Growth, Carcass Characteristics and Shell Quality of Grower Snails (*Archachatina marginata*) Fed Varying Levels of Soya Bean Meal

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Abstract

This study was conducted to determine the effects of soya bean meal fed to grower snails at varying level of inclusion (23%, 25% and 27%) on their growth performance, carcass characteristics and shell quality. The experiment lasted for 10 weeks. Twenty-seven (27) 5-month old Achachatina marginata grower snails were randomly divided into three (3) groups of nine snails each per treatment, divided into three replicates of three snails each. The parameters examined were growth performance, feed intake, feed conversion ratio, and carcass and shell characteristics. Data collected were analyzed by the one-way analysis of variance and significant means were separated with Duncan's multiple ranged test at 5% level of probability The study revealed that the 27% SBM diet supported significantly higher final body weight, body weight gain, total feed intake, live weight, dressing percentage, visceral percentage, shell thickness and shell weight. However, no significant differences were recorded in the final shell circumference, shell circumference gain, final shell length and shell length gain as a result of the slow growth rate of snails. It was concluded that compounded feeds containing as much as 27% SBM is a way of ensuring all-year availability of feed for commercial snail production.

Key words: Soya bean meal, carcass characteristics, shell quality, *Achachatina marginata*

Introduction

Snails belong to the Phylum *Mollusca* which is the second largest invertebrate group in the animal kingdom after insects (Yoloye, 1994). In West Africa, *Archachatina marginata* and *Achatina achatina* are among the largest land snails, which are mostly found in the humid forest areas from where they are gathered by the rural dwellers for consumption.

Snails, like other animals, need the basic nutrients (energy, protein, fat, amino-acids, vitamin and minerals) for optimum functioning of metabolic chemical reactions involved in growth, maintenance, shell formation, production and reproduction (Ugwuowo and Ani, 2011) The

choice of feeding materials is based on available information that snails can utilize a number of feeds for growth, as well as the fact that snails are vegetarians (FAO, 1986; Philips, 1992) to the extent that each of the feeding materials can influence the growth rate of snails. Snails' requirements for calcium, phosphorus, potassium and magnesium are relatively high compared to other animals. These minerals determine the rate of shell secretion by the mantle and development of shell (Imevbore and Ademosun 1988; Imevbore and Ajayi, 1993).

In Nigeria, snail population has been on the decline due to indiscriminate extraction from the wild habitat without replacement. Human activities such as deforestation, use of pesticides and herbicides, slashing and bush burning have not helped in the conservation of these valuable animals (Okpeku and Omueti, 2003). Today, there is an increasing interest in the rearing of snails to make them available in commercial quantities for marketing at all seasons of the year. However a number of problems surround artificial rearing of snails. These include their very slow growth rate and seasonal breeding pattern (Omole *et al.,* 1999) which severely limit their productivity. In addition, the scarcity of natural feed sources in sufficient quantities throughout the year poses a serious problem in the continued harvesting of Snails in sufficiently large numbers to meet their demand (Imevbore and Ademosun, 1988).

These natural feed resources are only available during the wet season. It is an established fact by some researchers that for all-round availability of feed, compounded feed is desirable. Forage feeds are more expensive than the conventional animal feed because farmers cannot store them in their fresh state for future use because of their perishable nature, unlike formulated feed that can be compounded once and stored for longer periods. In addition, the availability of herbages is affected by seasonal changes. As an alternative therefore, compounded feed can be used for feeding snails. In addition, these conventional animal feed also have mineral/vitamin designed to provide the nutrients required by snails for growth and development which may be lacking in some of the natural feed resources (Eze *et al.,* 2013).

Snail farming has numerous advantages. Snail farms can be established and maintained cheaply in terms of housing, feeding and health care. Snail meat compares favourably with other conventional sources of animal protein such as beef, pork, goat meat and poultry meat (Nyameasem and Borketey-la, 2014). The meat has a crude protein content of about 19% (fagbuaro *et al.,* 2006). The low cholesterol and high iron content of the meat makes it a good cure for fat-related ailments such as hypertension, diabetes, reduction in labour pain in women during child delivery among others (Bright, 1996). Snails can be reared by the physically challenged because it is not strenuous and labour-intensive. They require little capital to raise, unlike the rearing of other livestock. This study was designed to provide information on the effects of feeding varying levels of soya bean meal on the carcass and shell quality of snails.

Materials and Methods

Experimental Location

The experiment was carried out at the Delta State University Teaching and Research Farm Asaba Campus, Asaba, Nigeria.

Experimental Ingredient

Soya bean seeds were purchased from the Asaba main market, Asaba, Nigeria. The seeds were sun-dried, toasted, decoated, and then milled into powder to obtain soya bean meal (SBM), and stored in plastic containers for later use.

The Experimental Animals

Forty (40) grower snails of the species *Archachatina marginata* were purchased from Songhai Farms, Amukpe, Sapele in Sapele Local Government of Delta State, Nigeria. These snails were quarantined for two (2) weeks prior to the commencement of the experiment to allow for the acclimatization of the snails, and to observe them for possible presence of disease. During this period the snails were fed with Paw-paw leaves *(Carica papaya)* and Water leaf (*Talinium triangulae),* Clean water was sprinkled on the snails every morning and evening. The duration of the experiment was for ten (10) weeks

A total of twenty-seven (27) *Archachatina marginata* grower snails were selected from the forty (40) snails reared in the pre-experimental period, and were randomly divided into three (3) groups of nine (9) snails each per treatment which consisted of three replicates of three snails each per treatment. The snails were fed with three experimental diets which were formulated to contain soya bean meal (SBM) at 23%, 25% and 27% (Table 1). These snails were five (5) months old at the start of the experiment.

Table 1: Composition of the experimental diets for grower snails fed varying levels of SBM

	Levels of Soya Bean Meal (SBM) inclusion		
Ingredients	**23%**	**25%**	**27%**
Yellow maize (9%)	55.50	50	43
Blood meal (80%)	12.00	12	12
Wheat bran (!5%)	16.00	16	16
Soya beans meal (44%)	12.50	18	25
Bone meal	3	3	3
Vit. premix	1	1	1
Total	**100**	**100**	**100**
Calculated Analysis			
Metabolizable Energy (kcal/kg)	2751.80	2685.80	2601.80
Crude protein %	22.75	24.67	27.12
Calcium %	0.73	0.74	0.76
Crude Fibre%	4.05	4.33	4.70

Housing and Feeding

The snails were kept in wooden cages which measured 15cm x 60cm x 30cm each, constructed under a roofed shade to prevent direct sunlight on the snails. These wooden cages were suitable for backyard snail production. The snails were weighed individually, and randomly distributed into the cages ensuring similar average weight per treatment. The floor of each of the cages was filled with loamy soil to a depth of fifteen (15cm) centimetres. The soil, before use, was spread out under direct sunlight for one week to get rid of harmful soil micro-organisms.

Weighed quantities of the experimental diets were placed in flat plastic containers inside the cages every morning at about 8.00am, Nigerian time. Clean water was sprinkled every morning

and evening to keep the soil moist, while drinking water was provided in shallow flat plastic plates for the snails to have access to water all the times.

Droppings were removed every morning so as to maintain a clean environment inside the cage.

Data Collection

Data were collected on growth performance, carcass characteristics, feed intake, and on feed conversion ratio as follows.

i. Body weight

The experimental snails were weighed individually on arrival, and on weekly basis after that. Body weights were recorded to the nearest 0.01g for 10 weeks.

ii. Shell length

This was done fortnightly by measuring the long axis of the snail on individual basis with the use of a flexible measuring tape, and recorded to the nearest 0.01cm.

iii. Shell Circumference

This was done with a measuring tape around the largest circumference of the shell on individual basis. This was done fortnightly too.

iv. Feed Intake

This was obtained weekly, on replicate basis, as the difference in weight between the total feed offered the snails and the weight of air-dried left-over feed during the same period.

v. Feed Conversion ratio (FCR)

This was calculated using the following formula: $FCR = \frac{\text{Feed intake (g)}}{\text{Body weight gain (g)}}$

vi. Carcass Evaluation

At the end of the experiment, two (2) snails were collected from each replicate, giving a total of six (6) snails in each treatment. This gave a total of eighteen (18) snails out of twenty-seven snails used in the experiment.

The live weight of each snail was taken, and the shell contents carefully removed from the shell with a hooked pin, dried carefully with a paper towel and weighed. The contents were then separated into edible and non-edible portions, and weighed.

The empty shells were air-dried for 48 hours and weighed.

Carcass and shell characteristics were obtained using the following formulae.

$$\text{Shell Percentage} = \frac{Weight\ of\ shell}{\text{Live weight of snail}} \text{ x } 100$$

$$\text{Visceral Percentage} = \frac{Weight\ of\ Viscera}{\text{Live weight of shell}} \text{ x } 100$$

$$\text{Dressing Percentage} = \frac{Weight\ of\ Edible\ portions}{\text{Live weight of snail}} \text{ x } 100$$

Shell thickness for each of the snails was taken at three different locations at the aperture with a micrometre screw gauge, in millimetres, and the average thickness per snail recorded.

Statistical Analysis

All data collected were subjected to one-way analysis of variance, and significantly different means were separated using Duncan's multiple ranged test at 5% level of probability using statistical analysis system, (2011).

Results and Discussion

Growth Performance

Table 1 shows the effect of feeding varying levels of soya bean meal (SBM) on growth performance of grower *Achachatina merginata* snails. The results showed that snails fed 27% of SBM had the highest final body weight and body weight gain. This is in line with the findings of Ugwuowo and Ani (2011) that animal growth depends greatly on the level of protein intake and utilization of the feed materials. Ani *et al.* (2013) also observed that snails performed better when fed higher protein levels and energy levels. Significant ($P<0.05$) differences were not recorded in the final shell circumference, shell circumference gain, final shell length and shell length gain. This may be attributed to the slow growth rate of snails which is in line with the finding of FAO (1986).

Table 2: Growth performance of Grower snails fed varying levels of soya bean meal (SBM)

	Levels of inclusion of SBM		
Parameters	**23%**	**25%**	**27%**
Initial body weight (g)	35.62±0.00	35.64±0.00	35.61±0..00
Final body weight (g)	41.88±0.44^{c}	42.47±0.55^{b}	45.05±0.85^{a}
Body weight gain (g)	6.26±0.44^{c}	6.83±0.55^{b}	8.44±0.85^{a}
Initial shell circumference (cm)	11.05±0.00	11.06±0.00	11.05±0.00
Final shell circumference gain (cm)	12.01±0.00	12.01±0.00	12.01±0.00
Shell circumference gain (cm)	0.96±0.00	0.95±0.00	0.96±0.00
Initial shell length (cm)	6.02±0.00	6.01±0.00	6.02±0.00
Final shell length (cm)	6.06±0.00	6.06±0.00	6.07±0.00
Shell length gain (cm)	0.04±0.00	0.05±0.00	0.05±0.00
Total feed intake (g)	372.08±5.15^{b}	385.38±4.27^{a}	388.57±2.72^{a}
Feed conversion ratio (g)	59.34±3.66^{a}	56.18±3.85^{b}	46.04±4.06^{c}

a,b,c: Means within rows bearing different superscripts are significantly (P<0.05) different

Snails fed 25% and 27% inclusion level of SBM had higher feed intake. However, they also had the least feed conversion ratio because of the high weight gain recorded. This is because a low feed conversion ratio is an indication of high quality feed. It has also been established that feed consumption increases with increase in dietary protein level (MacDonald *et al.,* 1987; Bright, 1996).

Carcass Characteristics

The effect of feeding varying levels of SBM on the carcass characteristics of growing *Achachatine marginata* snails is presented in Table 3.

Significant (P<0.05) differences were recorded in all the parameters measured.

Table 3: Carcass characteristics of Grower snails feed Soya bean at varying levels of inclusion

Parameters	**Levels of inclusion**		
	23%	**25%**	**27%**
Live weight (g)	41.87 ± 0.44^{c}	42.41 ± 0.54^{b}	44.05 ± 0.85^{a}
Dressing percentage	17.95 ± 0.25^{c}	19.11 ± 0.50^{b}	20.57 ± 0.74^{a}
Visceral percentage	6.99 ± 0.29^{b}	7.39 ± 0.14^{ab}	7.73 ± 0.27^{a}
Shell thickness (cm)	1.28 ± 0.01^{b}	1.30 ± 0.01^{b}	1.38 ± 0.02^{a}
Shell weight (g)	8.40 ± 0.15^{b}	9.02 ± 0.17^{a}	9.36 ± 0.06^{a}

a, b, c: mean within rows bearing different superscripts are significantly (p<0.05) different

Snails fed 27% soya bean meal had the highest live weight, dressing percentage, visceral percentage, shell thickness and shell weight. This is in agreement with the results of Ejidike (2004) and Ejidike (2007) who found that animal performance is greatly dependent on the levels of protein intake and utilization. Ugwuowo (2011) also observed that high dietary protein encourages high percentage edible weight. This is also in consonance with the work of Ani *et al.* (2013) that as a rule, heavier animals are expected to have higher carcass yield than lighter ones. Grower snails fed 23% of Soya bean meal had the lowest live weight, dressing percentage, visceral percentage and shell weight.

Conclusion

It was observed that soya bean meal at 27% inclusion level supported higher final body, body weight gain, and live weight, dressing percentage and shell thickness. However SBM at 25% also supported higher visceral percentage and shell weight. Snails feed 23% of SBM had the highest feed conversion ratio. Compounded feeds containing as much as 27% SBM may therefore be a way of ensuring all-year availability of feed for commercial snail production.

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