies as well as active function of the animal in question. Various studies have revealed that *A. marginata* accepts and utilizes artificial diets for meat yield (Uga, 1989; Amubode and Ogogo, 1994; Ejidike 2001; 2004). During the study, there was no snail mortality. Daily weight gain (DWG) ranges from 0.63-1.06 g indicating that the nutrients and minerals contents of TASHM were well absorbed and utilized optimally for better conversion into animal flesh.

The results obtained on the growth performance of snails fed diets containing different levels of TASHM are presented in Table 3. The body weight gain and the morphological parameters (shell length, shell width, shell aperture) increase of snails on diet III were highly influenced ($p<0.5$) than the snails on the other diet treatments. The values from snails fed on diet I (control) was significantly ($p<0.5$) lower than the snails fed on the other diets treatments. The daily weight gain (DWG) (0.6-1.1g) of the snails fed on diets containing TASHM compared more favorably to *A. marginata* fed on the diet I and was also better than DWG values (0.4-0.6g) of *A. marginata* fed on different crude protein diets (Ejidike, 2004). This better performance might be due to the superior mineral contents of the TASHM, the protein content (6.1%) being lower than that of maize (9.0%).

These performances prove TASHM to be a good agricultural by-product/feedstuff in the nutrition of *A. marginata*. It is known that diets formulated for animals using agricultural by-products and wastes have great potentials in providing adequate feed at reduced cost. The mean value of feed conversion ratio (FCR) of 1.0 being the optimum diet for animal growth in this study is similar to the value of 1.02 reported by Ejidike (2004) on *A. marginata* hatchlings fed 25% crude protein diet.

From this study it could be stated that TASHM is a suitable substitute for maize in *A. marginata* diets. There is presently no known competition in its usage unlike maize, which is staple food in this part of the world and

it is being competed for human consumption, industrial, and livestock feed industry making it quite costly for the use of the average snail farmer.

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