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Feeding Responses in Snailets of African Giant Land Snails (*Archachatina marginata*) to Different Food Items in the Sub-Saharrah Tropical Region, Nigeria

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Abstract: The study of feeding responses of snailets of African giant snail (*Archachatina marginata*) fed with different food items: Ugwu leave (*Talfairia* sp.), Pawpaw fruit (*Carica papaya*), banana fruits (*Musa sapientum*) and three levels of compounded feed with crude protein: 16.25, 15.88, 15.60% was carried out in the University Mission Research (UMR) snailery unit. Six treatments (T1-T6) were established with fifty snailets each and fed with different food items under the same environmental condition. Observations were made on feed utilization (intake), growth rates and mortality rates that were recorded bi weekly, which covered a period of six months. Results showed that the snailets in all the treatments utilized the f eed types significantly ($p<0.05$); while the feed intake with respect to growth pattern (weight gain) in treatments 1-6 had no significant difference ($p>0.05$). Snailets fed with compounded feed (T: 6) with mean intake and mean growth rates: 12.57 and 2.96 g, respectively had the best performance. Highest mortality rate (46%) was recorded in treatment 3 fed with banana and the least rate was generally obtained from compounded feed in treatment 4 with 16% mortality. It can be concluded that snailets in treatment 6 (compounded feed) with higher crude protein percentage (15.60%) had the highest total weight gain and mean total feed intake of 1480 and 12.57 g, respectively, when compared with other treatments.

Key word: Snailets, *Archachatina marginata*, crude-protein, weight gain, mortality, responses

INTRODUCTION

Human beings throughout the world have consumed snail meat since prehistoric times. It is high in protein (12-16%) and iron (45-50 mg kg^{-1}), low fat (0.05-0.8%) and contains almost all amino acid needed by humans[1].

History had it that snail farming began with a Roman farmer called Lippious who first established a snail farm around 560AD, purposely or body fathering and better prices[2]. Since the at of rearing snails has turned out to be an household venture especially in recent times, many people are practicing the farming both at large and small scale enterprises. Snail species such as *Archachatina marginata* are economically viable due to its high demand as a protein source in many West African countries. There is a flourishing international trade in Europe and North America. In France, the annual requirement is about 5 million kilogram, over 60% are imported and annual estimates consumption in Italy is 306 million snails[1].

The geometric trend in human population growth is another factor posing high demand and pressure on the animal protein sources, such as beef, goat, chicken, fish and pock. Snail meats stand to be an alternative but not an exemption. F.A.O.[3] recommended the incorporation of other alternative animal protein sources such as snails and cane rat as strategies for poverty alleviation and animal protein supply most especially in the tropics where retarded growth in children is rampant. Omole[4] and Awesu[5] reported that snail meat contains high quality protein and essential amino acid that could be used as supplement to the requirement obtained from conventional livestock sources. It was further emphasized that snail meat contains low fat and cholesterol compared to other source of protein, a quality that makes it suitable in diet of hypertensive patients. Protein content of snail meat is within 15.76-18.26% a proportion, which is comparable with 16.9% in mutton, 18.6% in duck and 20.5% in chicken.

F.A.O.[3] also reported fat content of snails to be between 0.96-3.0%, relatively low proportion compared to conventional live stock sources such as chicken egg (9.6%), mutton (21.4%) and duck (23.0%). Snail meat competes favourably with poultry egg and flesh in essential amino acid and digestible protein[6]. All over Africa, most especially in Ghana and Nigeria, larger quantities of snails notably *Archachatina marginata* are consumed annually and many regarded the meat as

delicacies[7]. Various researches have undergone on food requirements and growth performances of snail species under captive rearing[5]. It has shown that a number of environmental factors such as structural and climatic factors as well as feeding and growth parameters have great influence on their survival[8]. Ajayi[9] used dry and wet apartment in rearing giant snails. It was discovered that the snail retired to their shells by day and emerged only at night or after rains when the relative humidity in highest. It was further reported that young and adult snails usually come out from their hiding places or from their shells between 18.30-18.50 hours of the day. Awesu[5] observed that *Archachatina marginata* were usually active and consumed food in the morning (07-09 h), evening (17-19 h) and most of the period at night, especially if the weather is humid.

Growth pattern in snail can be divided into three phases[1]. The first phase is evolutionary adaptation for the organism with poor mobility and survived without food. The second phase is the period between the first two months where by the snails grow to sexual maturity. During this period, the shell is well formed and snail weighs between 100 and 450 m. Differences in growth rates of the various ecotypes are very evident during the period. The last part is the adult phase, which start when the snail reaches sexual maturity. An average life expectancy is five to six years, although there are reports of snails surviving up to nine or ten years. This study however focused on the feeding responses of snailets of African Giant Snail (*Archachatina marginata)* to different food items under husbandry management.

MATERIALS AND METHODS

The experiment was carried out in the research centre of University Mission Research (UMR), Wildlife Unit of the University of Ibadan. Six units of rectangular cages (snailet cages) dimension 1.2 x1.2x0.9 m were constructed of wood with all the sides netted with a 2 mm diameter plastic net material (mosquito net) and doubled-up with 1cm diameter fine wire inch (mesh\chicken net) to keep off predators (snakes, lizard, ants and cockroaches). The four legs of each cage was immersed with plastic containing liquid (water and denatured engine oil) to further prevent access of predators. Each cage was filled with the humus up to 10 cm (4 inches) after which wetting with water was done to prepare them for stocking.

Batch of fifty snailets in each of the six replicates (T1-T6) was grouped based on age and body weights. Experimental cages 1-4 contained the snailets ten weeks of age, while 5 and 6 cages contained juvenile of twelve weeks old, based on the snailets availability. Each cage consisted of fifty snails.

The experimental designs in relation to food items used are as follows:

Treatment 1	fed with	Ugwu leaves (*Telfaira* sp.)
Treatment 2	fed with	Pawpaw fruit (*Carica papaya*)
Treatment 3	fed with	Banana (*Musa sapientum*)
Treatment 4	fed with	Compounded feed A
Treatment 5	fed with	Compounded feed B
Treatment 6	fed with	Compounded feed C

The feeding responses were determined based on quantity of feed given minus the quantity of waste or the left over. The foods were served on a flat galvanized metal sheet at interval of two days (every 48 h) before 8 a.m. The left over were collected weighed and recorded at every 48 h.

All the six replicates were fed according to the proportion of their body weight. Cheney[10] observed that snail eat food equal to 10-20% of their body weight. The weight gained (biomass) in each replicate was measured once per two weeks.

RESULTS AND DISCUSSION

The Table 1 and 2 below showed the proximate composition of the feed items and the performance of six treatments, respectively. The compounded feeds (T: 4-6) have the highest crude protein: 16.25, 15.88, 15.60%, respectively, while the raw foods fed (T: 1-3) have the crude protein: 3.46, 1.02 and 1.02%, respectively (Table 1).

The snailets in all the treatments (T: 1-6) utilized the feed types significantly ($p<0.05$); The performances of the treatments on feeds (Table 2) indicated that treatment six has the highest total weight gain of 2520 g, while treatment 3 (treatment fed with banana) have the least weight gain after the end of the experiment. Other observation also showed that the highest number of mortality was recorded in treatment 3 (46%) and the least was recorded in treatment 4 with 16% mortality rate.

Table 3 and 4 showed the mean total feed intake and average mean body weight gain per treatment for the period of six months. Treatment 6 has the highest total feed intake of 150.86 g with mean feed intake of 12.5 g. While the least feed intake was 82.78 g and mean of 6.89 g as observed in treatment 2 (Table 3). The feed intake with respect to growth pattern (weight gain) in treatments 1-6 had no significant difference ($p>0.05$). But at the end of the six months treatment 6 have the highest total body weight gain and mean weight gain of 35.47 and 2.96 g, respectively. The least total weight and mean weight gain was obtained from treatment 3 with values 1.61 and 1.31 g, respectively (Table 4).

The snailets fed with compounded feed types (T: 4-6) performed better than those fed (T: 1-3) with

Table 1: Proximate composition of the feed items used

Feed Composition	T_1 Ugwu	T_2 Pawpaw	T_3 Banana	T_4 Compounded feeds A	T_5 B	T_6 C
% Crude protein	13.46	1.02	1.02	16.25	15.88	15.60
% Fat	0.22	0.33	0.18	5.08	5.33	6.15
% Fibre	1.86	2.86	1.12	13.88	13.27	14.23
% Ash	1.66	2.56	1.86	15.88	15.33	15.28
% Moisture Content	56.88	89.01	88.77	1.78	0.35	10.14
% Carbohydrate				39.00	44.00	49.00
% Calcium Fortification				30.00	30.00	30.00

Source: Laboratory analysis, 2005

Table 2: The performance of snailets of african giant land snail (*Archachatina marginata*) on feed treatments (g)

-- Parameters	Number of Snails	T_1 Ugwu	T_2 Pawpaw	T_3 Banana	T^4 Feed A	T_5 Feed B	T_6 Feed C
Initial total snails Weight (g)	50	250	160	900	200	200	1040
Number of Snail at week 24		38	32	27	42	40	41
Final total Weight (week 24)		1060	840	750	1620	1440	2520
Initial average Weight (week 1)		5	3.2	18	4	4	20.8
Final average Week 24		27.9	26.3	34.0	38.6	36.0	61.5
Average Weight		.9	23.1	16.0	34.6	32.0	40.7
Final total Weight gain		810	680	432	1420	1240	1480
Total feed Intake	50	3.422.66	2.648.96	2.508.03	4.425.96	4.033.6	6.185.26
Average Total feed Intake per snail for 6 months		90.07	82.78	92.89	105.38	100.34	150.86
Mean Average total Feed intake Snails (g)		7.5	6.89	7.74	8.78	8.40	12.57
Number of mortality		12	18	23	8	10	9
% of mortality		24	36	46	16	20	18

Source: Field survey, 2005

Table 3: Mean total feed intake per treatment (g)

Bi-week Measurements	T_1 Ugwu	T_2 Pawpaw	T_3 Banana	T_4 Feed A	T_5 Feed B	T_6 Feed C
Week 1 and 2	3.50	2.38	5.18	2.80	2.80	7.70
Week 3 and 4	4.06	3.00	5.08	4.08	4.77	9.96
Week 5 and 6	4.76	3.79	6.80	5.25	5.02	10.04
Week 7 and 8	6.02	5.10	7.79	6.84	7.15	11.76
Week 9 and 10	7.74	7.47	7.10	8.23	7.10	11.30
Week 11 and 12	8.87	8.43	8.23	9.39	8.44	13.35
Week 13 and 14	6.84	5.24	7.62	7.86	7.49	10.00
Week 15 and 16	7.80	7.17	8.09	9.12	8.65	12.61
Week 17 and 18	8.63	8.70	8.29	1098	10.25	14.17
Week 19 and 20	9.56	8.97	8.35	12.50	11.85	16.05
Week 21 and 22	10.68	10.50	9.56	14.00	13.13	16.12
Week 23 and 24	11.61	12.03	10.80	14.33	14.00	17.80
Total	90.07	82.78	92.89	105.38	100.84	150.86
Mean	7.5	6.89	7.74	8.78	8.40	12.5

Source: Field survey, 2005

Table 4: Average mean body weight gain per treatment (g)

Bi-week	T_1 Ugwu	T_2 Pawpaw	T_3 anana	T_4 Feed A	T_5 Feed B	T_6 Feed C
Weighing						
Week 1 and 2	0.80	1.02	0.40	1.67	0.43	2.04
Week 3 and 4	1.00	1.04	1.20	1.67	2.13	2.08
Week 5 and 6	1.80	1.88	1.22	1.78	1.28	2.17
Week 7 and 8	1.91	2.89	3.27	3.64	2.34	3.90
Week 9 and 10	1.11	1.14	0.47	1.82	1.11	1.47
Week 11 and 12	1.33	1.19	0.23	1.82	6.67	1.40
Week 13 and 14	1.16	1.03	4.69	3.02	0.25	2.20
Week 15 and 16	1.86	1.08	0.00	2.86	2.75	3.90
Week 17 and 18	1.22	2.16	0.97	3.57	3.00	5.12
Week 19 and 20	0.53	-1.88	-3.70	3.57	4.00	1.95
Week 21 and 22	1.84	3.13	2.73	3.09	4.00	6.34
Week 23 and 24	4.20	1.88	0.91	4.30	3.00	3.90
Total	18.78	16.56	1.61	32.81	24.96	35.47
Mean	1.56	1.38	0.13	2.73	2.08	2.96

Source: Field survey, 2005

fruits and leaves types: Ugwu (*Talfairia* sp.), pawpaw (*Carica papaya*) and banana (*Musa sapientum*). Esobe[11] reported that snails show relatively poor feeding responses to feed that are coarse, undesirable and unpleasant to their taste.

This observation is important in the experimental design, most especially in the formulation of the compounded rations, to meet the dietary requirements of snails and to achieve the particle size, of feed powder that could be easily injected by the snailets. At the outset of the study, (the first two weeks) the treatments with Ugwu, pawpaw and banana fruits had better response in growth performance than the compounded feed. After this period the snailets became adapted to the compounded rations. This confirmed with the report of Cobbinah[1] that snail will accepts many types of food over period of time while in captivity.

Analysis of feed intake from all the experimental design (T: 1-6) indicated that snailets were able to utilize all the feed types significantly ($p<0.05$), though the growth relationships associated with them are significantly different ($p<0.05$). The proximate analysis revealed that the compounded rations (T: 4, 5, 6) have higher crude protein values: 16.25, 15.80 and 15.60%, respectively than for Ugwu, pawpaw and banana: 13.46, 1.02 and 1.02%, respectively. The compounded feed were fortified with 30% calcium of the total weight, this accounted for higher growth responses observed in the replicates. The observations was in support of Mount[8] that growing animals required higher nutrient food with crude protein metabolic energy for their body growth and development. Analysis of feed intake of the snailets with response to the growth pattern (weight gain) in the study (T: 1-6) showed no significant different ($p>0.05$), but the growth performance of the snailets are significant to the feed types ($p<0.05$). Treatment 6 (compounded feed C) recorded the highest mean growth rate with an average of 2.96g bi-weekly. While treatment 4 and 5 have mean growth rates of 2.73 and 2.08 g, respectively.

The feed treatments of Ugwu, pawpaw and banana (T: 1-3) have the following mean growth rates of 1.56, 1.38 and 0.13 g, respectively. The growth performance associated with different levels of feeds was in response to their protein levels and calcium fortification despite the same environmental condition of their settings[5]. There is significant difference ($p<0.05$) between the feed types and rate of mortality. Pollard[12] reported that temperature is another important factor that affect the performance and mortality rate of the snails. The highest mortality rate was recorded in treatment 1 of banana (46%), with the least in treatment 4 of compounded feed (16%).

CONCLUSION

.It can be concluded that snailets performed better on compounded feeds (T: 4,5,6) with high crude protein percentage than with the fruits and leaves (T: 1,2,3) in response to their feed intake and weight gain. This is in line with the findings of Adeyemo and Borire[13] that reported significant differences in the body weight gain of snails fed different levels of yam peel. Mortality was generally below average in all the diets, indicating that the treatments were not detrimental to the health of the snails[14].

Apart from the good performance of snails when fed with compounded feed, it was considered to be cheaper, easily assessable at all feed mills and available all the year round. Other advantage is that it can be stored for a longer period of time when compared with direct agricultural food such as banana, pawpaw and

vegetables. The compounded feed is also seen as been economically viable for intensive and large-scale snail farmers, because it acts as growth booster most especially during wet season when weather condition is moderately below 30°C[15]. In such a study, the feed can be used to compliment other sources of food such as fruits, leaves and vegetable; there by reduce the production cost in snail farming ventures.

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