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Influence of various feeding regimes on the performance of *Archachatina marginata* snail

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Abstract

This study was to evaluate the growth response of Archachatina marginata as influenced by four natural diets: Pawpaw (Carica papaya) cocoyam (Colocasia esculenta), cocoyam (Xanthosoma sagittifolium), and cassava (Manihot esculenta) leaves and growers mash (a compounded ration). One hundred and twenty (120) grower snails (Archachatina marginata) were purchased from a farm in Ibadan, Oyo State. Data were collected on the growth parameters (weight, length and circumference of shell of the snails arranged in a Completely Randomized Design and replicated three (3) times. The results showed that pawpaw (Carica papaya) recorded the highest mean in all the parameters measured and throughout the duration of the experiment. Cocoyam (Colocasia esculenta) leaf had a better mean than the Cassava (Manihot esculenta) leaves in terms of weight gained whereas the reverse is the case in terms of length and circumference of shell. Pawpaw (Carica papaya) is therefore, recommended to both local and small scale farmers in Abia State and in Nigeria for feeding their snails and cocoyam (Colocasia esculenta) leaves and growers mash as an alternate feed.

Keywords: Feeding regimes, performance, *Archachatina marginata*

Introduction

Heliculture is the farming of snails. It has become an important economic activity in Nigeria in recent times in renewed trust to increase animal protein production (Ugwuowo and Ani, 2011). *Archachatina marginata,* common name is the giant West African snail, is a specie of air breathing tropical land snail, a terrestrial gastropod mollusk in the family Achatinidae. The outer shells are dark skinned; they live up to 4 to 5 years. It attains maturity at 9 to 10 months and can lay 8 to 9 eggs per clutch (Ibom *et al.*, 2008).

Snail farming is environmentally friendly and can be done with little skill and cash (Akinnusi, 2014). Snails are acceptable nationwide and in all cultures in Nigeria snail meat (Congo meat) is regarded as a delicacy. It is palatable, nutritious, rich in protein and iron as well as calcium and phosphorus. A recent study has shown that glandula substances in edible snail meat cause agglutination of certain bacteria. This information could be of value in fighting variety of ailments including whooping cough. Edible snail also plays an important role in folk medicine (Yeates, 1995). Snail farming has the following advantages over most of the livestock: Low capital requirement for its establishment and operation, less demand for professional knowledge, very high fecundity (ability to reproduce), low mortality rate, less labour requirement, the animal is noiseless, the availability of domestic and international market (Akachukwu, 2008). Recently, the production of snail has not kept pace demand (Ejidike *et al.*, 2002) with different environmental and technical factors implicated. Several factors can greatly influence the growth of snails, these includes stocking, stress, temperature, feed and soil moisture (Akinnusi, 1998). Another significant problem facing snail farming is feeding. This led to the study of how various feeding materials can be used to increase the performance of the snail.

The survivability of snail in wherever places it can be found is because of conducive weather condition and acceptable vegetation on which they feed (Wosu, 2003). Faced with these dangers which potentially threatens the survival of these snails, there is need to promote snail production in terms of feeding. This research however is to investigate the effect of various feeding regimes on the performance of the snail. The feeding materials include fresh pawpaw leaf, fresh cassava leaf, and two species of fresh cocoyam leaves. This is to know how the performance of the snail will be when fed these feeding materials.

Materials and methods

Experimental site

The study was carried out at Snailery unit of teaching and research farm of Michael Okpara University of Agriculture Umudike, Abia State, Nigeria. Umudike falls within the tropical rain forest ecological zone of south eastern Nigeria, located between altitude 0.5º 29 and 0.5º 43N and longitude 0.7º 35 at a height of 122m above sea level. Umudike is known as high rainfall of more than (900mm per annual having annual rainfall duration of mostly between then months of April and October and five months of dry season with high temperature (>23ºC) that is often accompanied by high relative humidity (>60%) especially in rainy season (NRCRI, 2017).

Experimental animal

One hundred and twenty snails were completely randomized into four (4) treatment diets, replicated four times with ten snails per replicate. The study lasted for eight weeks

Experimental procedure

The twelve baskets were provided with humus soil thoroughly heated to kill harmful microorganisms. The soil was thoroughly moistened with water prior to the introduction of the snails and consequently moistened every morning and evening with formulated concentrate and conventional sliced herbages.

The concentrates and herbage were weighed daily before they were fed to the snails. Water was also given*ad libtum* to the snails; their water was changed every day. The snails were weighed weekly using electronic sensitive weighing balance and their lengths were taken using vernier caliper.

Experimental materials

Twelve baskets, heated soil, fresh pawpaw leaf, fresh cocoyam leaf 1, fresh cocoyam leaf 2, cassava leaf, feeding and watering trough, electronic sensitive weighing balance, vernier caliper etc.

Experimental diet

The experimental diet involved the use of concentrate, pawpaw leaf, cocoyam leaf 1, cocoyam leaf 2, and cassava leaf. T_1: concentrate diet + pawpaw leaf; T_2: concentrate diet + cocoyam leaf 1; T_3: concentrate diet + cocoyam leaf 2 and T_4: concentrate diet + cassava leaf.

Growth parameter

Data were collected on initial body weights on the commencement of the study and on a weekly basis to determine their weight gain. Quantity of concentrate given, the leaf and their leftover were determined, feed conversion ratio, as well as record on mortality of the snails was also obtained. The data collected were used to determine the following growth parameters

Average feed intake (g/snail) =

$$\frac{\text{Qty of feed given} - \text{left over}}{\text{No of snail} \times \text{No of days}}$$

Average weekly weight gain (g/snail) =

$$\frac{\text{Final weight} - \text{Initial weight}}{\text{No of snail} \times \text{No of weeks}}$$

Average weekly mortality (%) =

$$\frac{\text{No of snail dead}}{\text{Initial stock} \times \text{No of weeks}} \times \frac{100}{1}$$

Feed conversion ratio =
Quantity of feed consumed
Weight of the snail

Linear parameter

Data were collected weekly on width and length measurement over the eight week period. Carcass characteristics were measured using the formula:

Shell percentage = Weight of shell x 100
Live weight of snail

Visceral percentage =
Weight of visceral x 100
Live weight of snail

Dressing percentage =
Weight of edible portion x 100
Live weight of snail

Experimental design

The experimental design was Completely Randomized Design (CRD). The statistical model used was

$Yij = \mu + ti + eij$

Yij = Single observation
μ = Overall mean
Ti = effect of treatment
eij = random error

Data analysis

All data collected were subjected to Analysis of Variance (ANOVA) using the General linear model procedure of Statistical Procedure for the Social Science (SPSS).

Results and discussion

The growth performance of grower snails fed concentrate and vegetable leaves is presented in Table 1. All the parameters measured were significant ($p<0.05$) except the initial body weight. The final body weight of snails fed control (T_1) diet had significant ($p<0.05$) higher mean, while snails fed T_2 & T_3 had lower mean among the treatment groups. Weight gain of snails fed T_1 diet were significantly ($p<0.05$) different, with higher mean although, it was comparable to snails fed T_4 diet; while snails fed T_2 diet had lower mean among the treatment groups. Snails fed T_1 diet had significant ($p<0.05$) higher total feed intake mean than snails fed T_2 diet which had lower mean among the treatment groups. The same trend was followed in the total feed intake per gram per snail and average daily feed intake per gram per snail. The table shows the mean weight of snails fed pawpaw leaf, cocoyam leaves, and cassava lead. From the table it was observed that the snails fed with pawpaw leaf, T_1 had the highest weight gain (5.78) than cassava leaf T_4 (4.14), followed by cocoyam leaves. According to Anibijuwon and Udeze (2009) reported that pawpaw has very high calcium and potassium hence it helps in the growth of snails. Also, Ejidike and Omisade (2007) who fed *Archachatina marginata* with fresh carica papaya leaf concluded that pawpaw leaf T_1 recorded the highest mean in weight gain.

Table 1: Effect of body weight of grower snail fed herbages and concentrate

Parameters	T1	T2	T3	T4	SEM
Initial weight	200.00	193.33	200.00	193.33	2.25
Final weight	293.33^{a}	260.00^{b}	260.00^{b}	273.33^{b}	4.58
Weight gain	93.33^{a}	46.67^{c}	60.00^{bc}	80.00^{ab}	6.28
Total feed intake	3240.00^{a}	2266.66^{b}	2320.00^{b}	2320.00^{b}	63.03
Tfi/g/snail	324.00^{a}	226.67^{b}	232.00^{b}	232.00^{b}	12.61
Av. dfi/g/snail	5.78^{a}	1.04^{b}	4.14^{b}	1.14^{b}	0.22

a, b, c, mean along the same row with different superscript are significantly different ($p<0.05$).

The weekly Body Length of the grower snails fed concentrate and vegetable leaves is shown in Table 2. There were significant ($p<0.05$) differences on all the weekly body length except in weeks 4, 5 and 7. At week 1, there were significant ($p<0.05$) difference among the groups. Snails fed T_1 and T_4 had higher mean while snails fed T_3 had lower mean among the treatment group. Week 2 and 3 followed the same trend where snails fed T_4 diet had significant ($p<0.05$) higher body length mean than snails fed T_3 diet which gave lower mean among the treatment groups. At week 8, snails fed T_1 diet had significant ($p<0.05$) higher body length mean; although snails fed T_4 diet competed favourably with the snail fed control (T_1) diet; while snails fed T_2 had lower mean among the treatment groups. This finding showed that pawpaw leaf (T_1) had the highest mean in body length. There was a significant difference between the treatments. It was observed that snails fed pawpaw leaf had the highest body length than snails fed cassava leaf (T_4), then followed by cocoyam leaf (T_2 and T_3) according to Anibijuwon and Udeze (2009) pawpaw leaf recorded the highest in body length.

Table 2: Weekly body length of the grower snail fed concentrate and vegetable leaves

Parameters	T1	T2	T3	T4	SEM
WEEK 1	8.00^{a}	17.93^{ab}	7.73^{b}	8.00^{a}	0.05
WEEK 2	8.07^{a}	7.93^{ab}	7.73^{b}	8.10^{a}	0.06
WEEK 3	8.07^{a}	7.93^{ab}	7.73^{b}	8.10^{a}	0.06
WEEK 4	8.40	8.10	8.13	8.10	0.05
WEEK 5	8.40^{a}	8.10	8.13	8.13	0.05
WEEK 6	8.40^{a}	8.17^{ab}	8.13^{ab}	8.23^{ab}	0.04
WEEK 7	8.47	8.20	8.23	8.30	0.05
WEEK 8	28.50^{a}	8.20^{b}	8.23^{ab}	8.30^{ab}	0.05

a, b, c means along the same row with different superscript are significantly different (p<0.05).

The weekly month length of snails fed concentrate and vegetable leaves is shown in Table 3. The weekly mouth length of snails was not significantly ($p>0.05$) different except in weeks 2 and 3. The mouth length of snails fed T_2 had significant ($p<0.05$) higher mean at week 2 than snails fed T_3 diet which had lower mean among the treatment groups. It followed the same trend at week 3. Pawpaw leaf T_1 had the highest mean in mouth length. This finding is in accordance with the report of Ayoola and Adeyeye (2010). They reported that pawpaw (C*arica papaya*) has very high calcium (8612.50mg/kg) and potassium (2889mg/kg).

Table 3: Mouth Length of the Grower Snail Fed Concentrate and vegetable leaves

Parameters	T1	T2	T3	T4	SEM
WEEK 1	11.00	11.00	10.70	11.00	0.09
WEEK 2	11.17^{ab}	11.30^{a}	10.70^{b}	11.20	0.09
WEEK 3	11.17^{ab}	11.30^{a}	10.70^{b}	11.20^{a}	0.09
WEEK 4	11.43	11.50	11.03	11.30	0.09
WEEK 5	11.40	11.50	11.03	11.30	0.09
WEEK 6	11.43	11.50	11.03	11.30	0.09
WEEK 7	11.47	11.50	11.03	11.30	0.09
WEEK 8	11.43	11.50	11.03	11.37	0.10

a, b, c, means along the same row with different superscript are significantly different (p<0.05).

The weekly width of the mouth of grower snails fed concentrate and vegetable leaves is shown in Table 4. The weekly parameters of the mouth width of grower snails were significantly ($p<0.05$) different except in week 1. The snails fed T_4 had significant ($p<0.05$) higher mean at week 2 than snails fed T_3 diet which had lower mean among the groups. At week 3, snails fed T_4 had significant ($p<0.05$) higher mean, while snails fed T_3 had lower mean among the treatment groups. At week 4, snails fed T_1 diet had significant ($p<0.05$) higher mouth width mean, while snails fed T_3 had lower mean among the treatment groups. The same trend was followed from week 5 to week 8 with snails fed T_1 diet had significant ($p<0.05$) higher mean, although, comparable to snails fed T_4; while snails fed T_3 diet had lower mean among the treatment groups. The results showed that pawpaw lead T_1 had the highest mean than those fed with cocoyam and cassava. According to Ayoola and Adeyeye (2010), the mouth length of T_1 pawpaw ranked highest in all the treatment followed by cassava leaf T_4 and then followed by T_2 and T_3 (cocoyam leaves).

Table 4: Width of the mouth of grower snails fed concentrate and vegetable leaves

Parameters	T1	T2	T3	T4	SEM
WEEK 1	11.83	11.90	11.43	12.20	0.13
WEEK 2	12.17^{a}	11.90^{ab}	11.43^{b}	12.20^{a}	0.12
WEEK 3	12.17^{a}	11.90^{ab}	11.43^{b}	12.20^{a}	0.12
WEEK 4	12.50^{a}	12.13^{a}	11.57^{b}	12.37^{a}	0.13
WEEK 5	12.50^{a}	12.13^{a}	11.57^{b}	12.37^{a}	0.13
WEEK 6	12.50^{a}	12.13^{a}	11.57^{b}	12.37^{a}	0.13
WEEK 7	12.53	12.13^{a}	11.57^{b}	12.37^{a}	0.13
WEEK 8	12.53^{a}	12.13^{a}	11.57^{b}	12.37^{a}	0.13

^{abc}**means along the same row with different superscript are significantly different ($p<0.05$).**

The carcass characteristics of the grower snails fed concentrate and vegetable leaves are presented in Table 5. All parameters measured were not significant ($p>0.05$) except weight of edible portion of the snails. There were significant ($p<0.05$) difference on the weight of edible portion of snails fed different treatment diets. The snails fed T_1 diet had significant ($p<0.05$) higher than while snails fed T_4 diet had the lower mean among the treatment groups. Although, snails fed T_1 (control) diet were similar ($p>0.05$) to snails fed T_2 and T_3.

Table 5: Carcass characteristics of the grower snail fed concentrate and vegetable leaves

Parameters	T1	T2	T3	T4	SEM
Live weight	57.64	48.83	51.08	49.25	1.92
Dressed %	46.61	47.56	46.62	46.19	0.54
Visceral %	20.20	21.40	24.32	20.32	0.83
Shell %	17.05	17.08	16.45	16.51	0.58
Wt of edi portion	26.61^{a}	23.19^{ab}	23.81^{ab}	22.70^{b}	0.66
Wt of viscera	11.74	10.49	12.40	10.04	0.59
Wt of shell	9.65	8.36	8.41	8.19	0.37

^{abc}**means along the same row with different superscript are significantly different ($p<0.05$).**

Conclusion and recommendation

The findings from this study showed that pawpaw leaf (*Carica papaya)* recorded the highest mean in all the parameters measured and throughout the duration of the experiment. Cocoyam (*colocasia esculenta)* leaf had a better mean than the cassava *(Manifot esculenta)* leaf in terms of

weight gained whereas the reverse is the case in terms of length and circumference of shell. Pawpaw (*Carica papaya)* is therefore, recommended to both local and small scale farmers in Abia State and in Nigeria for feeding their snails and cocoyam (*colocasia esculenta)* leaf and growers mash as an alternate feed.

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