



**PERFORMANCE AND ECONOMIC EVALUATION OF AFRICAN GIANT LAND SNAIL  
(*Achatina achatinta*) FED DIFFERENT LEVELS OF WHOLE JACKFRUIT MEAL**

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A study was undertaken to investigate the performance and economic evaluation of the African Giant Land Snail *Achatina achatina* fed different levels of Whole Jack Fruit Meal (WJFM). A total of 120 growing snails of similar weight were used for the study which lasted for 8 weeks. The Snails were randomly allotted to four treatment groups, (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>) with the inclusion levels of Whole jackfruit meal and each of the treatments replicated three times in a CRD experimental design. The jackfruit was sourced from Igbo-Ukwu in Aguata local government area of Anambra state. At the end of the experiment the following growth parameters were evaluated and observation noted; Weight Gain, Average Daily and Total Feed Intake, Shell Length, Shell Aperture, Shell Girth, Shell Thickness, Feed Cost and Feed Conversion Ratio. The finding revealed that the snails fed with WJFM showed a progressive increase in body weight with no significant difference (P>0.05) among the mean body weight at the end of the experiment and also with the Shell Aperture (P>0.05). Increase in Shell Length, Shell Girth and Shell Thickness were all recorded, with significant difference (P<0.05) among treatments. There was also no significant difference (P>0.05) between treatments in Average Daily and Total Feed Intake, Feed Cost/ Weight Gain and the Feed Conversion Ratio (FCR). Thus it can be deduced from the study that farmers may incorporate whole Jackfruit meal based diet on the production of snails since it proved acceptable to snails and at the same time influenced the overall performance of the snails.

**Keywords:** *Achatina achatina*, Whole Jackfruit Meal, Growth Performance.

### **Introduction**

Animal protein is sourced from both macro-livestock such as cattle, sheep, and goats and micro livestock including grass cutter and snails as well as fisheries. Livestock and livestock products are estimated to make up over half of the total volume of agricultural output in the industrialized countries and about a third of the total developing countries (Ejidike, 2002). Livestock provides about 58% of the meat consumption in Nigeria. The major source of animal protein for the Nigerian populace come mainly from livestock in the form of chicken, beef, mutton and pork (Ejidike, 2002). These major sources are being decreased by persistent drought, disease, high cost of feed, primitive animal husbandry techniques and low productivity of local animal breed. The increasing human population increased the demand for protein especially from animal source. This is because the protein consumption in most developing countries is inadequate compared with the developed countries of the world (Omole *et al.*, 2000).



One of the major problems facing the rearing of snails is the formulation of an improved and acceptable diet that will meet the nutrient requirement of snails at low or no cost. Studies suggested the animal protein intake of Nigerians to be low, and this has led to an acute malnutrition amongst the greater percentage of the rural populace. Also Agbogidi and Okonta (2011) reported that the protein consumption in Nigeria is below 67g recommended by the World Health Organization. Since the growth, development and reproduction of an animal are highly dependent on the quality of its feed, there is need undertaking the study on "the growth performance and economic evaluation of Giant African Land Snails (*Achatina achatina*) fed whole jackfruit meal (*Artocarpus heterophyllus*) based diet.

**Materials and methods**

The study was carried out at the Snail and Edible Insect unit of the Teaching and Research farm of the Department of Animal Science and Technology, Nnamdi Azikiwe University, Awka, Anambra State. The location lies between Latitude 6.24°N & 6.28°N and longitude 7.00°E and 7.08°E on the South Eastern part of Nigeria. (Ezenwaji *et al*, 2013).

One hundred and twenty (120) grower snails (*Achatina achatina*) of similar weight were procured from a reputable source at Onitsha, Anambra State. The experimental design was a Completely Randomized Design (CRD), with four treatments of 30 snails per treatment and three replicates of 10 snails.

The snails were fed once a day, in the evenings due to the snail's nocturnal feeding habit. The snails in treatment one (T1) were fed with diet without any inclusion of whole jackfruit meal, those in T2 had 5% level of inclusion of WJM, T3 had 10% level of inclusion of WJM and T4 had 15% level inclusion of WJM as shown in table 1. The feed saucer was cleaned daily before introduction of fresh feed. The soil was pulverized and watered to make it moist. The study lasted for a period of 56 days

The feed intake was measured by subtracting the feed refused from feed offered on daily basis. The shell length and shell girth were measured using Vernier caliper on weekly basis. The shell thickness was measured using a micrometer Screw guage at the beginning and end of the experiment. The shell aperture circumference was measured using a thread and meter rule on weekly basis. The weight gain was measured using a sensitive scale on weekly basis. The proximate analysis to chemically evaluate the nutritional potential of the whole jackfruit meal and experimental diets were determined by the methods of AOAC (2002).

**Table 1: Percent Composition of Feed Ingredients of Snails Fed with Different Levels of Whole Jack Fruit Meal**

<b>Ingredients</b>	<b>T1 (0%)</b>	<b>T2 (5%)</b>	<b>T3 (10%)</b>	<b>T4 (15%)</b>
Maize	49.25	44.25	39.25	34.25
Cassava Flour	11.00	11.00	11.00	11.00
WJPM	0.00	5.00	10.00	15.00
Soybean cake	15.00	15.00	15.00	15.00
Fish meal	3.00	3.00	3.00	3.00
Wheat offal	10.00	10.00	10.00	10.00



Palm kernel cake	3.00	3.00	3.00	3.00
Bone meal	5.00	5.00	5.00	5.00
Limestone	3.00	3.00	3.00	3.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
TM/Vit premix	0.25	0.25	0.25	0.25
Total	100	100	100	100

## Results and Discussions

The growth performance evaluation of *Achatina achatina* is presented in Table 2. There was no significance difference among treatments in the Average Daily (ADI) and Total Feed Intake ( $P>0.5$ ). Although, feed intake as observed in  $T_1$  (0% WJFM inclusion) appears to be moderately high compared to the snails fed WJFM at  $T_2$  5%,  $T_3$  10%, and  $T_4$  15% respectively. The greater feed intake not significant at ( $P>0.5$ ) could be attributed to the greater palatability of the control diet  $T_1$ , to the snails compared to the Whole Jack Fruit Meal diet (WJFM).

The Total Weight Gain (TWG) of the Snails compared to the control diet ( $T_1$ ) did not show any significant difference. Even though the snails consumed more of the control diet  $T_1$ . This findings agrees with Oji, (2000) where he stated that the growth performance of the snails is the measure of increase in body weight over time and largely dependent on the nutrient absorbed by the specific tissues of the body. Even though the snails on  $T_1$  consumed more feed, it may be that the body could not utilize it efficiently. This result may have agreed with this finding that the Whole Jack Fruit Meal at 15% inclusion level ( $T_4$ ) contains nutrient enough to effect changes in the total weight gained by the *A. achatina* snails although not significantly different ( $P>0.5$ ).

This study showed that there was higher Feed Conversion Ratio (FCR) recorded by the snails on  $T_1$  over the snails on  $T_2$ ,  $T_3$  and  $T_4$ , although without significant difference ( $P>0.05$ ). This indicates that the African giant land snail *A. achatina* utilized nutrients in  $T_1$  with 19.63% CP, more effectively. It was observed from the findings that the diet containing lower percentage of Crude Fiber (CF) was found to have higher Feed Conversion Ratio compared to the snails on Whole Jack Fruit Meal (WJFM). This may have attributed to the higher FCR as seen in control diet  $T_1$ . This could also have resulted due to some anti-nutrients found in Jackfruit seed as reported earlier by Ebenebe *et al.*, 2014.

The findings from this study showed a clear difference between the costs of feed per weight gained by the *A. achatina* snails between the treatments with the WJFM diets having lower cost. It was observed that the feed cost per kg weight gain and the cost of feed intake of the snails decreased with increasing level of the Whole Jackfruit Meal (WJFM) in the diets, with snails placed on  $T_4$ , having the least value at ₦28.846/g and ₦14.032 respectively. While those on  $T_1$  cost ₦30.785 per feed intake and ₦129.266/g. This low cost of WJFM based diets could have been as a result of the easy accessibility of the Jackfruit. The finding agrees with Ndyomugenyi *et al.*, 2014 that reported that Jackfruit is readily available in rural areas and will eventually be obtained at low or no cost. The result suggest that the cost of producing snail feed with Whole Jackfruit Meal (WJFM) would be lower to the corresponding body weight gain compared to the control



diet (T<sub>1</sub>), thereby making it more economical in snail farming, since the cost of feed is believed to constitute the greater percentage in livestock production.

**Table 2: Growth performance and cost evaluation of *Achatina achatina* fed whole jackfruit meal based diet.**

Parameters	T1	T2	T3	T4
Average daily feed intake.	0.89 ± 0.40 <sup>a</sup>	0.62 ± 0.36 <sup>a</sup>	0.85 ± 0.37 <sup>a</sup>	0.60 ± 0.35 <sup>a</sup>
Total feed intake	43.67 ± 19.52 <sup>a</sup>	30.13 ± 17.73 <sup>a</sup>	41.57 ± 18.34 <sup>a</sup>	29.23 ± 17.23 <sup>a</sup>
Total weight gain	10.40 ± 6.22 <sup>a</sup>	5.90 ± 0.00 <sup>a</sup>	9.95 ± 0.92 <sup>a</sup>	14.40 ± 0.00 <sup>a</sup>
Average daily weight gain	0.21 ± 0.13 <sup>a</sup>	0.12 ± 0.00 <sup>a</sup>	0.20 ± 0.02 <sup>a</sup>	0.30 ± 0.00 <sup>a</sup>
Initial weight gain	53.15	51.50	56.55	51.80
Final weight gain	63.55	57.40	66.50	66.20
Feed cost per weight gain	31.35	25.08	26.91	8.78
Feed cost	0.17	0.16	0.16	0.15
Cost of feed intake	7.46	4.91	6.44	4.32
Feed conversion ratio	4.20	5.11	4.18	2.03

Rows sharing similar subscript are not significantly [*p* (>0.05)] different from each other

The shell growth Characteristics of *Achatina achatina* fed whole jackfruit meal based diet is shown in Table 3. The Findings from this study revealed that there was significant difference (*P*<0.05) in the total Shell Length Gain (SLG) between the treatments, although, snails in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> were not significantly different from each other. The significant difference (*P*<0.05) as observed in snails fed 15% inclusion of WJFM (T<sub>4</sub>) with the other treatments could be as a result of the balanced mineral bound in the Ash ( Phosphorus and Calcium) necessary for snail shell as well as the Calorie-Protein Ratio (CPR) of the Whole Jack Fruit Meal.

The Shell Thickness (ST) was significantly different (*P*<0.05) between the treatment with the snails on T<sub>1</sub> superior to the other treatments. Even though at 0% and 15% (T<sub>1</sub> and T<sub>4</sub>). The Shell Girth Gain (SGG) was also found to be significantly different (*P*<0.05) between the treatment. On the contrary, the study revealed that there was no significant difference (*P*>0.05) in the Shell Aperture Gain of the snails between T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and the control diet (T<sub>1</sub>). The study also revealed that the Average and the Total Weight Gain, the Shell Length (SL) and the Shell Girth (SG) Gain of snails which consumed the diet containing Whole Jackfruit Meal (WJFM) at 15% inclusion level (T<sub>4</sub>) with 3184.82 kcal/kg ME, was superior to those on T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. This could be attributed to the report by (Odunaiya and Akunnusi, 2008) where they asserted that a positive correlation between the Growth Performance, Shell Length, and Shell Girth had been established, especially in growing snails. This was observed from the finding as the snails on T<sub>4</sub> increment in SL, WG and SG was superior to the other treatment in a positive relationship even though they significantly do not differ at (*P*>0.05).

**Table 3: Shell Growth Characteristics of *Achatina achatina* fed whole jackfruit meal based diet.**



Parameters	T1	T2	T3	T4
Shell length initial	7.96	7.89	8.17	7.79
Shell length final	8.13	8.07	8.26	8.37
Shell length increase	0.17 ± 0.19 <sup>b</sup>	0.19 ± 0.01 <sup>b</sup>	0.09 ± 0.05 <sup>b</sup>	0.54 ± 0.58 <sup>b</sup>
Shell girth initial	3.99	3.92	4.05	3.89
Shell girth final	4.10	4.10	4.18	4.18
Shell girth increase	0.12 ± 0.04 <sup>c</sup>	0.19 ± 0.03 <sup>b</sup>	0.14 ± 0.01 <sup>bc</sup>	0.30 ± 0.01 <sup>a</sup>
Shell aperture initial	10.77	10.84	11.15	10.68
Shell aperture final	11.17	11.15	11.36	11.18
Shell aperture increase	0.40 ± 0.18 <sup>a</sup>	0.33 ± 0.21 <sup>a</sup>	0.22 ± 0.23 <sup>a</sup>	0.52 ± 0.02 <sup>a</sup>
Shell thickness initial	0.91	0.86	0.85	0.79
Shell thickness final	1.26	1.31	1.15	1.15
Shell thickness increase	0.35 ± 0.00 <sup>b</sup>	0.46 ± 0.01 <sup>a</sup>	0.30 ± 0.01 <sup>c</sup>	0.37 ± 0.01 <sup>b</sup>

*Rows sharing similar subscript are not significantly ( $P > 0.05$ ) different from each other while rows sharing different subscript <sup>a,b,c</sup> shows significance difference ( $P < 0.05$ ).*

## Conclusion

The study showed that whole Jackfruit is a very good feed resource for the snails since it was able to improve their performance and can be obtained at low or no cost according to earlier report making it possible for the low income earners to engage in the production and at the same time meeting up with the protein requirement of the teeming populace as recommended by FAO. Therefore 15% inclusion level of Whole Jack Fruit Meal can be recommended as it did not only gave relatively better result on the growth performance (SL, SG, WG) but also found to have the least Feed Cost and Feed Cost/Kg Weight Gain making it a cheap source of snail feed.

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