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Impact of Artificial Diet on Captive Rearing of African Giant Land Snail *Archachatina marginata* Pulmonata: Stylommatophora

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Abstract

The effect of 25% crude protein diet, green papaw (Carica papaya) *leaves or 25% crude protein diet plus green papaw* (Carica papaya) *leaves (ratio 1:1) on the African giant land snail's* (Archachatina marginata) *growth performance and survival were studied for over 180 days. The study diet treatments were designated treatment I - III respectively. The* Archachatina marginata *were stocked five snails per replicates of nine for the three treatments in wooden cages raised 10cm above the ground; and fed 2% body weight/day. The* Archachatina marginata *fed on treatments 1 and 11 had similar ($p>0.05$) body weight gain. The body weight gain of* Archachatina marginata *fed on treatment 111 was significantly influenced ($p<0.05$) more than those on the treatments I and II. The morphological parameters (shell, length, shell width, shell aperture) followed the same trend of significance as body weight.*

Key words: *African Giant Land Snail, artificial diet, captive rearing.*

Introduction

Food accounts greatly for the survival and multiplication of animals under captive rearing. The fact that *A. marginata* is a seasonal animal in the wild coupled with the seasonal occurrence of its natural food mostly plant materials have stimulated strong research interest aimed at exploiting different locally available feedstuffs in formulating and preparing diet for the animal. *A. marginata* is a mollusc which thrives well in humid terrestrial environment unlike many other molluscs which are completely aquatic. It accepts and utilizes various plant food materials as well as artificial diets (Imevbore and Ajayi, 1993; Ejidike, 2001). However, farming of this animal in the tropics is facing a lot of challenges partly due to scarcity of its natural plant food during the dry season whereas its demand in both local and international markets is increasing rapidly. Artificial diet that aids the growth of *A. marginata* is believed to have potentials in increasing the yield of the animal under large scale farming when incorporated. Ejidike (2004) stated that food plays a vital role in the survival, growth and reproduction of cultivated animals; it is therefore, advisable for the farmers to give adequate attention to food supply needs of their snails for maximum and sustainable production of the animal. *Carica papaya* leaves (papaw) have been reported by various authors for optimum growth performance of *A. marginata* (Koudanda and Ehouinson 1995; Stievenart, 1996) and is considered for the purpose of this study as a good comparison as well as supplement with 25% crude protein diet deserving of appropriate evaluation. Successful use of artificial diet might

stimulate interest and increase the number of farmers that would invest on *A. marginata* in West Africa being sure of having its food readily and locally available. This study therefore, aims at investigating the effect of artificial diet, green papaw plant leaves fed singly or supplementing artificial diet with green papaw leaves on growth performance of *A .marginata*.

Materials and methods

Forty-five juvenile *A. marginata* (10±1g) hatched in the Teaching and Research Snail Farm in Department of Ecotourism and Wildlife Management, Federal University of Technology, Akure in Nigeria were used in this study. The juveniles were randomly grouped into three and assigned to the treatments as Treatment I (25% crude protein diet), Treatment II (green papaw (*Carica papaya*) leaves), Treatment III (25% crude protein diet + green papaw (*Carica papaya*) leaves - ratio 1:1). Each treatment was replicated thrice. The juvenile *A. marginata* were stocked in cages (1m x 0.6m x 0.45m) constructed of wooden frame and chicken wire mesh (2mm diameter). Each cage was raised 10 cm above the ground with four wooden legs. The 25% crude protein diet was formulated and prepared using locally available feedstuffs (Table 1) the diet was pelleted, sun-dried, packed in polyethylene bags and stored in room temperature for subsequent feeding of the experimental *A. marginata*. Green pawpaw (*Carica papaya*) leaves were harvested daily from the University farms and vicinity. The studied *A. marginata* were fed with their respective treatment's diet at 2% body weight once daily at 1800 hours for 180 days. The *A. marginata* were also observed daily and their survival noted. The *A. marginata* in each of the experimental cages were individually weighed bi-weekly and their ration adjusted accordingly. The *A. marginata* shell length, shell width, shell aperture were measured using a sliding calliper. At the start and at the end of the feeding trial *A. marginata* was randomly taken from the treatments, killed and used to determine carcass composition using AOAC (1990) methods.

Data collected on the growth performance indices were subjected to analysis of variance (Steel and Torrie, 1980) and the means were separated using Duncan's Multiple Range Test (Duncan, 1955).

Table 1: Feed formulation (g/100g) and proximate composition (g/100g) of the artificial diet.

Ingredient	%
Groundnut cake	11.0
Blood meal	18.0
Yellow maize	43.0
Brewer's waste	10.0
Red palm oil	5.0
Oyster shell	10.0
Vitamin premise	3.0

Proximate Composition	
Moisture	7.6
Protein	24.9
Crude fibre	3.7
Crude fat	4.3
Ash	9.6

Results and Discussion

Throughout the feeding trial all the *Archachatina marginata* on the diet treatments fed actively and hundred percent survival of the animals was recorded in all the treatments. These indicate that the treatment diets were highly acceptable and well utilized by the snails used in this experiment. The growth response of the *A. marginata* fed with the diet treatments is shown in Table 2. The daily weight gain of the *A. marginata* ranges from 0.47g to 0.72g in the treatments indicating that the nutrients in the diets were of good quality for *A. marginata* body weight gain. *A. marginata* fed treatments I and II had similar ($P>0.05$) body weight gain. The non-existence of significant difference ($P>0.05$) between the *A. marginata* fed on these diet treatments indicate that *A. marginata* optimally utilised the artificial diet as it does the green *Carica papaya* leaves. However, the body weight gain of the *A. marginata* fed on treatment III was highly influenced ($P<0.05$) than the *A. marginata* fed on treatments II and I. This significant difference ($P<0.05$) in body weight gain might be as a result of the fact that the sources of the nutrients utilised by the *A. marginata* are from plant material (natural food) and artificial diet thereby providing optimum nutrients and choice of selecting either artificially prepared diet or natural food to the snails. This finding supports the report of Ejidike and Afolayan (2000) that supplementing natural food with artificial diet gives fast growth in *A. marginata*. It is observed from Fig. I that from the 14th day of the feeding trial, treatment III proved to be relatively the best diet for optimum body weight gain of *A. marginata*. The morphological parameters (shell length, shell width, shell aperture) of the *A. marginata* in all the diet treatments were influenced by the diet treatments. However significant difference ($P<0.05$) existed between the morphological parameters of *A. marginata* on treatment III and the other treatments. This proves the diet treatment to have affected the entire body of the *A. marginata*.

The positive effect of 25% crude protein diet on both body weight gain and morphological parameters increase suggests that artificial diet, when properly formulated and prepared is suitable in feeding *A. marginata* under captive rearing. The 25% crude protein diet is also being proved suitable protein level hence it compares favourably with *Carica papaya* that various authors reported to be the plant leaves that performs optimally in terms of growth of *A. marginata* (Koudande and Ehouinsou, 1995; Stievenart, 1996).

The nutrient utilisation indices presented in Table 2 indicate that utilisation of the nutrients in Treatment III by *A. marginata* was more than for each of the other treatments and this was reflected on the body weight gain of the animal. The *A. marginata* fed 25% crude protein diet plus *Carica papaya* leaves (Treatment III) had highest body protein retention (Table 3). This could be due to the fact that the nutrients contents in the diet and *Carica papaya* leaves are more balanced than when fed singly as in treatments II and I. These findings agree with those of Calow (1970) and Van der Steen *et al.* (1973) that the food choices of terrestrial gastropods are influenced by the qualitative composition of the food and its quantitative availability as well as by the nutritional needs of the gastropods.

From these findings it might be stated that artificial diet could play a vital role in aborting snail's plant food scarcity due to seasonal nature of its plant food material. And it as well seems to have high potential for mass production of African giant land snail (*A. marginata*) for augmenting animal protein supply in the diet of the people of not only Nigeria but throughout West Africa.

Conclusion

From these results, it could be deduced that properly formulated and prepared artificial diet would provide constant supply of the animal feed as well as high potential for mass production of the African giant land snail (*A. marginata*) thus overcoming the seasonality of its occurrence which is associated with seasonality of its food.

Table 2: Growth performance and nutrient utilisation of *A. marginata* fed on 25% crude protein diet, green *Carica papaya* leaves or 25% crude protein diet plus green *Carica papaya* leaves.

	Treatments		
	I	II	III
Average initial weight (g)	10.0 ± 0.1^{a}	10.0 ± 0.1^{a}	10.0 ± 0.1^{a}
Average final weight (g)	85.9 ± 0^{3a}	94.2 ± 0.2^{a}	130.8 ± 0.3^{b}
Average weight gain (g)	75.9^{a}	84.2^{a}	120.8^{b}
Average daily weight gain (g)	0.48	0.52	0.72
Average initial shell length (cm)	3.6 ± 0.1^{a}	3.6 ± 0.1^{a}	3.6 ± 0.1^{a}
Average final shell length (cm)	7.8 ± 0.2^{b}	8.2 ± 0.2^{b}	9.9 ± 0.2^{c}
Average initial shell width (cm)	2.8 ± 0.1^{a}	2.8 ± 0.1^{a}	2.8 ± 0.1^{a}
Average final shell width (cm)	5.4 ± 0.1^{b}	5.6 ± 0.1^{b}	6.9 ± 0.1^{c}
Average initial shell aperture (cm)	2.6 ± 0.1^{a}	2.6 ± 0.1^{a}	2.6 ± 0.1^{a}
Average final shell aperture (cm)	4.9 ± 0.2^{a}	5.0 ± 0.2^{a}	5.2 ± 0.1^{b}
Survival %	100	100	100
Feed conversion ratio (FCR)	2.9	2.7	1.4
Protein efficiency ratio (PER)	0.7	1.0	1.5

a, b, c, ….average followed by the same superscript are not significantly different ($p>0.05$)

Table 3: Carcass proximate composition of the *A. marginata* fed the diet treatments

	Initial	Treatments		
		I	II	III
Moisture	7.1	7.2	7.1	7.4
Crude protein	56.0	70.7	71.5	74.1
Lipid	1.1	6.8	7.1	7.4
Ash	6.7	6.2	5.4	6.4

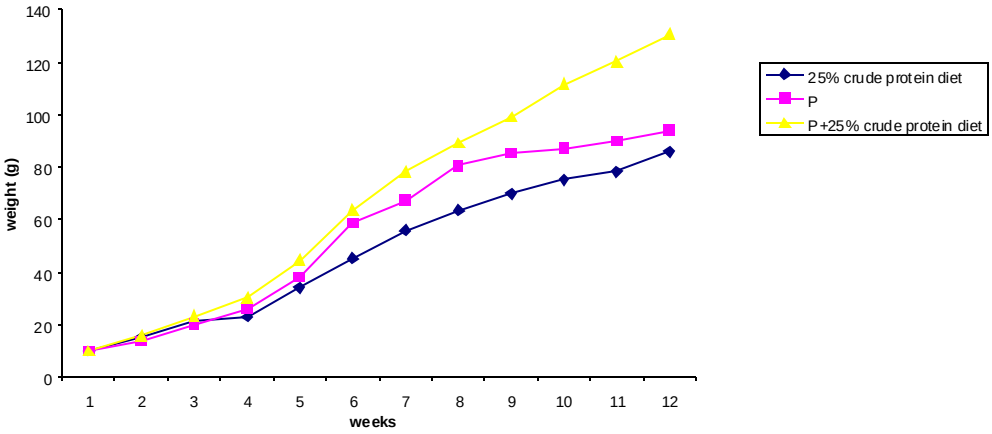

fig 1 pattern of growth of A marginata fed artificial and natural diets

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