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Assessment of Growth Rate of Juvenile African Giant Land Snail, *Archachatina marginate*, Under Three Feeding Treatments

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Abstract This study assessed the growth rate of snailets of *A. marginata* under three feed treatment. Ninety snailets divided into thirty snailets per treatment were used for the study. Data collected include Shell Length, Shell Width, Aperture Length and Weight gained. The results indicate that Treatment C (T_C) had the highest value for all the growth parameters assessed, while Treatment A (T_A) had the least values. The mean Weight gained varied between 16.01±1.92g (T_C) and 12.55±0.90g (T_A) and was significantly different between the treatments (p<0.01), mean length and shell width varied between T_A (4.24±0.40, 6.50±0.40) and T_C (4.48±0.13, 6.92±0.30) and were not significantly different (p<0.05). The mean mouth aperture of *A. marginata* fed with T_C (4.90±0.19) was greater than and significantly different form T_A (4.35±0.30) and T_B (4.58±0.28) at p<0.05. These findings indicate that local farmers who feed their snailets with only vegetable leaves and fruits obtained locally could obtain mature snails with good weight and shell growth even without combination with any other feed material.
Keywords Growth rate; Snailets; *Archachatina marginata*; Feed treatment; Nigeria

Introduction

Snails reared in captivity are regarded as a mini-livestock (Ukpong et al., 2013). It is a source of protein, income, and employment, hence, a means of poverty alleviation for the rural people. However, due to slow growth rate, prolonged maturity period of 18 months, long incubation period of about 30 days (Awesu, 1980; Ogogo, 1989; Akinnusi, 2004), cannibalism, termites, rodents, soldier ants, shortage of feeding materials and improper watering in dry season (Udedibia et al., 1987; Cobbinah, 1993; Deekar, 1997; Ogogo, 2004; Akinnusi, 2004), successful snail farming has been limited.

In Nigeria and in some West African countries including Ghana, studies have been conducted on the performance of *A. marginata* on compounded rations in with a view to providing steady snail food supply especially during the dry season for consistent snail farming as well as providing rations for optimal snail growth (Awesu, 1980; Ogogo, 1989; Akinnusi, 2004; Ogogo, 2004; Ukpong et al., 2013; Nyameasem and Borketey-La, 2014). Production of *A. marginata* can be sustainable and economical when both qualitative and quantitative feed requirements are known and established. This could be made possible by formulating and preparing of nutritionally balanced and least-cost diets for the snails using locally available ingredients. This study therefore aims at evaluating the growth performance of *A. marginata* hatchlings fed with three different feed materials with a view of making adequate recommendation to farmers to ensure maximization of profit in their business.

Materials and Methods

Study Area

The experiment was carried out in the Snailery Unit of the Department of Forest and Wildlife. University of Uyo Annex, Town Campus, Uyo. Uyo is located on Latitude; 4°58 - 5° 05'N. Longitude 7°45' - 8°00E in Akwa Ibom State, Nigeria with a mean temperature of 29℃, mean rainfall of 3000 mm and a mean relative humidity of 75%. The state is located in the rainforest agro-ecological zone and covers an area of 15,750

hectares (Ukpong et al., 2013).

Procurement and stocking of samples

ninety sample juvenile snails from the snail unit of Akwa Ibom State Agricultural Development Programme (AKADEP), Mbiaobong Etoi, Uyo, Akwa Ibom State and stocked in a concrete pen measuring 2.8 m x 1.5 m x 1 m (length x width x depth). The floor of the pen was filled with sterilized loamy soil collected from the departmental arboretum and the top of the pen was covered with net and mesh wire. They snails were allowed acclimatization period of two weeks. The average temperature, relative humidity and photoperiod during the experimental period (March to June, 2012) ranged from 26 ℃ to 31 ℃, 50% to 70% and 12 to 18 h respectively.

Feed Treatment

Ninety (90) five weeks old snailets obtained from AKADEP were divided into three sets of twenty (30) snailets each and subjected to three different feed treatments (A, B and C) using completely randomized design with three replications. Each snailet was marked using car paint for identification. Individual snails in T_A were indicated using Roman numerals, while T_B where indicated using alphabet are T_C where indicated by number.

The feed treatment in T_A comprised vegetable leaves, fruits, poultry residue, corn mill and soybean residue. T_B comprised corn mill, soybean, fruits and vegetable leaves, while T_C was made of vegetable leaves and fruits only (control).

Data Collection

Data were collected on the early growth rate of the snails fortnightly for four months. The parameters assessed were; weights of snail, length, width and aperture of each snail. The body weights were measured using electronic weighing balance in grams, Shell length **w**as measured along the axis of the snails using the measuring tape to the nearest centimeter, shell width was measured around the largest position of the shell using also the measuring tape to the nearest centimeter and aperture was measured through the opening apex using also the measuring tape to the nearest centimeter.

Data Analysis

Data collected were subjected to analysis of variance (ANOVA) and means separated using least significant difference (LSD) as outlined by Steel and Torrie (1980) and Ukpong et al. (2013) at 5% probability level.

Results and Discussion

Mean weight gain for the sample Snails

The results of growth morphology of the juvenile snailets are shown in Table 1. The result indicates that the mean weight gained by each of snailets where significantly different (p>0.05) for each treatment. Moreover, there was significant difference between the means weight gained. Snailets fed with T_C had the highest weight gain (16.01±1.92 g), followed by T_B (14.45±1.20 g), while snailets fed with T_A had the least weight gain (12.55±0.90). The above mean weight obtained for the feed treatments are higher than those obtained by Ukpong et al. (2013), implying that the present feed gives a better growth rate in terms of weight gained than those used by Ukpong et al. (2013) whose feed treatments indicated a mean weight gain of between 5.86 g and 8.58 g. Also, a correlation of the weight gained and age showed all the three treatments had positive correlation. T_C had the highest correlation coefficient of 0.946 7 and T_A had the least coefficient of 0.654 2 (Figure 1). The

Table 1 Mean growth rate of juvenile snails

Variable	T_A	T_B	T_C	*P* value
Mean weight gained (g)	12.55±0.90c	14.45±1.20b	16.01±1.92a	> 0.05
Mean shell length (mm)	4.24±0.40	4.29±0.30	4.48±0.13	< 0.05
Mean shell width (mm)	6.50±0.60	6.52±0.95	6.92±0.30	< 0.05
Mean mouth aperture (mm)	4.35±0.30c	4.58±0.28b	4.90±0.19a	> 0.05

> = significant at 0.05 probability level, < 0.05 = not significant at 0.05 probability level, mean values with different letters means there is significant difference between them

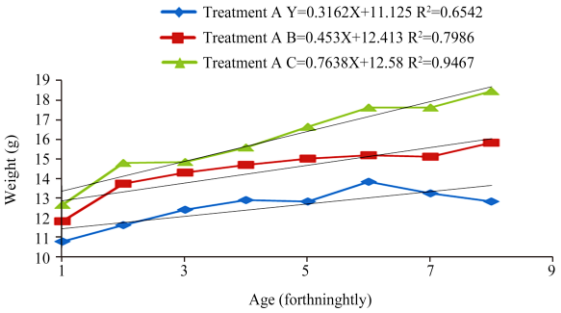

Figure 1 Correlation of weight gained against age

above results indicate the weight gained and shell growth rate were significantly higher for snailets treatment C and lower for treatment A. This could be attributed to the level of nutrients in the feed diets (Nyameasem and Borketey-La, 2014). The higher performance of snailets fed with T_C implies the diet contained the essential nutrient and energy levels and met the snailets optimum requirement for growth (Radrizzani, 1992; Bright, 1996). Nyameasem and Borketey-La (2014) and Ani et al. (2013) observed that decrease in dietary protein below 18% resulted in reduced performance in snails. However, Sang-Min and Tae- Jun (2005), Omole et al. (2000) and Hodasi (1979) reported that a diet containing between 22% to 28% and 2 200 Kcal/kgME - 3.3 Mcal/kgME was optimal for snail growth. The energy content of the compounded diets in the present study could be said to compare favorably with above values.

Shell growth rate of the sample snailetss

Table 1 also indicates the growth response of the snailets to the varying feed treatment. The mean shell length varied between 4.24±0.40cm in T_A, treatment B (4.29±0.30) to 4.48±0.13 cm in treatment C, although they were not significantly different from each other (p>0.05). The same trend was followed by the mean shell width as it from 6.50±0.60cm in T_A to 6.52±0.95 cm in T_B and 6.92±0.30 cm in T_C (p<0.05). There was significant difference between the feed treatments with regards to mean mouth aperture growth (p>0.05). Snailets feed with T_C had the highest mean mouth aperture (4.90±0.19) against 4.58±0.28 observed in T_B and T_A gave the least mouth aperture growth of 4.35±0.30.

The higher shell length, width and aperture increments observed among snailets fed with T_C over T_B and T_A (Table 2, 3 and 4) could also be attributed to the growth performance of the diet which had a high correlation between weight gained (-0.7212), shell width (0.965 6) and mouth aperture (0.958 0). A positive correlation between weight gained, shell length, and shell width has been established growing snails (Odunaiya and Akinnusi, 2008; Ani et al., 2013). The fortnightly range of increment of shell length and width (4.24 to 4.48 and 6.50 to 6.92 mm, respectively) obtained in the present study compares favorably with the values (17.0 to 19.8 and 11.9 to 13.2 mm) reported by Nyameasem and Borketey-La (2014) and above the values (8.77 to 11.4 and 3.67 to 6.60 mm) reported by Omole et al. (2004) for growing snails. Also, the shell mouth aperture for T_C had a correlation with weight gained (-838 1), shell length (0.958 9) and shell width (0.980 8) in Table 4 than T_A (Table 2) and T_B (Table 3). The mouth aperture values compared favorably with the values (4.69±0.11 - 5.07±0.19 cm) obtained by Aluko et al. (2014). The variant in values of measured parameters between the authors and the present study could be attributed to factors such as differences in age of snail, species, management as well as environment.

Conclusion

The growth rate of juvenile snails can be enhanced by the combination of fruits and vegetables, in the absence of corn and soybeans residues as feed ingredient. This will have no adverse effect on the snail growth rate as the combination of fruits and vegetables still contain an appreciable amount of vital ingredients needed by the snailets for growth.

Table 2 Correlation matrix for T_A

	Weight	Shell length	Shell width	Shell aperture
Weight	1.000 0			
Shell length	0.98504	1.0000		
Shell width	0.5899	0.6170	1.0000	
Shell aperture	-0.6212	-0.6056	-0.8662	1.0000

Table 3 Correlation matrix for T_B

	Weight	Shell length	Shell width	Shell aperture
Weight	1.0000			
Shell length	-0.6371	1.0000		
Shell width	-0.3508	0.0014	1.0000	
Shell aperture	-0.6376	0.9930	0.0989	1.0000

Table 4 Correlation matrix for T_C

	Weight	Shell length	Shell width	Shell aperture
Weight	1.0000			
Shell length	-0.7212	1.0000		
Shell width	-0.8436	0.9656	1.0000	
Shell aperture	-0.8381	0.9589	0.9808	1.0000

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