Assessment of Growth Rate of Juvenile African Giant Land Snail, *Archachatina marginata*, 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°C, 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°C to 31°C, 50% to 70% and 12 to 18 h respectively.

Feed Treatment

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

The feed treatment in TA comprised vegetable leaves, fruits, poultry residue, corn mill and soybean residue. TB comprised corn mill, soybean, fruits and vegetable leaves, while TC 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 was 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 snaillets are shown in Table 1. The result indicates that the mean weight gained by each of snaillets where significantly different (p>0.05) for each treatment. Moreover, there was significant difference between the means weight gained. Snaillets fed with TC had the highest weight gain (16.01±1.92 g), followed by TB (14.45±1.20 g), while snaillets fed with TA 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. TC had the highest correlation coefficient of 0.947 and TA had the least coefficient of 0.654 (Figure 1). The

Table 1 Mean growth rate of juvenile snails

| Variable                  | TA              | TB              | TC              | 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
The higher shell length, width and aperture increments observed among snails 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 snails 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        |

Figure 1 Correlation of weight gained against age
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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