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ORIGINAL ARTICLE

COMPARATIVE EVALUATION OF THE GROWTH PERFORMANCE OF THE GIANT AFRICAN SNAIL ARCHACHATINA MARGINATA FED A FORMULATED DIET AND THREE SELECTED EDIBLE VEGETABLES

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ABSTRACT: The growth performance of the giant African land snail, *Archarchatina marginata* fed a formulated diet and three selected edible vegetables was investigated in an experiment conducted in the snail unit of the Delta State University Asaba Campus Research and Teaching Farm. The selected vegetables include: *Bracica oleracea* (cabbage), *Lactuca sativa* (lettuce) and *Carica papaya* (paw-paw). Parameters measured include feed efficiency ratio, feed conversion ratio, body weight, body length and shell diameter. Dietary treatment significantly affected the feed efficiency and feed conversion ratios. Significantly higher feed conversion ratio values were observed for the formulated diet and *Carica papaya*. Feed efficiency ratio was higher for *Lactua sativa*. Significant differences were observed in body weight of the snails fed the experimental diets, with the formulated diet recording the highest body weight values. Body weights of snails fed Carica papaya were significantly higher than snails fed cabbage and lettuce. There were no significant differences in shell diameter of the snails fed the experimental diets neither were there any significant differences in the length of the experimental animals as affected by diet.

INTRODUCTION

Many small animals, vertebrates and invertebrates, homoiotherms (endotherms) and poikilotherms (ectotherms) are used by man, since he gathers hunts or collects them in the wild. When bred under controlled conditions in captivity, these animals are referred to as mini-livestock (Hardoiun, 1995), which is a term used for small species that are less known in animal production. To qualify as mini-livestock, animals must have a potential benefit either nutritionally for food or economically for animal feed or revenue and are currently not being utilized to their fullest potentials (Hardouin, 1995). The giant African Snails are found in this group and are highly prized as food in West and Central Africa and Asia and attempts are being made at rearing and producing them commercially as viable ventures. Snail meat is rich in protein, low in fats and is a source of iron (Orisawuyi, 1989). The protein in snail meat compares favorably with conventional animal protein sources (Imevbore and Ademosun, 1988). Various researches have been carried out on feed requirements and growth performance of snail species under captive rearing (Ejidike, 2007). Studies showed that a number of environmental factors as well as feeding, have great influence on their survival. Other studies have shown that snails accept and utilize a variety of plant and food materials as well as formulated diets (Imevbore and Ajayi, 1993; Ejidike, 2001). Ejidike, (2004) stated that food plays a vital role in the survival, growth and reproduction of cultivated animals. Studies by Lameed, (2006) show feeding responses of snailets of the giant African land snail to different food items. Ejidike, (2007) studied the influence of formulated diets on the giant African snail reared in captivity. The studies revealed that morphological parameters were affected by the treatment diets. Funmilayo, (2008) investigated the growth performance of *Archachatina marginata* fed selected household wastes. Results revealed better growth performance with guinea corn bran, while paw-paw leaves had the least values for all parameters measured. This study compares the growth performance of snails fed a formulated diet and three selected edible vegetables. Parameters considered include feed conversion ratio, feed efficiency, body weight gains, body length and shell circumference.

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MATERIALS AND METHODS

The study was conducted over a period of twelve (12) weeks and was carried out in the snail unit of the Delta State University Asaba Campus Research and Teaching Farm, Delta State Nigeria (6^0 14' N and 6^0 49' E).

Seventy two (72) giant land snails of the specie *Archachatina marginata* weighing between 100–120g were purchased from Songhai Amukpe, a farm settlement in Sapele Local Government Area of Delta State. The snails were taken care of intensively for one month before the commencement of the experiment to allow for acclimatization. At the commencement of the experiment, 18 snails each were randomly allotted to each of the experimental diets. Each dietary treatment was further divided into 3 replicates of 6 snails per replicate. The diets were as follows, diet 1) a formulated diet which was used as the control, diet 2) *Bracica oleracea* (cabbage), diet 3) *Lactua sativa* (lettuce) and diet 4) *Carica papaya* (paw-paw). Weighed quantities of feed were supplied early every morning, while water was supplied twice a day. Data were collected at the beginning of the study and thereafter at two (2) weeks intervals. Data collected were feed intake, body weight gain, body length and shell circumference. Feed efficiency and feed conversion ratios were calculated from the data obtained. Proximate analysis was carried out using methods described by AOAC (1990).

The data were subjected to a One-way analysis of variance in a completely randomized design. Significantly different means were separated using Duncan's Multiple Range Test Procedure (Duncan, 1955).

RESULTS AND DISCUSSION

Composition of the different diets is presented in Table 1. Moisture content, crude protein, crude fiber, total ash, ether extract, calcium and magnesium were within ranges to satisfy the requirements of the giant African snail for growth and performance (Cobbinah, 1992).

Table 1: Analysis of the experimental diets (%)

Component	Diet 1	Diet 2	Diet 3	Diet 4
Moisture	2.00	49.87	48.13	53.17
Crude protein	3.50	0.50	1.05	0.03
Crude fiber	15.30	22.20	33.35	11.50
Ash	6.80	2.24	1.47	1.20
Ether extract	0.90	0.80	0.01	0.03
Calcium	12.00	0.09	0.05	0.01

Table 2: Bi-weekly weight changes of the snails fed the experimental diets (g)

	Weeks					
	2	**4**	**6**	**8**	**10**	**12**
Diet 1	63.37^a	89.38^a	113.43^a	116.47^a	118.49^a	122.89^a
Diet 2	5.57^d	12.95^d	13.76^d	16.67^d	19.56^d	23.23^d
Diet 3	13.19^c	21.19^c	22.69^c	27.51^c	30.25^c	34.14^c
Diet 4	25.07^b	65.22^b	106.36^b	109.37^b	111.19^b	115.28^b

^{abc} Means with different superscripts within columns differ significantly ($P<0.05$)

Table 2 shows the results for the bi-weekly weight changes of snails fed the different experimental diets. Results reveal significant ($P<0.05$) differences in weight changes as affected by diet, with the control diet having significantly ($P<0.05$) higher values over the 12 week period of the study. *Carica papaya* showed significantly ($P<0.05$) higher weight change values than the other experimental diets during the period of this study. Results indicate that *Bracica olececea* had lowest weight change values when compared to the control and the other experimental diets. Weight changes were significantly ($P<0.05$) higher in the first six weeks of the study for snails fed both the control diet and *Carica papaya*.

The results of the effect of diet on the length of the snails are presented in Table 3. Statistical analysis of values obtained revealed significant differences between the means. Results show that throughout the experimental period, the length of snails fed *Carica papaya* showed significantly ($P<0.05$) higher values than snails fed the other experimental diets,

Table 3: Bi-weekly changes in length of the snails fed the experimental diets (cm)

	Weeks					
	2	**4**	**6**	**8**	**10**	**12**
Diet 1	1.82^{b}	2.03^{c}	2.29^{b}	4.96^{b}	5.30^{b}	7.05^{b}
Diet 2	1.11^{c}	1.93^{c}	2.31^{b}	5.02^{b}	5.42^{b}	7.01^{b}
Diet 3	1.90^{b}	2.17^{b}	2.36^{b}	5.10^{b}	5.37^{b}	6.96^{c}
Diet 4	2.22^{a}	2.57^{a}	2.66^{a}	5.39^{a}	5.91^{a}	7.21^{a}

^{abc} Means with different superscripts within columns differ significantly (P<0.05)

The results of the bi-weekly changes in the shell circumference of the snails fed the experimental diets are given in Table 4. Statistical analysis of values obtained revealed significant differences between the means. The table shows that snails fed the control diet and *Carica papaya* had significantly (P<0.05) higher values than snails fed *Bracica olecacea* and *Lactua sativa*.

Table 4: Bi-weekly changes in shell circumference of the snails fed the experimental diets (cm)

	Weeks					
	2	**4**	**6**	**8**	**10**	**12**
Diet 1	1.77^{a}	2.45^{a}	3.37^{a}	4.15^{a}	5.10^{a}	6.25^{a}
Diet 2	1.23^{b}	2.12^{b}	2.81^{b}	3.61^{b}	4.54^{b}	4.90^{c}
Diet 3	1.21^{b}	2.16^{b}	3.03^{b}	4.39^{a}	4.63^{b}	5.76^{b}
Diet 4	1.03^{c}	2.48^{a}	3.33^{a}	4.30^{a}	5.10^{a}	6.28^{a}

^{abc} Means with different superscripts within columns differ significantly (P<0.05)

Table 5 shows results for the feed conversion ratio (FCR) of the snails fed the experimental diets. Feed conversion ratio is a measure of an animal's ability to convert feed mass into increased body mass. Results indicate significant (P<0.05) differences between the means, with the control diet and *Carica papaya* showing higher feed conversion ratios than the other experimental diets. Results indicate a general steady state in feed conversion from week 4, which could mean that feed conversion reached a maximum in the fourth week.

Table 5: Bi-weekly feed conversion ratio of the snails fed the experimental diets.

	Weeks					
	2	**4**	**6**	**8**	**10**	**12**
Diet 1	4.61^{a}	4.62^{a}	4.38^{a}	4.36 ^{a}	4.34^{a}	4.30^{a}
Diet 2	4.40^{a}	4.12^{b}	4.08^{b}	4.02^{b}	3.91^{b}	3.82^{b}
Diet 3	4.20^{b}	4.17^{b}	4.00^{b}	3.96^{b}	3.86^{b}	3.80^{a}
Diet 4	4.62^{a}	4.61^{a}	4.40^{a}	4.35^{a}	4.33^{a}	4.30^{a}

^{abc} Means with different superscripts within columns are significantly (P<0.05)

Livestock species that have low feed conversion ratio between 3.4-5.0 are considered efficient users of feed (Brown, et al., 2001). Results in Table 5 indicate that the snails in this study were efficient users of the feed used for these studies, since the FCR in each case was within the range of determined values (3.82-4.62) for different livestock species (Knott *et al.*, 2003; Malik *et.al.*, 1996). A look at the feed efficiency ratio which is the inverse of the feed conversion ratio should give more information on the use of the experimental diets for growth and performance of the snails. Table 6 the values for the bi-weekly feed efficiency ratio of the snails fed the experimental diets.

Table 6: Bi-weekly feed efficiency ratio of the snails fed the experimental diets

	Weeks					
	2	4	6	8	10	12
Diet 1	21.7^{b}	21.6^{b}	23.0^{b}	23.0^{b}	23.0^{b}	23.2^{b}
Diet 2	22.7^{a}	24.3^{a}	24.5^{a}	24.9^{a}	25.5^{a}	26.2^{a}
Diet 3	23.8^{a}	24.0^{a}	25.0^{a}	25.2^{a}	25.9^{a}	26.3^{a}
Diet 4	21.6^{b}	21.7^{b}	22.7^{b}	22.9^{b}	23.1^{b}	23.3^{b}

^{abc} Means with different superscripts within columns are significantly (P<0.05)

Statistical analysis reveals significant (P<0.05) differences between the means. Results indicate higher feed efficiency for snails fed *Lactua sativa* and lowest with snails fed the control diet and *Carica papaya*. This could mean that *Bracica olecacea* and *Lactua sativa* were more nutritious, this is in agreement with studies by Aduku, (1993). Oredein *et al.*, (1998) also reported that snails perform well on fruits such as paw-paw and vegetables such as cabbage, lettuce and water-leaf.

CONCLUSION

Results indicate that growth performance in terms of weight gain was higher in snails fed the control diet and *Carica papaya*. Results also indicate that snails fed *Lactua sativa* had higher feed efficiency ratio. This could mean that this diet was more nutritious than the other diets. Snails also feed well on vegetables as well as fruits. This study has shown that growth performances of snails fed such vegetables and fruit compare favorably well with formulated feed, and these feeding materials can be conveniently used to rear snails.

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