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Evaluation of the Growth Performance of Snails Fed Different Forages under Intensive Management

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Abstract: A six-week old experiment was conducted during the early rainy season of the year to investigate the growth performance of snails fed different forages under intensive rearing. The different forages used in the study constituted the treatment groups and they included: Fluted pumpkin (*Telferia occidentalis*) leaves (T_A), African Spinach (*Amaranthus sinensis*) leaves (T_B), Pawpaw (*Carica papaya*) leaves (T_C) and formulated mash (T_D). Thirty two (32) snails of 3 weeks old were divided into the four treatment groups of eight (8) snails each in a completely randomized design. Each treatment group was replicated twice. Result of data analysis showed that there was significant difference ($p<0.05$) in all the parameters studied which included feed intake, weight gain, feed conversion ratio and shell length increase. Feed intake was highest in T_A followed by T_C and then T_D. The highest weight gain recorded in T_D differed significantly ($p<0.05$) with those of T_A and T_B. There was no statistical difference between T_A and T_C. Feed conversion ratio was highest in T_B followed by T_C and least in T_D. Shell length increase was significantly lower ($p<0.05$) in the T_B than the other treatment groups that showed no statistical difference with each other. With T_A and T_C giving the highest weight gain after T_D and high overall feed intake, it may be advisable that heliculturists should use fluted pumpkin or Paw paw leaves in intensive snail rearing. Use of formulated ration may only be in time of forage shortages as may be occasioned by seasonal changes.

Key words: Growth performance, African giant snails, forages, intensive rearing

INTRODUCTION

The scarcity of meat for human protein requirement has necessitated the need for intensive rearing of some unconventional livestock such as the snail. Onoja (2005) stated that snail meat tastes good and is of high nutritive value. It serves special delicacies at homes and restaurants (Oyenike, 2008). This implies therefore, that snail can constitute a significant proportion of human diet. Imovbore and Ademosun (1988) reported that the dry matter of snail meat consists of high quality protein with high contents of important amino acids like lysine, leucine, arginine and tryptophan. In addition, snail meat has high level of calcium and phosphorus but low level of cholesterol thus making it unharmful. The proximate composition of snail meat compared to other conventional meat products is as shown in Table 1.

Ajayi *et al.* (1978) stated that apart from the nutritive value of snail meat, snail also supply valuable source of nutrition to livestock and other animals for instance, the non-edible parts (viscera and shell) can be recuperated for feeding monogastric animals.

Snails being nocturnal animals carry out most of their biological activities especially feeding and mating during the night, but during the day, they remain quiescent and hide away from predators (Akinnusi, 1997). He further stated that snail feed on a wide range of materials. While Esobe (1986) reported that *Achatina achatina* feed on both fruits and leaves of plants, Okoroh (1988) reported a disparity in preference for leaves and fruits between the young and adult snails. He said that the young snail like the leaves whereas adults relish the fruits more than leaves.

Growth is a major factor in assessment of performance and Plummer (1975) reported a direct proportional relationship between increase in body weight and increase in shell length. Okwuani (2002) stated that the growth of snail is inversely proportional to the age, with the younger ones growing more than the old ones. Ajayi *et al.* (1978) pointed out that even though snail feeds indiscriminately, not all food effect appreciable change in growth. They observed that some food may even lead to a retrogressive growth, cause some pathological conditions and loss of body weight.

In spite of the growing importance of snail, best production system as well as best nutrient materials for optimum production within a limited time has not been well documented. The research therefore is aimed at investigating the best nutrient or food item for growth under intensive production system.

MATERIALS AND METHODS

Location and duration of the study: The study was conducted at Orji farm situated at Umueze-Awkunanaw, Nkanu West Local Government Area, Enugu State,

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Table 1: Nutrient contents of snail meat compared to other meats

		Amino acids g/16g N			Minerals mg/100 g dry sample			
		Le	Ly	Tr	Ca	P	K	Fe
Snail meat	8.31	9.36	9.21	1.29	185.70	61.24	63.30	1.40
Beef	6.98	8.39	9.30	1.00	53.00	24.05	81.44	1.25
Broiler meat	8.90	7.75	9.22	0.80	55.60	28.29	74.14	0.90
Chevon	7.01	8.28	10.06	0.90	65.30	28.08	97.21	0.19
Mutton	6.40	8.85	10.28	1.32	55.20	22.45	82.83	0.85
Pork	7.22	7.90	9.96	0.70	64.00	34.42	83.45	0.90
Fish (Clarias)	5.78	9.45	11.44	1.40	69.12	26.13	61.48	0.55
Fish (Tilapia)	7.27	9.33	11.49	1.24	103.38	30.81	75.69	0.52

			Percentage of total		Proximate composition dry weight basis	
	CL	FS	SFA	UFA	CP	EE
Snail meat	20.28	0.42	28.71	39.67	88.37	1.64
Beef	76.84	1.06	46.19	31.92	92.75	4.59
Broiler meat	95.84	0.84	32.52	56.12	92.21	4.34
Chevon	69.00	0.76	39.72	35.11	86.63	3.01
Mutton	87.46	0.62	48.51	39.49	86.34	4.20
Pork	61.54	1.02	42.59	455.00	82.42	13.6
Fish (Clarias)	61.54	0.92	28.00	49.56	91.99	3.18
Fish (Tilapia)	65.20	0.39	32.38	42.58	90.81	3.35

Source: Imovbore and Ademosun (1988). Le = Leucine; Ly = Lysine; Tr = Tryptophan; CL = Cholesterol level; FS = Mg/100 fresh sample; SFA = Saturated fatty acid; UFA = Unsaturated fatty acid; CP = Crude protein; EE = Ether extract

Nigeria. The area lies between latitude 07° 4^1 North and 08° 2^1 South with longitude 06° 8^1 East and 07° 6^1 West. The area posseses such factors that could favour growth of snails. These include availability of giant trees for shade and cover, good radiation and availability of water and feed resources. The study lasted for six weeks (September to October, 2008).

Experimental snails: Thirty-two (32) snail hatchlings of three (3) weeks old were procured from Songhai farms, Amukpe-Sapele, Delta State, Nigeria. On arrival to the experimental site, all snails were allowed an acclimatization period of two (2) weeks and were generally fed and provided with water daily. Efforts were made to simulate the natural environment by covering the snail with leaves.

Experimental diets: The experimental diets consisted of fluted pumpkin (*Telferia occidentials*), African spinach (*Amaranthus sinensis*), Paw paw (*Carica papaya*) leaves and formulated mash feed. The choice for the use of these feed items was based on two main factors namely:

- Animal preference on the feed materials during the acclimatization period and
- Ready availability of the feed material

The composition of the mash used is shown in Table 2.

Experimental layout: The experimental snails were housed in a pen constructed with palm fronds. The pen was built under a pear tree (which provided constant shade) and near a well-water (for easy access to water for the animals).

Table 2: Materials used in compounding mash feed

Feeding ingredients	Nutrients supplied	Quantity (gram)
Wheat offal	Energy	320
Maize gluten	Protein	110
Fish meal (local)	Protein	55
Bone meal	Mineral	15
Salt	Mineral	2.5
Premix	Vitamin	2.5

At one side of the pen were some openings where the baskets could be brought out and taken back. The space provided avenue for attending to the snails with ease.

Procedure and management: Four (4) local baskets of 34 cm in diameter each were placed in the pen. Each basket was divided into two with wire gauze to provide two replicate groups per treatment. The experiment therefore had 4 treatments with 8 replicates. The baskets were tightly covered with metal-like mosquito nets. After recording the initial body weight and shell length of the individual snails, they were randomly assigned to the 4 baskets that represented the treatment groups. Each of the treatment which consisted of 8 animals was replicated twice.

Known weight of feed for each treatment was given to the snails daily in plastic saucer plate. The feed were fluted pumpkin (*Telferia occidentials*) leaves T_A, African spinach (*Amarathus sinensis*) (T_B), Pawpaw (*Carica papaya*) leaves (T_C) and formulated mash (T_D). Water was sprinkled on the baskets twice daily to ensure a cool and humid surrounding. Body weight and shell length were taken on weekly basis.

Experimental design and data analysis: A Completely Randomized Design (CRD) was used in the experiment since only treatment effect was evaluated. There were four treatments and eight snails were randomly assigned to each of the treatments. Each treatment was further replicated two times with four per replicate.

Data collected on feed intake, weight gain, shell length and feed conversion ratio were subjected to one-way Analysis of Variance (ANOVA) using the statistical method of Steel and Torrie (1980). The Least Significant Difference (LSD) was used to separate the difference of various means.

RESULTS

Table 3 shows that there was significant difference ($p<0.05$) in food intake of snails between some treatment groups. Feed intake was highest in T_A followed by T_C and lowest in T_D. However, there was no significant difference ($p>0.05$) in feed intake between T_A and T_B. Table 4 shows that there was significant difference ($p<0.05$) in weight gain between some treatment groups. Weight gain was highest in T_D followed by T_A but lowest in T_B. No significant difference ($p>0.05$) was observed between T_A and T_C groups.

There was a significant difference ($p>0.05$) in feed conversion ratio between some treatment groups as shown in Table 5. Feed conversion ratio was highest in T_B followed by T_C but least in T_D. No statistical difference was observed between T_A and T_B.

Table 6 shows that shall length was statistically lower ($p<0.05$) in T_B than any other treatments. No significant difference ($p>0.05$) existed between T_A, T_C and T_D.

Table 3: Mean weekly feed intake (grams)

Age (Weeks)	T_A	T_B	T_C	T_D
3	4.875	3.75	3.0	2.5
4	4.625	3.875	2.625	2.0
5	6.625	4.625	3.875	2.5
6	6.625	5.375	4.625	2.75
7	9.75	6.875	4.5	2.0
8	7.75	7.375	5.5	2.25
ΣX	40.25	31.875	24.125	14.0
X	6.71^a	5.3125^a	4.02^b	2.33^c
SE	±0.7081	±0.5696	±0.3649	±0.4669

Means with rows having different superscripts are statistically different ($p<0.05$)

Table 4: Mean weekly weight gain (grams)

Age (Weeks)	T_A	T_B	T_C	T_D
3	2.375	1.875	1.625	2.0
4	1.375	0.5	1.0	1.875
5	1.25	0.875	1.375	1.5
6	1.125	1.25	1.875	1.75
7	1.375	1.375	1.5	2.5
8	1.375	1.625	8.75	2.125
ΣX	8.875	7.5	8.75	11.75
X	1.48^b	1.25^c	1.46^b	1.96^a
SE	±0.1677	±0.1755	±0.1089	±0.1273

Means with rows having different superscripts are statistically different ($p<0.05$)

Table 5: Mean Weekly feed conversion ratio

Age (Weeks)	T_A	T_B	T_C	T_D
3	2.06	2.02	1.75	1.27
4	3.45	9.50	2.63	1.06
5	5.09	6.85	2.85	1.67
6	6.15	4.42	2.25	1.90
7	7.07	5.12	3.32	1.01
8	5.55	4.50	3.92	0.95
ΣX	29.37	32.41	16.99	7.86
X	4.89^a	5.40^a	2.83^b	1.31^c
SE	±0.6851	±0.9455	±0.2754	±0.1454

Means within rows having different superscripts are statistically different ($p<0.05$)

Table 6: Mean Weekly shell length increase (cm)

Age (Weeks)	T_A	T_B	T_C	T_D
3	0.40	0.30	0.39	0.31
4	0.37	0.23	0.34	0.25
5	0.36	0.11	0.26	0.26
6	0.21	0.19	0.21	0.13
7	0.25	0.22	0.25	0.21
8	0.18	0.20	0.41	0.29
ΣX	1.77	1.25	1.86	1.29
X	0.295^a	0.208^b	0.31^a	0.242^a
SE	±0.0346	±0.0230	±0.0305	±0.0240

Means within rows having different superscripts are statistically different ($p<0.05$)

DISCUSSION

The higher feed intake in T_A and T_B groups compared to T_C and T_D could be as a result of a difference in succulence, palatability and digestibility of the feed materials used. It is possible that the *Telferia occidentalis* (Fluted pumpkin) and the *Amaranthus simensis* (African spinach) in T_A and T_B respectively are more succulent, palatable and digestible than the others used in T_C and T_D. The Pawpaw leaves used in T_C was more fibrous to touch and probably bitter to taste, hence the less intake. The formulated mash of T_D was very dry and powdery. Perhaps, the very low water content of the mash made it unattractive to the snails.

The highest weight gain in T_D could be attributed to the nutrient composition of the mash. Being a formulated feed, it is expected to have a better balance of nutrients. Therefore, a little intake of food would give a corresponding gain in weight. That was not true for the forage used in T_A, T_B and T_C that have their nutrients predetermined by nature. It is possible therefore that the nutrients may not have been in the right proportion to effect significant weight increase as in T_D. Weight gain in T_A, T_B and T_C can only be effected by the available nutrients in the forages which can now be converted to flesh. This agrees with the report of Ajayi *et al.* (1978) who stated that not all food materials can exert appreciable change in snail growth.

The highest feed conversion ratio evidenced in T_A and T_B than in the other groups is reflective of the highest feed

intake recorded for them it can therefore be believed that the greater the feed intake, the greater the feed conversion ratio.

The shell length increase was statistically lower ($p<0.05$) in the T_B group than any of the other. It is possible that African spinach is relatively low in calcium and Phosphorus-both of which are very essential for shell growth and development. This finding agrees with the earlier report by Plummer (1975) that there is a proportional relationship between body weight and shell length increases.

Conclusion and Recommendations: In conclusion, best growth performance of snail could be achieved in intensive rearing with the use of formulated mash.

However, use of formulated mash at all-year-round should not be encouraged for economic reason except during the dry season when forages are generally unavailable.

I recommend the use of Paw paw leaves especially during the rainy season since it gave the best shell increase and second best weight gain. In addition, it is very easily available and affordable especially in the rainy season. Also, it suffers no competition between animals and man.

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