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Growth performance and reproductive characteristics of breeder snails *(archachatina marginata)* fed Groundnut cake at varying levels of inclusion

Eze, J. N.*, Oyana, V. N., Momah, L. N., Iyiegbuniwe, H. O., and Evien, C. O.

Federal College of Education (Technical), Asaba.
Corresponding Author E-mail: joantreasure45@gmail.com

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ABSTRACT: The study was conducted to examine the effects of groundnut cake served to breeder snails at varying levels of inclusion. 23%, 25%, and 27%. The snails were ten (10) months old. The trial lasted for 15 weeks. Thirty-six (36) *Archachatina marginata* breeder snails were randomly distributed into three (3) groups of twelve snails per treatment which were replicated 3 times in each of the groups. The parameters observed were growth performance, feed intake, feed conversion ratio, and reproductive characteristics. Data collected were analyzed by the use of a one-way analysis of variance and significant means were separated with Duncan's multiple-ranged test at a 5% level of probability. The study revealed that 27% of the GNC diet supported significantly higher final body weight, body weight gain, number of eggs laid, percentage fertility, and percentage hatchability. However, no significant ($p > 0.05$) differences were documented in the final shell circumference, shell circumference gain, final shell length, and shell length gain. It was established that compounded feeds containing as much as 27% GNC are better and a source of ensuring all-year availability of feed for commercial snail production.

Keywords: Breeder, hatchability, fertility, embryo, growth

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INTRODUCTION

Snails belong to the phylum Mollusca which is the second-largest invertebrate group in the animal kingdom after insects (Yoloye, 1994). The Giant African land snail (GALs) (*archachatina marginata*) being one of the most common snails in tropical Africa is also the most common edible land snail found and reared in Nigeria (Omole, 1997) (Abiola and Ikusika, 1998).

Snails are a good source of animal protein, containing about 18% crude protein of high biological value (Kehinde, 2009). The meat contains all the essential amino-acid such as lysine, and methionine, which are highly estimated and have low fat content and low cholesterol levels, which makes it a good remedy for fat-related diseases such as hypertension. The meat is also rich in calcium, iron, phosphorus, and potassium which are macro minerals needed for strong bones, Osmo-regulation and metabolic activities in the body of man and it is a good source of vitamins A, B6, E, and K, which are required for proper intake of primary nutrients such as carbohydrates, protein, fat, and oil (Kehinde, 2009 and Omole *et al*. 2011).

Snails could be fed with different feed resources such as leaves of pawpaw, plantain, sweet potatoes, etc. In the search to establish appropriate feed ingredients for rearing snails in captivity.

Numerous scientists have carried out different feeding trials over the years in quest of better feed options for snails in captivity, feeding snails with formulated diets has been buttressed by researchers because of its minerals/vitamin contents and also for its all-round availability which is not affected by the dry season (Eze *et al.* 2013; Ugwuowo and Ani, 2011).

MATERIALS AND METHODS

Experimental site

The study was conducted at the Federal College of Education (Technical) Teaching and Research farm in Asaba, Delta State, Nigeria.

Experimental animals (Snails)

A total of fifty (50) breeders of Giant African land snails (*archachatina marginata*) of ten (10) months old with an average weight of 99.93g were purchased from Songhai farms, Amukpe, Sapele Local government area of Delta State of Nigeria.

Experimental set - up

The snails were housed in wooden hatches measuring 35cm × 60cm × 30cm, which were kept under a roofed shade to prevent direct light on the snails. The hatches were filled with humus soil up to a depth of 13cm and moistened with water daily.

A total of thirty-six (36) breeder snails were selected from the fifty (50) snails bought and they were randomly distributed into three (3) groups of twelve (12) snails each per treatment, which consisted of three (3) replicates of four (4) snails each. The snails were fed with three (3) experimental diets which were formulated to contain groundnut cake at 23%, 25%, and 27%, as the main protein source (Table 1). Clean water was sprinkled on the snails every morning and evening and also a flat plate was used to provide water for the snails to allow them to have access to water at all times. The experiment was carried out for fifteen (15) weeks. Excreta was removed every morning before giving fresh feed to retain a clean setting inside the hutch.

Data collection

Data were collected on growth performances, feed intake, feed conversion ratio, and reproductive characteristics.

Body Weight (BW): Body weight was taken at the beginning of the experiment and every week, this was done on a replicate basis of fifteen (15) weeks.

Shell length (SL): This was done by assessing the long axis of the snail on an individual basis with the use of a flexible measuring tape. This was done fortnightly.

Shell circumstances (SC): This was done using a venial caliper around the largest circumference of the shell on an individual basis. This was done fortnightly too.

Feed intake (FI): This was obtained daily as variance in weight between the feed given and the feed remaining. This was done throughout the entire period of the experiment.

Feed conversion ratio (FCR): This was done using the following formula.

$$\text{FRC}=\frac{\text{feed intake}}{\text{body weight gain (g)}}$$

Reproductive performance

These were calculated using the following formulas:

$$\text{Fertility percentage} = \frac{\text{No of fertile egg}}{\text{no of eggs incubated}}$$

$$\text{Embryo mortality} = \frac{\text{No of dead in shell}}{\text{total no.of fertile egg}}$$

$$\text{Percentage mortality} = \frac{\text{No of eggs hatched}}{\text{total no of fertile eggs}}$$

These were done on replicate basis at the expiration of the experiment

Statistical analysis

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

RESULTS

The results of the growth performance of the breeder snails fed groundnut cake at the varying levels of inclusion were presented in (Table 2). The result indicated that the initial body weight (BW) of the snails was not significantly ($P>0.05$) different. There were significant ($P>0.05$) differences in the final body weight (FBW) and the body weight gain (BWG) with the snails in the treatment groups. Snails fed a 27% level of GNC inclusion level had a higher final body weight of 112.75± 0.65 and body weight gain of 12.82±0.60 respectively. The results of the feed conversion ratio (FCR) and total feed intake (TFI) were also significantly ($P>0.05$) different. Snails fed at 27% GNC inclusion level had a higher total feed intake (TFI) of 520.78±3.15 while snails at 27% GNC level of inclusion also had a lease feed conversion ratio of 40.62±2.33. The results however showed that there were no significant ($P>0.05$) differences in the Initial Shell Circumference (ISC).

Table 1: Composition of the experimental diets for breeder snails fed varying levels of groundnut cake.

Ingredients	Levels of Groundnut Cake (GNC) Inclusion		
	23%	25%	27%
Yellow maize 9%	56.00	50.00	45.95
Blood meal 80%	12.00	12.00	12.00
Wheat bran 15%	16.00	16.00	16.00
Groundnut cake 45%	13.00	19.00	23.05
Bone meal	2.00	2.00	2.00
Vitamin premix	1.00	1.00	1.00
Total	100.00	100.00	100.00

Table 2: Growth performance of breeder snails fed groundnut cake at varying levels of inclusion 2.3%, 25% and 27%.

Parameters	Levels of Inclusion		
	23%	25%	27%
Initial body weight (g)	99.93±0.00	99.93±0.00	99.93±0.00
Final body weight (g)	109.50±0.56^{c}	110.87±0.65^{b}	112.75±0.65^{a}
Body weight gain (g)	9.57±0.56^{c}	10.94±0.64^{b}	12.82 ±0.66^{a}
Initial shell circumference (cm)	16.06±0.00	16.06±0.00	16.06± 0.00
Final shell circumference (cm)	17.02±0.00	17.02±0.00	17.01± 0.00
Shell circumference gain (cm)	0.96±0.00	0.96±0.00	0.95±0.00
Initial shell length (cm)	9.01±0.00	9.01±0.00	9.01±0.00
Final shell length (cm)	9.06±0.00	9.06±0.00	9.06±0.00
Shell length gain (cm)	0.05±0.00	0.05±0.00	0.06 ±0.00
Total feed intake (g)	489.87±7.26^{c}	505.53±2.24^{b}	520.78 ± 3.15^{a}
Feed conversion ratio	51.19± 3.45^{a}	46.21± 3.25^{b}	40.62± 2.33^{c}

a, b, c means within row bearing the same superscripts are not significantly (p>0.05) different.

Table 3: Reproductive characteristics of breeder snails fed groundnut cake meal at varying levels of inclusion.

Parameters	Inclusion Level		
	23%	25%	27%
No of eggs laid	19.67±0.37^{b}	19.78±6.04^{b}	23.67 ± 1.44^{a}
Percentage fertility	79.56±2.83^{b}	78.89 ±2.44^{b}	85.53 ± 1.83^{a}
Percentage hatchability	83.01±0.04^{c}	86.77 ± 2.24^{b}	91.02 ±0.39^{a}
Percentage embryo mortality	16.98±1.32^{a}	13.23 ± 2.14^{b}	8.98 ±0.27^{c}

a, b, c, means within rows bearing the same superscript are not significantly (p>0.05) different.

Final Shell Circumference (FSC), Shell Circumstance Gain (SCG), Initial Shell Length (ISL), Final Shell Length (FSL) and Shell Length Gain (SLG). Results in Table 3 which is the reproductive characteristics of breeder snails fed groundnut cake at varying levels of inclusion showed significant (p<0.05) differences among the parameters measured. Snails fed 27% GNC level of inclusion had the highest number of eggs laid, percentage fertility, and percentage hatchability at 23.67 ± 1.44, 85.53 ± 1.83, and 91.02 ± 0.39 respectively. On the other hand, snails fed 23% of groundnut cake had the highest Percentage embryo mortality of 16.98±1.32.

DISCUSSION

The results in (Table 2) indicate that there was an increase in the growth of the breeder snails among the treatment groups. However, the effect of the levels of inclusion on the final body weight and body weight gain varied as indicated by the significant (p<0.05) differences recorded. Snails fed a 27% level of GNC had higher final body weight and body weight gain than snails fed 23% and 25% levels of the diet.

This was a result of the higher protein level feed fed to the snails. This was buttressed by the discoveries of Ejidike (2007), Ugwuowo and Ani (2011), and Ani *et al* (2013) that higher protein levels are essential animals for growth. No significant (p<0.05) differences were revealed in the final shell circumstances, shell circumstance gain, final shell length, and shell length gain, which may be accredited to the slow growth rate of snails and the short experimental period of fifteen (15) weeks as it takes

about 18-24 months for snails to attain matured live weight (Etukudo et al., 2016). Significant ($p<0.05$) differences were recorded in the total feed intake and feed conversion ratio. This was a result of the higher body weight recorded among the snails fed 27% level of the protein source. Table 3 results revealed significant ($p<0.05$) differences among the parameters measured. Breeder Snails fed 27% level of GNC had a higher number of eggs laid, percentage fertility, and percentage hatchability as well as the lowest in embryo mortality than others, while, snails fed 23%, level of GNC had the lowest percentage hatchability and highest embryo mortality. A higher level of protein has a greater influence on the reproductive performance of breeder snails as this aligns with the discoveries of Ejidike (2007) that a high protein level in diet results in better use and better performance. Okon *et al* (2012) observed that egg production, egg weight, and hatchability increase with an increased level of production.

Conclusion

The result of this study perceived that the GNC diet at a 27% level of inclusion sustained higher final body weight, body weight gain, number of eggs laid, percentage fertility, and percentage hatchability, with low percentage embryo mortality. Breeder snails fed at 23% GNC level had the highest feed conversion ratio and percentage embryo mortality. So farmers are advised to use higher levels of protein sources for snail feeding to achieve better results.

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