

Nutritional and Economic Evaluation of Snail Offal Meal as a Protein Source in the Diets of Growing African Land Snails (*Archachatina marginata*)

Popoola¹, Y.A., Olorunghobunmi¹ T.O., Ajijola¹ S., Idowu¹ A.B., Adedotun¹ A.O., Olalere¹ M.O., Owosibo³ A.O., Olatundun² B.E., Ajayi³ O.T., Abraham⁴ O.A. and Omole¹, A.J.

¹Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Nigeria

²University of Ilesa, Osun State

³Federal College of Animal Production and Health Technology, Moor Plantation, Ibadan, Nigeria.

⁴University of Abuja, Nigeria.

Target Audience: Researchers, Livestock Farmers, Feed Processors and Industries, Feed Milling Industries

Abstract

This study evaluated the performance of growing snails Archachatina marginata fed varying levels of snail offal meal (SOM) as alternative source of protein to replace soybean meal. A total of 150 growing snails were allotted to five dietary treatments. The treatment groups were SOM₁, SOM₂, SOM₃, SOM₄ and SOM₅ which contained 0, 5, 10, 15 and 20 % inclusion of SOM in replacing soybean meal in a completely randomized design with three replicates per treatment over a 12-week feeding trial. The SOM were processed and dried before incorporation with feed ingredients. The management practices were all the same in all the treatments. Data were collected on growth performance, cost implications and carcass yield. There were significant differences in the mean total feed intake of the snails fed diets containing SOM. Results showed that snails fed 10% SOM recorded significantly higher ($P < 0.05$) final weight gain and superior FCR compared with other treatments. Higher inclusion levels (15–20%) resulted in reduced growth performance and poorer shell quality. Mortality was low across treatments but increased slightly at 20% SOM inclusion. The study concluded that snail offal meal can be included up to 10% in the diets of growing Archachatina marginata without adverse effects on performance or shell quality.

Keywords: *Archachatina marginata*, Snail offal meal, Nutritional evaluation, Growth performance, Shell quality.

Description of Problem

Snail farming is gaining popularity in sub-Saharan African because of its biological value as a source of animal protein for the population. Economic factors driving the rapid adoption of snail farming in Africa

include low initial capital investment, minimal feed requirements, adaptability to tropical climates, limited space needs, and strong market demand for giant African land snails (1). Snails have been described as nocturnal animals they have been

observed that snails feed mainly in the night, at dusk, or by day when there is rain or if the sky is overcast (2). The digestive system is well developed; numerous teeth like projections called radula are present in the mouth which serve as the teeth (3). Snail eats little quantity of feed compared to other conventional livestock such as poultry and sheep etc. (4).

One of the main things limiting livestock production is feed, which accounts for between 70 and 80 percent of all production costs. Most of the conventional proteins sources such as soybean meal and fish meal are expensive and are highly demanding, raising direct compete with human food needs. However, the use of unconventional, alternative source of protein with low cost, readily available and well processed that can partially or totally replace the conventional ingredients without any deleterious or negative effects on the performance of animals [5], (1)].

Snail offal, is a waste product which is mainly of viscera and non-edible portion of snails removed during snails processing, is regarded as waste and causing environmental concerns if not well managed. Preliminary works have revealed that snail offal is rich in crude protein, essential amino acids, and minerals, supporting the fact that it could be used as alternative and valuable source of protein in the diet of livestock. Using snail offal meal well processed could reduce the cost of feed, improve resource use efficiency and promote waste management. There is paucity of information on the use of snail

offal meal in the diets of growing snails. This study is to evaluate the effects of varying inclusions of SOM on growth performance, feed utilization, economic evaluation and survivability of growing snails

Materials and Methods

The experiment was carried out at the Snail Unit of the Institute of Agricultural Research and Training (I.A.R.& T.), Moor Plantation which is located on Longitude 03°51E, Latitude 07°23N and Altitude 650' lies in the humid zone of the rainforest belt 0703.25 of Southwestern Nigeria with mean annual rainfall of 1220 mm and mean temperature of 26°C. Five diets were formulated to contain 24% crude protein and approximately 2500 kcal/kg metabolizable energy. The treatment groups were SOM₁, SOM₂, SOM₃, SOM₄ and SOM₅ which contained 0, 5, 10, 15 and 20 % respectively with inclusion of (SOM) replaced soybean meal. The gross composition of the experimental diets is as shown in Table 1, SOM was included at 0, 5, 10, 15 and 20% of the entire diets. The protein content and energy level of the control diet (SOM) were in accordance with the recommended levels as suggested by (1).

Fresh snail offal was collected from local snail processing outlet in Apata, Ibadan, Oyo State, Nigeria. The offal was thoroughly washed, oven-dried at 60 °C for 48 hours, and milled into a fine powder. Proximate analysis of the snail offal meal was carried out following (1) procedures. The SOM was incorporated with other feed

ingredients; the management practices were all the same in all the treatments. A total of 150 snails were used for the experiment. The experimental design was completely randomized design. The snails were allotted into five treatments and replicated three times with a total of 10 snails per replicate. The snails were reared in a cage of 2 compartments and each compartment had a dimension of 0.5x 0.5m². Feed intake and weight gain were measured on daily and weekly basis respectively with the use of sensitive weighing balance. Feed intake was

calculated by subtracting the left-over feed from the feed given while the weight gain was calculated by deducting the initial weight from the final weight. Shell length and width were measured on weekly basis with vernier caliper. Micrometer screw gauge was used to measure the shell thickness on weekly basis. Feed conversion ratio was calculated as the ratio of feed intake to weight gain. All data were subjected to statistical analysis using analysis of variance and the means were separated using Duncan Multiple Range Test (8).

Table 1: Gross Composition of Experimental Diets (%)

Ingredient (%)	Cost (₦/kg)	Percentage inclusion of SOM				
		SOM ₁ (0%)	SOM ₂ (5%)	SOM ₃ (10%)	SOM ₄ (15%)	SOM ₅ (20%)
Maize	450	42.00	42.00	42.00	42.00	42.00
SOM	350	0.00	1.14	2.26	3.38	4.51
SBM	600	22.50	21.37	20.25	19.13	18.15
BDG	750	20.00	20.00	20.00	20.00	20.00
*Other fixed ingredients	550	15.50	15.50	15.50	15.50	15.50
Total	2,700	100.00	100.00	100.00	100.00	100.00
Cost/kg (N)	2,700	151.34	149.34	137.20	134.32	130.20
Calculated Composition						
Crude protein (%)		24.22	24.21	24.13	24.08	24.06
ME (kcal/Kg)		2605.20	2599.30	2589.45	2572.12	2571.13

ME= Metabolisable energy; SOM - Snail Offal Meal, SBM - Soya Bean Meal, BDG - Brewery Dried Grain
*Other fixed ingredients: Bone meal 5, Oyster shell 10, Premix 0.5

Result and Discussion

The result of proximate composition of snail offal meal was analyzed as showed below in Table 2. There were no significant

differences in the mean total feed intake of the snails fed diet containing SOM as observed in Table 3 below

Table 2: Proximate Composition of Snail Offal Meal (%)

Parameter	Value (%)
Crude protein	48.60
Ether extract	7.40

Crude fibre	3.20
Ash	12.10
Moisture	8.50
Nitrogen-free extract	20.20

Table 3: Summary of Performance of Snail fed diets containing SOM

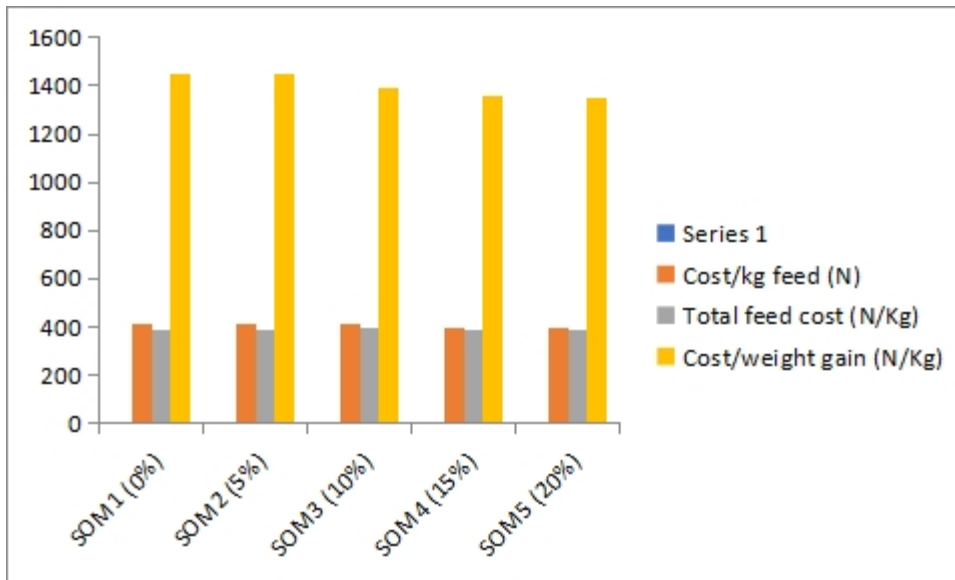
Parameters	SOM1 (0%)	SOM2 (5%)	SOM3 (10%)	SOM4 (15%)	SOM5 (20%)	± SEM
Initial weight (g)	85.20	84.09	85.10	85.50	85.3	1.96
Final weight (g)	168.4 ^b	172.6 ^{ab}	181.9 ^a	164.3 ^{bc^a}	158.1 ^c	13.90
Total weight gain (g)	83.2 ^{ab}	88.5 ^{ab}	96.8 ^a	78.8 ^{bc}	72.8 ^c	17.12
Total feed intake (g)	210.4 ^a	212.6 ^a	215.3 ^a	198.7 ^b	185.9 ^c	12.88
Feed conversion ratio (g)	2.53 ^b	2.42 ^{ab}	2.22 ^a	2.51 ^b	2.55 ^b	0.24
Cost/kg feed (N)	410.34	410.21	410.01	399.23	395.01	
Total feed cost (N/Kg)	387.43	390.47	396.46	387.73	385.00	
Cost/weight gain (N/Kg)	1452.57 ^a	1448.06 ^a	1391.08 ^b	1355.38 ^c	1351.22	

Snails fed diets containing 10% snail offal meal (SOM₃) recorded significantly higher ($P < 0.05$) weight gain and better feed conversion ratio compared to other treatments. Feed intake did not differ significantly among snails fed 0–10% SOM but declined at increasing rates of SOM from 15% to 20% inclusion levels. This follows the same trend with the weight gain. The best FCR was recorded in the snails fed diet SOM 3 with the value of

2.22. SOM have been found to improve weight gain, feed conversion ratio and protein efficiency was also economically profitable. It can successfully replace a significant portion of fish meal in aquaculture feed (9). (10) also reported the use of snail offal meal and concluded that it can replace fishmeal in broiler diets leading to improved growth performance and feed cost.

The result of the cost analysis is shown in Fig 1 below.

Fig. 1: Cost Analysis of Growing Snail fed with SOM



The total feed cost (N/Kg) increases as the level of SOM in the diet increased from 0% (387.432), 5% (390.47) and 10% (396.46), while the cost reduces at levels 15% and 20% to 387.73 and 385 respectively this is due to the high inclusion level of SOM which greatly reduced the cost of the feed. The cost per weight gain (N/Kg) recorded shows that, there was a reduction in the cost of utilizing snail offal meal (SOM) as the level increases from 0% to 20%. (11) reported a drastic reduction in the cost of laying hen feed when fishmeal was substituted with SOM. Replacing high cost protein source can reduce feed cost in livestock production.

The result from the shell quality parameters of snails fed diets containing SOM. Shell length and shell thickness from SOM 3 compared favorably with the diet SOM 1, there was no significant difference between them, and however, it was significantly different than SOM 4 and SOM 5. Shell length and shell thickness is important to the growth performance of snails. It impacts their survival and defense. It can be deduced from the study that the inclusion of SOM in the diets of snail promoted better growth trait in the shell length and thickness when compared with the control.

The observed shell quality reduction at higher SOM levels may be linked to mineral imbalance, particularly calcium

availability, which is critical for shell development.

Table 4: Shell Quality Parameters of Snail fed diets containing SOM

Parameter	SOM1	SOM2	SOM3	SOM4	SOM5
Shell length (cm)	9.6 ^a	9.8 ^a	10.2 ^a	9.1 ^b	8.9 ^b
Shell thickness (mm)	1.82 ^a	1.85 ^a	1.90 ^a	1.61 ^b	1.52 ^b

Conclusion

The inclusion of snail offal meal (SOM) in snail diets presents a promising alternative protein source, especially in regions where conventional feed ingredients are scarce or expensive. This study indicated that SOM at 10% inclusion support growth performance, improve protein intake, and reduce feed cost without compromising the health or productivity of growing snails. Snail offal meal can be effectively utilized as an alternative protein source in the diets of growing *Archachatina marginata* at inclusion levels of up to 10% without adverse effects on growth performance, feed efficiency, shell quality, or survivability. Incorporating SOM into snail diets offers a cost-effective and environmentally sustainable feeding strategy for snail farmers. It also promotes sustainable agriculture by recycling by-products within the snail production system.

Application

Snail offal meal can be included in the diet of growing snails at levels up to 10 % without negative effects on growth or feed

intake. It should be properly processed (dried and milled) to ensure hygiene and nutrient availability. Quality control is essential to avoid contamination and ensure consistency in nutrient composition. Farmers should be trained on formulation and safe handling of SOM-based feeds to maximize its benefits. Integrating SOM into snail feeding programs supports cost-effective and eco-friendly snail production.

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