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Performance and Carcass Evaluation of Snails (*Archachatina Marginata*) Fed Diets Containing Bambara Groundnut Meal (*Vigna Subterranea*)

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ABSTRACT

A sixty-day experiment was carried out to evaluate the dietary effect of Bambara groundnut on the performance of Archachatina marginata. The experimental diets were formulated with 0%, 15%, 30% and 45% Bambara groundnuts varying inclusions levels. Performances of snails fed graded Bambara groundnut (BGN) levels were determined in a Completely Randomized Design (CRD). There were four treatments, each replicated three times with fifteen snails per replicate. Measurements taken were Life Weight, Mean Weight Gain, Feed Intake, Feed Conversion Ratio, Feed Cost and Carcass Characteristics. The final weight gain (170.15g) and weight gain (15.01) of snails fed 45% BGN diets were significantly ($P < 0.05$) higher than values obtained from snails fed with 0%, 15%, and 30% BGN diet. Snails fed 0 and 15% BGN diet did not differ significantly ($P > 0.05$) in their feed intake (57.36g), (56.51g). The Feed Conversion Ratio (FCR) of snails fed 30 and 45% diets (6.29 and 6.23 respectively) were comparable and significantly ($P < 0.05$) different from the FCR value (18.65) of snails fed with 15% BGN diets. There were significant ($P < 0.05$) difference among treatments in final body weight, weight gain (WG) and Feed conversion Ratio (FCR). The result obtained in the study showed that up to 15, 30 and 45% BGN inclusion level in the diet of snails can improve their growth performance with 45% inclusion level as the most appropriate dietary level.

Keywords: Snail, Performance, Bambara groundnuts, Carcass, Diets, ,Archachatina marginata

INTRODUCTION

Snails are common creatures of both aquatic and terrestrial ecosystem and they are considered as indicator species of both areas. Snail plays an important role in the balance of nature both as predators and prey. Scientist and Conservationist have recently observed that snail species are rapidly dwindling and disappearing. (Oyeagu et al, 2018). It is very crucial to encourage snail farming as a means of conserving this important resource. Bush burning still remains a practice among farmers in developing nations. (Ambe et al, 2015). This is gradually leading to extinction of snails from bushes and forests because snails were previously gathered from the wild only. Human activities in the forest, such as road construction, farming, and mining, allows for homestead snail production. (Ejidike 2016) The growth of snail like other animals differs with respect to what they are fed. The nutrient content of the feed has a strong and positive impact on the growth of snails. (Ogunyemi, 2019). The fact that snails are feeding on all experimental diets with weight gains suggest that the diets are well received by the snails. This is despite the fact the diets differ in capacity. The quality and level of nutrient in the diet is important for animal production. (Anigbogu et al, 2011).

Bambara groundnut belongs to the family Leguminosae, sub-family Papilionoideae. Bambara groundnut was derived from the name of a tribe from the Bambara people, central Mali near Timbuktu. (Hilllocks et al, 2012). Captive breeding of snail is a relatively new area of animal production in Africa. For a very long time, it is erroneously believed that snail population in the wild is inexhaustible (Douglas, et al.

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2013). Nowadays, the situation at roadside and township markets in certain areas leaves no one in doubt that wild snail population has been greatly depleted. Snail rearing then appears to hold the key to all year round availability of snail meat in sufficient quantities. (Ndah et al, 2017) Snails are a significant sources of animal protein and contain practically all the essential amino acids required by man (Alikwe et al, 2014). Nutrient deficiencies can lead to the compromising of physiological process. (Gernand et al, 2016)

MATERIALS AND METHODS

Experimental site, animals and duration of the study

The experiment was carried out in the Domestication unit of the Federal University of Technology, Akure. One hundred and eighty (180) medium sizes Archachatina marginata were used for the experiment. Archachatina marginata obtained from open market in Akure were used in carrying out the experiment. The duration of the experiment was 60 days.

Feed Ingredients and Their Sources

Bambara groundnut was the test protein ingredients used to formulate the experimental diets. Other feed ingredients included in the experimental diets were maize, wheat offal, fish meal, groundnut cake, bone meal, lime stone and vitamin premix. All the ingredients were purchased from Farm Support in Akure. Using bambara groundnut meal as the experimental protein source, four different diets with varying

Bambara groundnut protein inclusion levels (0, 15, 30 and 45%) were formulated which represents four treatments A, B, C, and D for 45 % respectively (Table 1) Each treatment was replicated three times to give a total of twelve experimental groups.

Experimental Procedure

180 juvenile snails were used for the experiment. The snails were divided into four groups of equal body weight and fifteen snails each in a group. The snails were randomly selected and housed in 12 plastic baskets labeled according to the dietary treatments and their replicates. Each plastic basket had 15 snails and each treatment was replicated three times. Feeding of the snails were ad libitum. Feed intake was determined by the weigh back technique. The snails were weighed at the beginning of the experiment, subsequently once in every week and at the end of the experiment. All measurements were taken between 7.00am and 10.00 am and mortality records were kept on a daily basis.

Table 1: Percentage Composition of the experimental diets

Ingredients	0%	15%	30%	45%
BGM	-	3.5	7	10
GNC	12	10	8.4	6.6
Fish Meal	16	16	16	16
Maize	47	47	47	47
Wheat Offal	6	4.5	2.6	1.4
Bone Meal	10	10	10	10
Limestone	5	5	5	5
Vitamin Premix	2	2	2	2
Oil	2	2	2	2
Total (%)	100	100	100	100

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Samping and Sampling Procedure

The snails for the study were introduced into the baskets using simple random sampling, The feed and the water were served inside flat trays. At the end of the experiment, 8 snails from each treatment were selected and slaughtered for proximate analysis according to AOAC (1990).

Parameters measured

The parameters measure includes Feed Conversion Ratio (FCR), Feed Intake, Weight Gain, Survival Rate (SR), Shell Length, Shell Weight and Shell Thickness, Percentage Weight Gain, Daily Feed Intake, Total Feed Intake, Live Body Weight, Carcass Weight and Quality. Protein Intake was calculated from the feed intake value and Protein Efficiency Ratio was weight gain divided by protein intake. They were calculated using the following formulars:

$$\text{Feed Conversion Ratio (FCR)} = \frac{\text{Feed Consumed}}{\text{Weight Gain}}$$

Survival Rate = (Total number of stock alive at end / Total number of stock at beginning) x100

Mean Weight Gain = Mean final Weight - Mean Initial Weight

Percentage Weight Gain = Final Weight Gain x 100

$$\text{Daily Feed Intake} = \frac{\text{Total Feed Intake}}{\text{Number of Days}}$$

$$\text{Total Feed Intake} = \frac{\text{Total Weight of food fed}}{\text{Number of snails.}}$$

Chemical Analysis

Proximate compositions:

The proximate composition of the experimental diet was determined according to the standard methods (AOAC, 2010).

Statistical Analysis

All the data collected were subjected to analysis of variance (ANOVA) using (SAS, 1997). Separations of significant means were done using Duncan's New Multiple Range Test (Duncan, 1955).

RESULT AND DISCUSSION

The Bambara Groundnut used in the study had a crude protein (CP) content of 24.11% for diet 1, 24.39% for diet 2, 24.83% for diet 3 and 24.93% for diet 4 as shown in Table 2. Feed intake by snails depends on the nutrient composition of the feed, texture and palatability (Ejidike and Afolayan, 2010)

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Table 2: Proximate composition of the experimental diets

Ingredients	Diet 1 (0%)	Diet 2 (15%)	Diet 3 (30%)	Diet 4 (45%)
Dry Matter	95.12	94.89	94.95	94.68
Crude Protein (%)	24.11	24.39	24.83	24.93
Ether Extract (%)	2.73	3.45	3.7	3.6
Crude Fibre (%)	9.3	9.05	8.79	8.77
Ash (%)	8.89	9.92	9.67	9.61
Moisture	4.88	5.11	5.05	5.32
Nitrogen Free Extract (NFE)	50.09	48.08	47.96	47.77

The difference in proximate composition of the Bambara Groundnut could be attributed to difference in the variety of the seeds, the effect of processing the flour and environmental factors. Table 3 shows the effect of experimental diet on the performance of the snails. Snails fed 45% BGN diet had significantly ($P<0.05$) higher feed intake than those fed 15% BGN diet. In table 3, the final body weight value (170.15g) and weight gain value (15.01g) of snails fed 45% BGN diets were significantly ($P < 0.05$) higher than values obtained from snails fed with 0% and 15% BGN diet. Snails fed 0% and 15% BGN diet did not differ significantly ($P > 0.05$) in their feed intake values (57.36g), (56.51g). The Feed Conversion Ratio (FCR) values of snails fed 30%, and 45% diets (6.29 and 6.23) were comparable and significantly ($P < 0.05$) better than FCR value (18.65) of snails fed with 15% BGN diets. There were significant ($P < 0.05$) difference among treatments in final body weight and weight gain (WG). The result is in agreement with the findings of Ogunyemi (2021) and Akinnusi (2004) as shown in Table 3. The final body weight and mean gain of snails were improved ($P < 0.05$) as the dietary protein level increased to 45%. This agrees with the earlier report of Ewuola et al. (2015), who found that the weight gain of grower rabbits was improved significantly ($P < 0.05$) as the dietary protein level increased.

Snails fed 45% BGN diets had significantly ($P < 0.05$) higher shell length and width values (9.93cm and 5.15cm) respectively than those fed 0%, 15% and 30% BGN diet (Table 3). Below the 45% protein level, there was no significant ($P > 0.05$) improvement on growth performance. This shows that the performance of growing land snail will not be optimized when they are offered 0% and 15% protein level diet. Earlier studies have recommended contrasting protein levels for growth of snails ranging between 19.5 to 26%. (Tchowan et al, 2018) Crude protein dietary levels of 25% had been used by Ejidike (2001). Ejidike (2001) had shown that diets containing 20% and 25% CP had similar influence on the growth performance of Archachatina marginata.

As shown in Table 3. The final body weight and mean weight gain of snails were improved ($P < 0.05$) as the dietary protein level increase to 45%. It's at variance with the value (18%CP) reported for growing snail (Archachatina marginata) by Torhemen et al. (2020). However, protein dietary level of 24.28% has been used by Adeyemo and Akeredolu (2002). The snail fed with 30% and 45% Bambara groundnut diet had weight gain values of 9.63g and 15.01g respectively. This signifies that both protein level diets were highly utilized and converted to snail flesh. This can generally be ascribed to the contribution of amino acid content of the diets that are higher in crude protein levels. This corroborates with the statement of Cobbinah et al. (2008) affirming that the growth performance of snail largely depends on the availability of adequate nutrition and good soil lack of which may cause fragile shell.

Increase in the level of BGN in the diets numerically decreased cost of one kg of feed and consequently reduced total feed cost but could not significantly ($P > 0.05$) influenced feed cost per kg live weight gain of the snail. However, this reduction in feed cost is likely to increase a farmer's income and profit from snails fed especially above 30% raw BGN diets. This observation had earlier been made by Okah et al, (2016) that the inclusion of raw BGN in the diet of pigs is economically viable. The reduction in feed cost as a result of the use of BGN diet is at variance with finding concerning other type of animals such as poultry where feed is the most expensive input (Ahmadu et al, 2010). Protein deficiency has been reported to cause fatigue in animals,

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decreased muscle mass and reduced immunity with exposure to diseases. (Jurgens, 2002). There was highest survival in snail fed 45% BGN diet (94%) and 0% control diet (90%) respectively. The least survival rate was observed in snail fed 15% BGN dietary level.

Table 3: Growth Performance of Archachatina marginata fed varying inclusion level of BGM supplements.

Performance Variables	Diet 1 (0%)	Diet 2 (15%)	Diet 3 (30%)	Diet 4 (45%)	SEM
Initial Weight of Snails (g)	152.45	153.97	153.37	155.14	0.56
Final Weight of Snails (g)	156.96^{b}	157.00^{b}	163.00^{ab}	170.15^{a}	3.13
Feed Intake (g)	57.36^{b}	56.51^{b}	60.57^{b}	93.53^{a}	8.89
Weight Gain per Snail (g)	4.51^{b}	3.03^{b}	9.63^{b}	15.01^{a}	2.72
Average Shell Length (cm)	9.61^{b}	9.62^{b}	9.05^{c}	9.93^{a}	0.18
Average Shell Width (cm)	4.82^{b}	4.97^{b}	4.82^{b}	5.15^{a}	0.08
Average Shell Weight (g)	1.27	1.42	1.01	1.14	0.09
Feed Conversion Ratio	12.71^{b}	18.65^{ab}	6.29^{a}	6.23^{a}	2.98
Cost of Feed per Kg (₦)	68.5	67.32	67.31	67.01	-
Cost of Feed per Kg WT (₦)	101.33	102.98	87.31	95.2	21.42
Mortality Rate (%)	10	24	11	6	-
Survival Rate (%)	90	76	89	94	-

Means with different superscripts a, b, c within the same rows are significantly different ($P < 0.05$).

Table 4, showed carcass analysis of Archachatina marginata fed different levels of BGN diet. The trend reveals the highest value in snail fed 45% BGN diet. Edible weight of snail was highest in snail fed 45% diet and lowest in 0% (control diet). Dressing percentage of snail was highest in 45% BGN diet and least ($P < 0.05$) in snail fed 0% BGN diet.

Table 4: Carcass characteristics of Archachatina marginata fed varying levels inclusion of BGM

Performance Variables	Diet 1 (0%)	Diet 2 (15%)	Diet 3 (30%)	Diet 4 (45%)	SEM
Live Weight (g)	97.07	91.75	97.31	97.37	1.38
Average Edible Weight (g)	6.27	6.3	6.45	6.51	0.06
Average Offal Weight (g)	2.62	2.31	2.08	2.9	0.18
Dressing Percentage (%)	32.78^{b}	42.01^{ab}	44.31^{a}	46.36^{a}	3

SEM = Standard Error of Mean

Table 5, showed the proximate analysis of the experimental snail (Archachatina marginata) fed the BGN diet. It shows similar CP of carcass fed different dietary treatment ranging from17.10% - 17.65%. in snails fed with 15, 30, and 45% of BGN. Percentage fat was highest in 45% BGN diet (2.92) and lowest in 15% BGN diet (2.19). Ash content was also highest in 45% BGN diet. Crude fibre was not detected in the carcass of all the snails while NFE range from 55.86 in 45% BGN diet to 57.71 in 15% BGN diet. The Nitrogen Free Extract (NFE) output was significantly ($P < 0.05$) higher with snails fed 15% BGN inclusion level than those of 0%, 30% and 45% BGN levels with 45% BGN level being the lowest.

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Table 5: Proximate Analysis of Archachatina marginata fed graded levels of bambara groundnut

Variables	0%	15%	30%	45%
Moisture Content (%)	9.94	9.76	10.55	9.38
Dry Matter (%)	90.06	90.24	89.45	90.62
Crude Protein (%)	16.88	17.21	17.1	17.65
Crude Fibre (%)	ND	ND	ND	ND
Fat (%)	2.6	2.19	2.59	2.92
Ash (%)	14.13	13.13	13.78	14.19
Nitrogen-Free Extract (NFE) (%)	56.45	57.71	55.98	55.86

Note*:* ND = Not Determined.

CONCLUSION

Snails are slow growth animals that need quality feed for optimum growth. The study found that including up to 15%, 30% and 45% BGN inclusion diet can improve the growth performance of snails. The most optimal level of BGN inclusion is 45 %, since it produces better result for key growth parameters of Weight Gain, Feed Conversion Rate, Shell Length and Width. Carcass of snails fed 45% BGN dietary level also produced more edible flesh. This suggests that 45% Bambara Groundnut inclusion level resulted in superior performance of Archachatina marginata

Declarations

Ethical Approval

Not Applicable

Conflict of interest

Funding

REFERENCES

1. Adeyemo A I, Akerodolu K E, (2002) Performance of the African Giant Snail (Archachatina marginata) on different feed items. Proc. 27th Ann. Conf. Nig. Soc. Of Animal prod. (NSAP) March 12-21, 2002. Fed. Univ. of Tech. Akure, Nigeria. Pp: 338-339.
2. Ahmadu J, Erhabor P. O, and Jimoh M. (2010) 11th Annual National Conference of National Association of Agricultural Economist (NAAE) on commercial Agriculture, Banking Reform and economic downturn, setting a new agenda for economic development in Nigeria, 27-33.
3. Akinnusi, O (2004) Introduction to snail farming (2nd Edition), Abeokuta, Triolas Esquisite Ventures, p_p 42-44.
4. Alikwe P. C N, Yeigba J, Akinnusi B. Oyenike, F. A., and Ohimein E. J. (2014) Performance and Carcass Characteristics of Giant African land Snails fed Alchorrea cordiforlia leaf meal in replacement of soybean meal, International Journal of Research in Agriculture and Food Science, 1(6):2311-2476.
5. Ambe B. A., Eja I. E, and Agbor C. E. (2015). Assessment of the impact and people's perception of bush burning on the grassland and montane ecosystem of the Obanliku hills/Plateau, Cross River state, Nigeria, Journal of Natural Sciences Research. 5(6):12-20.
6. Anigbogu, N. M., Onyejekwe, I. E., and Ndukwe C. O., (2011) Metabolism of protein and energy by Maradi goats fed Zymomonas mobilis fed degraded rice hull diets. Proceedings of the 16th annual conference of the Animal Science of Nigeria, Kogi State Uniersity, Faculty of Agricuture, Anyigba, Kogi State. Pp 99-103.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XI Issue X October 2024

7. AOAC, (1990) Association of Official Analytical Chemist. Ed. W. Horwitz, 15th Edition Washington, D. C 1230.
8. Cobbinah J R, Vink A, Onwuka B, (2008) Snail farming: production, processing and marketing 1st Edition.Wageningen: Agromisa CTA. 78P
9. Douglas D. D., Brown D. R. and Pederson N. (2013) Land Snail diversity can reflect degrees of Anthropogenic Disturbance. Ecosphere 4(2): 1-14
10. Duncan, D. E. (1955), Multiple Range and Multiple F test. A Biometric Approach, 11: 1-42
11. Ejidike, B.N. (2001). Comparative Effect of Supplemental and Complete diets on the performance of African Giant Land Snail (Archachatina marginata). Proc.26th Ann.Conf. Nig. Soc. For Anim. Prod. (NSAP) March 18-22, 2001. NAPRI, Zaria, Nigeria. 151-153
12. Ejidike B. N. (2016) Growth response of African Giant Land Snail Archachatina marginate fed on single plant leaves or the leaves supplemented with diets of 25% crude protein. International journal of current microbiology and applied sciences 5(5):934-939
13. Ejidike, B. N., and Afolayan T. A., (2010) Effects of natural and compounded ration on growth performance of African Giant Land Snail (Archachatina marginata). Journal of Resaerch in Forestry, Wildlife and Environment, 2(1):107-111
14. Ewuola G. O,. Ibironke S. I. and Fashakin J. B. (2015) Formlation and Nutritional Evaluation of Maize, Bambara groundnut and Cowpea seeds blend complementary foods. Am. J. Food and Nutr. 3(4):101-105.
15. Gernand A D, Schulze, K J, Stewart C P, West K P, Jr, and Christain P. (2016) Micronitrient deficiency in pregnancy worldwide: health effect and prevention, Nature reviews. Endocrinology, 12(5): 274-289.
16. Hillocks R. J., Benneth C., Mponda O. M (2012). Bambara nut: A Review of Utilization, Market Potential and Crop Improvement. African crop science journal 20: 1-6.
17. Jurgens, M H, (2002). Animal Feeding and Nutririon (9th ed). Kendal/Hunt Publishing Co., Iowa, USA PP. 144-146.
18. Ndah N. R., Lucha C. F., Chia E. L., Andrew E. E., Yengo T., Anye D. N. (2017) Assessment of the snail farming from selected villages in the mount Cameroon range, south west region of Cameroon. Asian Research Journal of Agriculture 6 (4): 1-11.
19. Ocheja J.O., Lalobe B. C., Okpanachi U., Alabor J. O., and Anaja A. (2012). Performance and Haematological parameters of pullets fed varying levels of Bambara waste. International journal of Agric and Rural Dev. Volume 15(2):1099-1103.
20. Ogunyemi O. O. (2019). Growth performance of juvenile African Giant Land Snail (Archachatina marginata) fed on different natural plant foods. Proceeding of 3rd Annual Conference of Wildlife Society of Nigeria, Ibadan, Nigeria pp 62-83.
21. Ogunyemi O. O. (2021). Growth performance of African Giant Land Snail Archachatina marginata fed varying dietary protein levels of plant source. JOJ Wildlife and Biodiversity, 3(3): 555-616
22. Okah U., Ubachi K. C., Uzoma P. O., (2016) Performance and carcass characteristics of weaner pigs fed dietary Bambara groundnut by-product. Nigeria journal of Animal Production 43(2): 343-350.
23. SAS (2000). Statistical Analysis System, multiple Incorporatrion. Users Guide Statistical Version. Cary, NC, USA.
24. Oyeagu C. E., Udeh F. U., Uzochukwu I. E., Osita C. O., Ugwu S. O., and Agugom O. H., (2018) Effect of dietary Centrosima pubescen leaf meal on growth and reproduction traits of Archachatina marginata snails. Journal of Applied Animal Resaerch, 46(1):947-952.
25. Tchowan, GM, Ngoula, F, Kenfack, A, Tchoumbooue, J, (2018) Effects of protein levels on the performance of the Giant African Land Snail in captivity. Journal of Agricultural Science 10(4): 278-286.
26. Torhemen L. A., Agabi B. M., Adi D. S., Torhemen M. (2020) Effects of processing methods of Bambara groundnut by-products diets on haematological and carcass characteristics of broiler finisher chickens. European Journal of Agriculture and Food Science 2(4): 2-5.