World Journal of Advanced Engineering Technology and Sciences
eISSN: 2582-8266
Cross Ref DOI: 10.30574/wjaets
Journal homepage: https://wjaets.com/

(RESEARCH ARTICLE)

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Growth performance and reproductive qualities of breeder snails (*Archachatina marginata*) fed different sources of protein

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World Journal of Advanced Engineering Technology and Sciences, 2024, 11(01), 216–219

Publication history: Received on 30 December 2023; revised on 09 February 2024; accepted on 12 February 2024

Article DOI: https://doi.org/10.30574/wjaets.2024.11.1.0047

Abstract

This experiment was conducted to compare the effects of different protein sources on the growth and reproductive performances of breeder snails, as protein sources are the main requirement for fast growth and development of cells for reproduction. Soya bean meal (SBM), cottonseed meal (CSM), and groundnut cake (GNC) were fed to the breeder snails. The snails were eight (8) months old with an initial average weight of 98.93g, and the experiment lasted for 12 weeks. Sixty (60) *Archachatina marginata* breeder snails were randomly selected and divided into 4 groups of fifteen (15) snails per treatment which were replicated three (3) times in each of the groups. The parameters examined 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 the Duncan Multiple Ranged Test at a 5% level of probability using SAS, 2011 [10]. The study revealed that soya bean meal (SBM) supports higher final body weight, body weight gain, and percentage fertility, while soya bean meal and cottonseed meal had higher percentage hatchability. However, no significant (P>0.05) differences were recorded in the final shell circumference, shell circumference gain, final shell length, and shell length gain. It was concluded that compounded feed with soya bean meal as the main protein source abetted fast growth and better productive performance.

Keywords: Growth; Reproductive; Hatchability; Fertility; Breeder

1. Introduction

The significance of snails cannot be overstressed, because it is a good source of animal protein, containing about 18% crude protein of rich biological value (Kehinde, & Omole *et al*) [6 & 8].. The meat contains all the essential amino - acids required such as Lysine, and methionine. Snails are extremely valued and contain less fat and low cholesterol levels, making them an antidote for fat-related diseases e.g. hypertension. Protein is significant for many roles in the animal's body, insufficient protein intake, affects vital organs and systems, including mammary, reproductive, and immune functions. These nutrients play a strategic role in the preservation of animal reproductive performance Ibtisham *et al* [5]. Bindari, *et al* [1] discovered that energy and protein are the major nutrients required in the maximum amount and should be the highest priority to enhance reproduction in dairy cattle. Animal growth and reproduction depend critically on the type of protein intake and consumption of other food nutrients, as the central objective of this study is to determine the protein sources that support fast growth and enhanced reproductive qualities for snail production on large-scale production and all year-round supply. To maximize food production and meat protein requirements, viable options and the different food sources need to be explored and evaluated (Mailafia *et al)* [7].

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2. Materials and Methods

The experiment was carried out at the Federal College of Education (Technical) Teaching and Research farm in Asaba, Delta State of Nigeria. The breeder snails were of the spice (*Achachatina marginata*) with an average weight of 98.93g which were bought from Songhai Amukpe, Sapele Local Government Area of Delta State. The snails were accommodated in wooden cages measuring 35cm x 60cm x 35cm, erected under a roofed shade to avoid direct sunlight on the snails. The cages were packed with humus soil up to a depth of 15cm and moistured with water. A total of sixty (60) breeder snails were randomly selected and divided into four (4) groups of fifteen (15) snails pre-treatment and were replicated three (3) times in each of the groups. The snails were served with three (3) experimental diets which were formulated to contain soya bean meal (SBM), cottonseed meal (CSM), and groundnut cake (GNC) as the key protein sources in each of the experimental diets and a control diet with jack bean meal (JBM). Clean water was sprinkled on the snails every morning and evening and a flat plate was also used to make available water for the snails to allow them to have access to water at all times. The experiment was carried out for twelve (12) weeks. Droppings were removed every morning before fresh feed was given, this was to offer a clean environment inside the cage.

Data were collected on growth performances, feed intake, feed conversion ratio, and reproductive qualities of the breeder snails. Body weight (g) was taken at the commencement of the experiment, and every week, this was done on a replicate basis for twelve (12) weeks. Shell length (cm) was taken by measuring the long axis of the snail on an individual basis with the use of a flexible measuring tape. This was done forth nightly. Feed intake was obtained daily as the difference in weight between the feed-given, and the feed remaining. This was done during the course of the entire period of the experiment. After the experiment, two (2) snails each were collected from each replicate giving a total of twenty-four (24) snails out of the sixty (60) snails used in the experiment.

2.1. Reproductive Characteristics

These were calculated using the following formulas:-

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

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

$$\textbf{Percentage hatchability} = \frac{\text{No of egg hatched}}{\text{Total no of fertile egg}}$$

Data collected was subjected to a one-way analysis of variance and significantly different means were separated with the Duncan Multiple Range Test at a 5% level of probability using a (Duncan) [3].

Table 1 Composition of the Experimental Diets

	Control Diet		**Experimental**	**Diets**
	Jack Bean Meal	**Soya Bean Meal**	**Cotton Seed Meal**	**Groundnut cake**
Yellow maize (9%)	50	50	50	50
Blood meal (80%)	12	12	12	12
Wheat bran (15%)	16	16	16	16
Jack bean meal (35%)	18	-	-	-
Soybean meal (44%)	-	18	-	-
Cotton Seed Meal (41%)	-	-	18	-
Groundnut Cake (45%)	-	-	-	18
Bone meal	3	3	3	3
Vitamin Premix	1	1	1	1
TOTAL	100	100	100	100

Table 2 Growth performance of breeder snails fed different sources of protein

Parameters	**Jack Bean Meal (JBM)**	**Soya Bean Meal (SBM)**	**Cotton Seed Meal**	**Groundnut Cake (GNC)**
Initial body Weight (g)	*98.93*	98.93	98.93	98.93
Final body weight (g)	106.85[b]	111. 37[a]	107.64[b]	107. 67[b]
Body weight (g)	7.92 [b]	12. 44[a]	8.71[b]	8.74[b]
Initial shell circumference (cm)	16.06	16. 06	16.06	16.06
Final shell circumference (cm)	17.02	17.02	17.02	17.02
Shell circumference gain (cm)	0.96	0.96	0.96	0.96
Initial shell Length (cm)	9.00	9.01	9.00	9.01
Final shell length (cm)	9.05	9,06	9.05	9.06
Shell length gain (cm)	0.05	0.05	0.05	0.05
Total feed intake (g)	515.65	505.92	498.57	508.45
Feed conversion ratio (g)	65.11[a]	40.67[c]	57.24[b]	58.18[b]

a, b, c, d: means within row bearing the same superscript are not significantly ($p<0.05$) different.

The results of the growth performance of the breeder snails fed different protein sources presented significant ($P<0.05$) performance in the final body weight and body weight gain of the breeder snails. Breeder snails-fed soya bean meal had the highest final body weight and body weight gain compared to other sources of protein jack bean meal (JBM), cottonseed meal (CSM), and groundnut cake (GNC). This could be a consequence of the high protein and essential amino acid content of soya bean meals that are requisite for growth. This is in harmony with the discovery of Ugwuowo & Ani, [11] that achievement in snail production includes others as protein is mandatory for growth. No significant ($p>0.05$) variances were noted in the final shell circumference, shell circumference gain, final shell length, and shell length gain. This may be also a consequence of the slow growth rate of snails which is in synchronization with the works of (Etukudo) [4]. There are no significant ($p>0.05$) differences documented in the total feed intake among the treatment means. However, significant ($p<0.05$) differences were noted down in the feed conversion ratio. Snails fed the control diet Jake bean meal (JBM) had the highest feed conversion ratio followed by snails fed cottonseed meal (CSM) and groundnut cake (GNC) while snails fed soya bean meal (SBM) had the lowest feed conversion ratio (FCR) as a result of the higher body weight recorded because weight gain is a function of feed conversion ratio. A low feed conversion ratio is an indication of a high-quality feed (Bright) [2].

Table 3 Reproductive Characteristics of Breeder Snails fed Diets Containing Different Protein Sources (0 —12) Weeks

	Control Diet		**Experimental Diets**	
Parameters	Jack Bean Meal	Soya Bean Meal	Cotton Seed Meal	Groundnut cake Meal
No eggs laid	21.25	22.11	20.67	20.33
Percentage fertility	74.32[b]	90.77[a]	76.90[b]	75.32[b]
Percentage hatchability	78.40[c]	87.96[a]	89.82[a]	83.02[b]
Percentage Embryo mortality	13.41[b]	12.04[b]	10.18[b]	16.98[a]

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

The result in Table 3 displayed the reproductive performance of *Archachatina marginata* snails served the different protein sources. The result revealed significant ($p<0.05$) differences in the reproductive performance apart from the number of eggs laid. Breeder snails fed Soya beans meal had higher percentage fertility, though snails fed SBM and CSM had the highest percentage hatchability. Nevertheless, snails-fed groundnut cake had the highest percentage of embryo

mortality. The nutritional superiority of soybeans may have affected the fertility and hatchability rates with a lesser percentage of mortality of the embryo. Agreeing to Oyeagu *et al* [9], the most vital factor impelling the performance of animals in captivity, all other factors being constant, is the quality of diet offered to the animals.

3. Conclusion and Recommendation

The outcome of this study detailed that snails-fed soybean meal (SBM) supported higher final body weight and body weight gain, percentage fertility, and percentage hatchability with a low feed conversion ratio. So, it is prudent to use soya bean meal to feed snails because of the essential amino acid contents of soya beans.

Compliance with ethical standards

Acknowledgments

First and foremost we give all the glory to the almighty one for his grace and mercies upon our lives, and appreciation goes to our colleagues who supported us in one way or another during the experimental stage.

Disclosure of conflict of interest

There is no conflict of interest.

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