MEDWIN PUBLISHERS
Committed to Create Value for Researchers

Journal of Ecology and Natural Resources
ISSN: 2578-4994

Growth Performance of African Giant Land Snail Archachatina Marginata Fed Varying Dietary Protein Levels of Plant Source

Ogunyemi OO*

Department of Forest Resources and Wildlife Management, Ekiti State University, Nigeria

***Corresponding author:** Ogunyemi OO, Department of Forest Resources and Wildlife Management, Ekiti State University, Ado-Ekiti, Nigeria, Email: olumideogunyemi80@yahoo.com

Research Article

Volume 5 Issue 1

Received Date: December 14, 2020

Published Date: February 01, 2021

DOI: 10.23880/jenr-16000226

Abstract

The effects of isocaloric plant protein diets on the growth performance of African giant land snail *Archachatina marginata* were investigated for 28 weeks. A total of 120 juvenile *A. marginata* snails were used. Ten snails were randomly assigned to each of the four experimental diets containing 12%, 14%, 16%, and 18% crude protein from plant source respectively. Each diet constitutes a treatment and each treatment was replicated three times with 10 snails per replicate. Data on growth parameters were collected bi-weekly. Results showed that the performance of snails fed was significantly ($p<0.05$) influenced by levels of dietary protein. The snail fed with 16% level of crude protein had the highest final somatic body weight (42.6g) and the superior feed conversion ratio (2.35) while beyond 16% level of crude protein the growth response declined. It was evident from this study that *A. marginata* snails fed 16% crude protein of plant source were the best in growth performance and that snails could be raised on diets comprising of crude protein exclusively from plant source.

Keywords: Growth Performance; Experimental Diet; Feed Conversion Ratio; Crude Protein

Introduction

Snail farming has become an interesting venture in Nigeria. The relatively low capital in setting up the business coupled with low fat and cholesterol content of snail carcass has made farming of snails a promising one. Among the various challenges facing intensive snail farming is the slow growth which could be attributed to unfavorable weather condition, genetic makeup, stocking density and nutrition [1]. Nutrition in particular has been identified to be one of the major factors that affect the growth performance of snail especially under captive condition [2]. The biology and plant food preferences of Archachatina marginata have been thoroughly studied and in the recent times the introduction of compounded rations into the nutrition of captive snails with a view to provide steady snail food supply especially during dry season for consistent snail farming as well as providing rations for optimal snail growth has stimulated increase interest toward the rearing of captive snails in Nigeria. Ejidike [3] previously demonstrated that practical snail diets based on natural foods could be further improved by balanced formulated feeds with varying level of crude protein at different stages of life. Ogunyemi [4] reported that production of land snails can be made sustainable only when the nutritional requirements are known and compressed into nutritionally balanced formulated feeds for snails at different stages of life. Protein has been observed as the most expensive component in supplemental animal feed; therefore the investigation of dietary protein requirement of Archachatina marginata juveniles is paramount using locally available plant ingredients. The experiments reported here were conducted to evaluate the response, in term of growth performance of Archachatina marginata fed with diets of different percentages of crude protein from plant source.

Materials and Methods

The study was carried out in Ekiti State University Teaching and Research Farm, Ekiti State, Nigeria. The university is located within the tropic and lies between longitude 7^0 42' 9'' and latitude 5^0 16' 19''. The prevailing climate is tropical with an average temperature of 25^0C all year round and high relative humidity. Ecologically, it lies in the lowland rainforest with mean annual rainfall which varies between 1250mm to1400mm across the state. The pattern of rainfall distribution is unimodal with a long rainy season between April and mid- November with a peak in September while dry season stretches from mid- November to the end of March.

The snail farm has an area of $144m^2$ and each of the experimental treatment units were located under half walled roofed enclosure, protected from adverse weather. There were Paw-paw, Plantain, Orange trees and other woody plants around the farm to create microclimate for snails as prescribed by Cobbinah [5]. During the study, intensive system of snail rearing was employed and food, water were administered to the snails in a close system during the study.

Juvenile snails numbering one hundred and twenty (120) with an average weight of 12±4.1g were purchased, acclimatized and fed regularly with various food items for four consecutive days before the commencement of the experiment. Twelve (12) snail pens were prepared, labeled with different alphabet for identification. The treatment pens were labeled thus: 12% Crude Protein Feed trial, (Treatment A), 14% Crude Protein Feed trial (Treatment B), 16% Crude Protein Feed trial (Treatment C) and 18% Crude Protein Feed trial (Treatment D). The treatment pens were filled with hot water sterilized soil, rich in humus to a depth of 5cm to serve as bedding media for the snails and the soil was replaced with sterilized soil every 3 months to prevent excessive contamination with snail droppings and mucus secretions. At the commencement of the experiment, the initial weight of the snail was determined with a sensitive balance scale. One hundred and twenty (120) snails were allotted at random to each of the 12 pens and were subjected to four treatments in replicates of 10 snails per each of the three replicates to study the growth performance of juvenile *A. marginata* fed on isocaloric diets with varying percentages of crude protein (12%, 14%, 16%, and 18%) from plant source. The trial diets were formulated using locally available feed ingredients procured from a reputable farm. The snails were fed once daily at 2% body weight at 1800hours in each of the treatments and later adjusted in accordance with increment in the somatic weight of the snails. The growth parameter of snails on different feeding trials was measured bi- weekly for 28 weeks of the growth experiment. Proximate analysis of the trial diets were carried according to A.O.A.C [6] was subjected to one-way analysis of variance Steel and Torrie [7] and Duncan's Multiple Range Test Duncan [8] when required.

Results and Discussion

The ingredient constituents of the formulated isocaloric diets use for the experimental trials are presented in Table 1 while Table 2 shows the proximate composition of the experimental diets. The diet D with 18% crude protein had the highest percentage of lipid content while the lowest lipid content was recorded in diet A with 12% level of crude protein. The lipid content in the experimental diet increases with the level of crude protein. The crude fibre content of the experimental feeds recorded the highest value in diet D with 18% crude protein while the lowest value of crude fibre was recorded in diet A with 12% crude protein. The crude fibre content of the experimental diets was relatively higher in diet D with 18% crude protein (3.90 ± 0.04) and diet C with 16% crude protein (3.72 ± 0.09) with the lowest value recorded for diets with 12% and 14% crude protein. The Ash content of the diet had the highest value 9.47 ± 0.01 in diet D while diet A recorded the lowest value of 8.37 ± 0.01. The performance (final weight, average weight gain and daily weight gain) of *A. marginata* fed with four dietary crude protein levels are shown in Table 3.

Ingredient/Diet	A (12%)	B (14%)	C (16%)	D (18%)
Yellow maize	82.43	70.71	70.97	65.27
Soya beans	4.57	10.29	16.03	21.73
Wheat offal	10.00	10.00	10.00	10.00
Bone meal	2.00	2.00	2.00	2.00
Vitamin premix	0.50	0.50	0.50	0.50
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25

Table 1: Percentage Composition of Experimental Diets.

There were significant differences ($p < 0.05$) among treatment trials in average final somatic body weight. It was observed from the result that diet C performed best with the highest average final body weight. This is followed by diet D with 18% level of crude protein while the least body weight gain was recorded in diet A with 12% level of crude protein. There was significant increase ($p< 0.05$) in the growth and feed conversion ratio (AWG and FCR) up to an optimum of 16% crude protein level and beyond which growth response declined. The growth data vividly revealed the declination in the growth response at 18 % level of crude protein. The highest percentage weight gain of 178.4 percent was observed in snail fed diet C (16% CP) while the least percentage value of 121.6 was recorded for snail feed on the experimental diet A (12% CP) level. The statistical evaluation of the percentage weight gain of group of snails fed revealed that, differences in the percentage weight gain among treatments were significant ($p<0.05$).

Parameters/Diets	12% (Diet A)	14% (Diet B)	16% (Diet C)	18% (Diet D)
Dry matter	88.74	89.61	89.50	88.70
Ash	8.37	9.26	9.40	9.47
Crude Protein	12.14	14.11	16.08	18.16
Crude fibre	3.61	3.67	3.82	3.90
Crude fat	3.47	3.49	3.53	3.59
Carbohydrate	57.63	57.65	57.64	57.67

Table 2: Proximate Composition of Experimental Diets.

	Treatments			
Parameters	A	B	C	D
Mean Initial Weight (g)	15.3^{a}	15.2^{a}	15.3^{a}	15.4^{a}
Mean Final Weight (g)	33.9^{a}	36.8^{b}	42.6^{c}	39.8^{d}
Percentage Mean weight (%)	121.6	142.1	178.4	158.4
Total food supply (g)	100	100	100	100
FCR	2.95	2.72	2.35	2.51

Means with different superscripts are significantly different ($P< 0.05$).

Table 3: The Performance of Growing *A. marginata* snails fed varying dietary crude protein level.

Discussion

The growth performance of *A. marginata* snails fed with the different levels of crude protein from plant source is presented in Table 2. The initial body weight of the experimental snails recorded no significant differences at $p>0.05$. The mean final body weight and percentage mean weight of snails fed with varying levels of crude protein were significantly increased and performed best with feed of 16% crude protein and this is followed by diet D with 18% level of crude protein. The significant variation in growth parameters of the snails which may be attributable to differences in crude protein levels, since the initial weight of the experimental snails were not significant and similar feeding regimes were used in the study. This agrees with the findings of Imevbore and Ajayi [9] that snail grows and performs optimally on compounded ration of high crude protein content. The differences shown in the growth parameters could be further attributed to variations in the protein levels of the feeds which were in conformity with the findings of Ejidike [1] who had earlier reported that variation in dietary levels of protein affects the growth responses of juvenile snails. The observation of significant increase in the growth performance and feed conversion ratio up to an optimum of 16% crude protein level and beyond which growth response declined may be linked with the imbalance in calorie to protein ratio. Jackson [10] reported the side effects of imbalance calorie to protein ratio in the diets of animals. He further reiterated that high protein to low energy level in formulated feeds slow down the growth rate of animals. Hodasi [11] discovered that snail utilize balanced protein and energy rich diets for optimal growth in captivity. Visual observation of the experimental snails fed on diets of lower percentage of crude protein did not revealed any form of morphological symptoms of nutritional deficiency except for reduced growth response. However with respect to the high performance of diet C with 16% crude protein, it my strong believe that the diet produced a good combination of metabolizable protein and energy requirements for juvenile snails without utilizing the protein requirement for energy

generation. Food conversion ratio (FCR) was superior for *A. marginata* snail fed diet C with 16% crude protein with mean food conversion ratio of 2.35 compared with those fed with other dietary treatments (2.95, 2.72, and 2.51, Trt. A, Trt. B and Trt. D respectively). The nutritious composition of diets A and B with 12% and 14% crude protein may be inadequate for the snails to meet their optimal growth requirements while the food conversion ratio of diet D with the highest (18%) level of crude protein may be as a result of imbalance in the calorie to protein ratio. The outcome of the trials shows that the somatic body weight which were higher for snails fed with diet comprising of 16% crude protein had better food conversion ratio than the rest of the experimental feeds fed to the that snails which indicate maximum nutritional derivation from combination of ingredients that produce feed with 16% crude protein and 3141.04kcal/kg. This result is in agreement with the findings of Ejidike and Afolayan [12] that formulated concentrate fed to snails' impact positively on the growth performance and sensory properties of snail species. The results of this study obviously showed that the higher the percentage of crude protein with commensurate energy requirements of snail, produces higher progression of weight gain.

Conclusion

Archachatina marginata cultural characteristics have made it the object of interest in mini livestock farming in Nigeria. The growing advancement in its farming has necessitated increase interest in nutritional requirements at lower stages of life. The results obtained from this study has been able to make it evident that increment in the level of crude protein from exclusive plant source with commensurate energy level to a point increased the average weight gain of juvenile African giant snails.

References

1. Ejidike BN (2001) Dietary protein requirements of the African giant land (*Archachatina marginata*). Journal of Applied Tropical Agriculture 6: 111-115.

2. Akinnusi O (2002) Comparative evaluation of fresh fruits leaves and concentratre feed on the growth and reproductive performance of the African land snail (*Archachatina marginata*). Proceedings of the 27th Annual Conference of the Nigerian Society of Animal Production (NSAP), Federal University of Technology, Akure (FUTA), pp: 328-320.

3. Ejidike BN (2016) Growth Response of African Giant Land Snail *Archachatina marginata* Fed on Single Plant Leaves or the Leaves Supplemented with Diet of 25% crude Protein. International Journal of current Microbiology and Applied Sciences 5(5): 934-939.

4. Ogunyemi OO (2019) Growth Performance of Juvenile African Giant Land Snail (*Archachatina Marginata)* fed on Different Natural Plant foods. Proceedings of 3rd Annual Conference of Wildlife Society of Nigeria. Ibadan, Nigeria, pp: 62-83.

5. Cobbinah JR (2008) Snail farming in West Africa. A practical guide. Ibadan, Oyo, Nigeria: C.T.A Publication

6. AOAC Association of Official Analytical Chemists (1990) Official methods of analysis. 18th (Edn.), Washington (DC): AOAC.

7. Steel RGD, Torrie JH (1980) Principles and procedures of Statistics. 2nd (Edn.), New York: Mc Graw- Hill.

8. Duncan DB (1955) New Multiple Range Test. Biometrics 11: 1-42.

9. Imevbore EA, Ajayi SS (1993) Food preference of the African giant land snail (*Archachatina marginata*) in captivity. African Journal of Ecology 31(3): 265-267.

10. Jackson S, Summer JD, Leeson S (1982) Effects of dietary protein and energy on broiler performance and production costs. Poultry Science 61(11): 2232-2240.

11. Hodasi JK (1986) Some observation on edible land snail of West Africa. World animal Review 52: 198-217.

12. Ejidike BN, Afolayan TA (2010) Effect of natural and compounded ration on growth performance of African giant land snail (*Archachatina marginata*). J Res Wildlife Environs 2(1): 107-111.