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EFFECT OF DIFFERENT PROTEIN LEVELS ON THE GROWTH PERFORMANCE OF AFRICAN GIANT LAND SNAIL (*ACHATINA ACHATINA*) FED SOYBEAN MEAL BASED DIETS

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ABSTRACT

The effect of different protein levels on the growth performance of African giant land snail (*Achatina achatina*) fed soybean meal based diets was investigated at the Snail Teaching and Research Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. Sixty four (64) snails of 4 weeks old African giant land snail (*Achatina achatina*) with initial average weight of 1.71-1.84g, were randomly divided into four groups of 16 snails each. The groups were randomly assigned to diets at four crude protein levels (16, 18, 20 and 22%) in a completely randomized design (CRD). Treatments were replicated twice with 8 snails per replicate placed in plastic baskets measuring 30cm in diameter and 13cm in height with hot water-treated loamy soil at 5cm depth. Feed and water were provided *ad libitum* for 16 weeks. Results showed that there were significant (P<0.05) differences among treatments in feed intake, final body weight, weight gain, feed conversion ratio, average shell length and average shell width. Snails fed diets containing 16, 18, 20 and 22% crude protein had FBW of 8.35g, 8.36g, 8.98g and 10.04g, respectively; weight gain of 6.51g, 6.55g, 7.18g and 8.33g, respectively and feed intake of 12.61g, 12.14g, 8.09g and 14.16g, respectively. There were no significant differences (P≥0.05) among treatments in initial body weight, protein efficiency ratio, average shell weight, average visceral weight, average edible weight and feed cost per kg weight gain. The results obtained in this study show that dietary protein level of about 22% is adequate for the growth of African giant land snails (*Achatina achatina*) in the humid tropics.

KEY WORDS: Snail, Diets, Growth, Protein, Soybean.

INTRODUCTION

The demand for animal protein in a developing country like Nigeria has not only been on the increase, but has far outstripped supplies. The low level of animal protein production and the rapid increase in the cost of animal protein source have put protein of animal origin out of the reach of an average Nigerian. There is therefore, an urgent need for increased livestock production, especially those that are highly prolific with rapid turnover rate at a very low cost. There is also need to diversify livestock production with emphasis on micro-livestock in order to find solution to the problems of acute shortage of animal protein in the diets of average Nigerians (Ani and Adiegwu, 2005). Snail farming can conveniently be done in the back yards. This is due to the fact that snail farming is environmentally friendly and can be done with little skill (Akinnusi, 1998a; N.R.C., 1991). The faecal dropping does not give offensive odour and it does not make the environment filthy in any way. Snails are also good converters of vegetable protein to useful animal protein. Snail meat competes favourably with poultry egg and fish in essential amino acids and digestible protein (Imevbore, 1990). It is essentially rich in lysine, leucine, arginine and tryptophan and contains high level of iron, calcium and phosphorus (Amusan and Omidiji, 1998). The galacton present in its abdominal gland serves as a medicinal substance of high immunological value which cures tuberculosis, ulcer, asthma and circulatory disorders (Imevbore, 1990; Amusan and Omidiji, 1998; Okonkwo *et al* .,2000) also pointed out that snail meat is useful in the treatment of some human diseases like anaemia, hypertension and asthma. Its shell can also be used in the production of buttons, rings among others. Although snails can subsist on legumes, forages, and food waste that are not of direct value to humans, the growth obtained through feeding young *Achachatina marginata* on plant food materials supplemented with commercial diet was significantly higher than that obtained through feeding with only plant food material (Ejidike, 2001; Stievenart ,1992; Omole *et al*., 2000). According to these authors, there is, the need to use complete balanced feeds in snail production. The use of diets that can actually meet the nutrient requirements of snails can increase their growth rate and meat quality. This study was therefore, conducted to investigate the effect of different protein levels on the growth performance of African giant land snail (*Achatina achatina*) fed soybean meal based diets

Materials and Methods

The experiment was carried out at the Snail Teaching and Research Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. The feed ingredients used for the research were procured from Orie Orba market near Nsukka in Enugu State. Nsukka lies within longitude 6^{o} 45^{1}E and 7^{o}E and latitude 7^{o} 12.5^{1}N (Ofomata, 1975) and on the altitude 447m above sea level. The climate of the study area is typically tropical, with relative humidity ranging from 65 – 80% and mean daily temperature of 26.8^{o}C (Agbagha *et al* .,2000). The rainy season is between April – October and dry season between November – March with annual rainfall range of 1680 – 1700mm (Breinholt *et al*., 1981).

Sixty four (64) 4 weeks old African giant land snail (*Achatina achatina*) with initial average weight of 1.71-1.84g, selected from the existing stock in the Snail Research Unit of the Department of Animal Science Research Farm were used for the study. The snails were randomly divided into 4 groups of 16 snails each. The groups were randomly assigned to 4 soybean meal based diets containing four crude protein levels (16, 18, 20 and 22%) of two replicates in a completely randomized design (CRD). The composition of the diets is presented in Table 1.

Table 1: Percentage composition of experimental diets

	Dietary crude protein levels (%)			
	16.00	18.00	20.00	22.00
Diets/ Ingredients	1	2	3	4
Maize	28.56	26.46	24.35	21.85
Cassava	21.48	19.85	18.11	16.37
Wheat offal	21.48	19.85	18.11	16.37
Soybean meal	21.48	26.75	32.43	38.41
Oyster shell	6.75	6.75	6.75	6.75
Vita/min Premix	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated composition:				
Crude Protein (%)	16.00	18.00	20.00	22.00
Energy (MJ/kg ME)	11.17	11.09	10.92	10.88

Each treatment was replicated 2 times with 8 snails per replicate placed in 8 plastic baskets measuring 30cm in diameter and 13cm in height. The baskets were filled with hot water-treated loamy soil at 5cm depth to get rid of any harmful micro organism. Feed and water were provided *ad libitum* throughout the period of the study which lasted for 16 weeks. The snails were weighed at the beginning of the experimental feeding and subsequently on a weekly basis. The quantity of feed that was offered to the snails daily and the leftover, when available were weighed with a 5kg capacity Top-loading scale to determine daily feed intake. Parameters measured were feed intake, live body weight, shell length and shell width. Feed conversion ratio (FCR) was calculated as feed: gain; protein intake was calculated from feed intake values and protein efficiency ratio (PER) as weight gain divided by protein intake. Feed cost per kg weight gain was calculated as feed cost per kg x FCR. The snails were monitored on daily basis to detect and isolate sick and dead ones.

At the end of the experiment, 3 snails from each treatment were selected and slaughtered for carcass analysis. The foot (edible portion), the shell and the visceral materials were weighed separately for each snail.

Proximate and statistical analyses

Proximate analysis of the diets was carried out according to AOAC (1990).

Data obtained were subjected to analysis of variance (Steel and Torrie 1980). Significantly different means were separated using Duncan's New Multiple Range Test, and compared at 5% probability level (Duncan, 1955).

RESULTS AND DISCUSSION

Table 2 below shows the proximate composition of the experimental diets.

Table 2: Proximate composition of experimental diets

(%)	Dietary crude protein levels			
	16.00	18.00	20.00	22.00
Diets/ Ingredients	1	2	3	4
Dry matter	94.00	93.98	93.37	93.59
Crude protein	16.09	18.31	19.90	22.10
Ether extract	8.00	7.02	6.90	6.20
Ash	10.55	10.57	10.09	10.61
Moisture	6.00	6.02	6.63	6.41
Crude fibre	4.53	4.59	4.65	4.89
Nitrogen –free extract	54.83	53.49	51.83	49.99

Table 3 shows the effects of the experimental diets on the performance of snails. There were significant (P<0.05) differences among treatments in feed intake (FI), final body weight (FBW), weight gain (WG), feed conversion ratio (FCR), average shell length and average shell width. Snails fed 22%CP diet had significantly (P<0.05) higher feed intake than those fed 20%CP diet. Snails fed 16%, 18% and 20%CP diets did not differ significantly (P≥0.05) in their feed intake values (12.61g, 12.14g and8.09g, respectively). Similarly snails fed with 16 and 18% CP compared with 22 % CP did not show any significant (P≥0.05) difference in their feed intake values(12.61g, 12.14g and 14.16g for 16%CP , 18% CP and 22 % CP diets, respectively). However, the final body weight value(10.04g) and weight gain value(8.33g) of snails fed 22%CP diet were significantly (P<0.05) higher than values obtained from snails fed with 16 and 18% CP diets(Table 3). There were no significant (P> 0.05) differences between final body weight and weight gain values of snails fed with 20% CP and those fed diets containing 16 and 18% CP . The FCR values of snails fed 16, 18 and 22%CP diets (1.77, 1.85 and1.70, respectively) were comparable (P≥0.05) and significantly (P<0.05) higher than the FCR value (1.24) of snails fed 20%CP diet.

Table 3: Performance of snails fed the experimental diets

	Dietary crude protein levels (%)				
	16.00	18.00	20.00	22.00	SEM
Parameters/diets	1	2	3	4	
Initial body wt(g)	1.84	1.81	1.81	1.71	0.05
Final body wt(g)	8.35^{b}	8.36^{b}	8.98^{ab}	10.04^{a}	0.43
Weight gain (g)	6.51^{b}	6.55^{b}	7.18^{ab}	8.33^{a}	0.43
Feed intake(g)	12.61^{ab}	12.14^{ab}	8.09^{b}	14.16^{a}	1.65
Feed conversion ratio	1.77^{a}	1.85^{a}	1.24^{b}	1.70^{a}	0.39
Protein efficiency ratio	1.53	2.04	2.63	2.48	0.41
Av. Shell length (cm)	3.86^{b}	3.88^{b}	3.60^{c}	4.13^{a}	0.01
Av. Shell width (cm)	2.16^{b}	2.19^{b}	2.16^{b}	2.29^{a}	0.01
Av. Shell wt (g)	1.2	1.35	0.99	1.05	0.24
Av. Visceral wt (g)	2.4	2.25	1.59	2.2	0.38
Av. Edible wt. (g)	4.5	4.20	4.35	4.29	1.66
Cost of feed per kg(₦)	46.50	48.30	50.30	51.90	-
Cost of feed per kg wt gain(₦)	82.31	98.53	132.29	128.71	16.68

a, b, c, d= means on the same row with different superscripts are significantly (P<0.05) different

SEM=Standard error of mean

Snails fed 22%CP diet had significantly (P<0.05) higher shell length and width values (4.13cm and 2.29cm, respectively) than those fed 16%, 18% and 20%CP diets(Table3). Snails fed 16, 18 and 20%CP diets had comparable (P≥0.05) shell width values(2.16cm, 2.19cm and 2.16cm, respectively). Snails fed 16% and 18% CP diets had comparable shell length values (P≥0.05), and this was significantly (P<0.05) higher than the shell length value of those fed 20%CP diet. There were no significant differences (P≥0.05) among treatments in initial body weight, protein efficiency ratio, average shell weight, average visceral weight, average edible weight and feed cost per kg weight gain. It was observed that snails mostly feed at night between the hours of 10.00 p.m 1.00 a.m despite the fact that the feed is presented to them earlier in the day. This result is in agreement with the findings of Amusan and Omidiji (1998) and Akinnusi (2002). 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 increased to 22 %. This agrees with the earlier report of Eshiett *et al*. (1979), who found that the weight gain of grower rabbits was improved significantly (P<0.05) as the dietary protein level increased. This result tends to suggest that the crude protein requirement of the snails was met by the 22% CP diet of 10.88MJ/kg ME. Below the 22% CP level, there was no significant (P≥0.05) improvement on growth performance. This shows that the performance of growing land snails would not be optimized when they are offered a 16% or 18% CP diet. The value of 22% dietary CP obtained in the present study is in agreement with the finding of Akinnusi (2002) and those of Sang-Min and Tae-Jun (2005). However, it is at variance with the value (18%CP) reported for growing snail (*Archachatina marginata*) by Adu *et al*. (2002). Crude protein dietary levels of 18.15% had also been used by Adeyemo and Borire (2002), 24.28% by Adeyemo and Akeredolu (2002) and 25% by Ejidike (2001 and 2004). Ejidike (2001) had shown that diets containing 20% and 25% CP had similar influence on the growth performance of *Archachatina marginata* . Those snails fed the 20% and 25% CP diets had 0.4g and 0.5g weight gain values, respectively. This signifies that both protein levels diets were highly utilized and converted to snail flesh. Moreover, this agrees with the result obtained in this experiment which recorded an optimum growth performance at 22% crude protein level. This can generally be ascribed to the contribution of the amino acid content of the diets that are higher in crude protein levels. From the growth indices (daily weight gain, shell *Achatina achatina*. The feed intake and feed conversion ratio values of snails were similar in all the treatments, thus indicating the marked effect of the CP level on them. However, the result on feed intake and feed conversion ratio recorded in this study is at variance with the observations of Adeyemo and Borire(2002) and Akinnusi (2002). The shell length and shell width were improved as the dietary protein level increased to 22 %. This shows a remarkable difference in the quality of the experimental diets. This trend showed that growth of snails linearly increased up to the minimum required protein level and was similar below this level of protein. The shell length values (3.6-4.13cm) differ from 0.75cm reported for six months old *Achatina achatina* by Omole *et al*. (2000). The growth in body tissues and shell signifies weight gain in snails both of which are influenced by the nutritive value of feed, especially protein. According to Omole *et al*. (2000), protein functions mainly in tissue growth; carbohydrate, particularly nitrogen- free extract provides the necessary energy for metabolic activities while calcium functions in shell growth. Interestingly, the optimum dietary level for snails determined in this study is comparable with that reported for abalone, *Haliotis discus hanna* (Uki *et al* .,1986; Mai *et al* .,1995).

CONCLUSION

Considering the growth response obtained in the present study, the dietary protein level of about 22% is adequate for the growth of African giant land snails (*Achatina achatina*) for better economic returns to the farmer.

REFERENCES

Ani, A. O. and Adiegwu, L. I., 2005. The feeding value of velvet beans (*Mucuna Pruriens*) to weaner rabbits. Proc. 30th Ann. Conf. of Nig. Soc. for Anim. Prod. (NSAP), 20th -24th March, 2005. University of Nigeria, Nsukka, Nigeria.pp186-189.

Adeyemo, A. I. and Borire O. F., 2002. Response of giant land snail(*Archachatina marginata*) to graded levels of of yam peel meal-based diets Proc. 27th Ann. Conf. Nig. Soc. for Anim. Prod. (NSAP), March 17-21¸2002. Federal Univ. of Tech. Akure, Nigeria. Pp335-336.

Adeyemo A. I. and Akeredolu K. E., 2002. Performance

Adu O. A, Ojurongbe A. O. and Omole A. J., 2002. Performance and carcass analysis of giant land snail (*Archachatina marginata*) fed supplementary diets. Proc. 27th Ann. Conf. Nig. Soc. for Anim. Prod. (NSAP), March 17-21¸2002. Federal Univ. of Tech. Akure, Nigeria. Pp325-327.

Agbagha, F. M., Ezema F. U. and Omeke, B. C. O., 2000. Studies of Management Effects on Fertility of Purbred and Crossbred Exotic Gilts in Two Breeding Farms at Nsukka. Nigeria Journal of Animal Production. 28(1)Pg 20.

AOAC, 1990. Association of Official Analytical Chemists. Official Methods of Analysis 5th ed. Washington, D. C. 1230.

Akinnusi. F. A. O., 1998a. Life History studies of Archachatina marginata (Swainson). Proceedings: Silver Anniv. Conference of NSAP/WASAP Inaugural Conference held in Abeokuta Ogun Sate. Nigeria. 21 -26th March 1998: 403-404.

Akinnusi. F. A. O., 2002. Comparative evaluationof fresh fruits, leaves and concentrate feed on the growth and reproductive performance of the African giant land snails (*Archachatina marginata*). Proc. 27th Ann. Conf. Nig. Soc. for Anim. Prod. (NSAP), March 17-21¸2002. Federal Univ. of Tech. Akure, Nigeria. Pp328-330.

Amusan JA and Omidiji MO., 1998. Edible land snails. A technical guide to snail farming in the tropis. Verify printers Ibadan, .60.

Breinholt, K. A, Gowen, F. A and Nwosu C. C., 1981.Influence of Environmental and Animal Factors on Day and Night Grazing Activity of Imported Holstein Freisian Cows in the Humid Lowland Tropics of Nigeria. Trop. Journal of Animal Produc.6:4.

Duncan, D. B., 1955. New Multiple Range and Multiple F Tests.*Biometrics.*11: 1-42.

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.

Ejidike B. N., 2004. Growth performance and nutrient utilization of African giant land Snail (Archachatina marginata) hatchlings fed different protein diets. Appli. Trop. Agric. 102-105.

Eshiett, N. O, Omole, T. A and Oluyemi J. A., 1979. The crude protein and energy requirements of rabbits in the tropics. Nig. J. Agric. Sci. 1(2):113-117.

Imevbore, E. A., 1990. Management techniques in rearing African giant land snail (*Archachatina marginata*). PhD Thesis, Dept of Animal Science, University of Ibadan, Nigeria (Unpublished).

Mai, K, Mercer J. P. and Donlon J., 1995. Comparative studies on the nutrition of two species of abalone, *Haliotis tuberculata l and H.discus hannai*. iv:Optimum dietary protein level for growth. Aquaculture*,* 136:165-180.

NRC. 1991. National Research Council. Quail. In: Micro livestock - Little Known small Animals with a Promising Economic Future. National academy Press, Washington D.C. 147-155.

Ofomata, G. E. K., 1975. Nigeria in Maps. Eastern States, Ethiope Publishing Co. Ltd. Benin

Okonkwo, A. C; .Isaac L. J; Nkanga I. and Usoro O. O., 2000. Effect of various feeding regimes on the performance of snails (Archachatina marginata). Proc. 25th Ann. Conf. Nig. Soc. for Anim. Prod. (NSAP), March 19-23¸2000. Michael Okpara Univ. of Agric. Umudike, Nigeria. 314-315.

Omole A. J; Tewe, O. O, Makinde G. O, Adetoro F. O, Saka J. O and Ogundola I., 2000. Preliminary studies on the response of growing snails (Archachadina marginata) to compounded feed as a supplementary ration. Tropical Animal Production Investigation , 3: 35-40.

Sang-Min, L and Tae-Jun, L., 2005. Effects of dietary protein and energy levels on growth and lipid composition of juvenile snail. J.Shellfish Res. FindArticles.com.06 Jan.2009,http;/findarticles.com/articles/mi_m0QPU/is_1_24/ai_n13807889.

Steel, R. G. D. & Torrie, J. H., 1980. Principles & Procedures of Statistics. A Biometric Approach (2nd ed.). McGraw-Hill Publishers, New York. 633pp.

Stievenart C., 1992. Observation on shell lip formation and reproduction in the giant African land snail (A. marginata). Snail Farming Research, 4: 20 – 29.

Uki , NA. Kemuyama and Watanabe Y., 1986.Optimum protein levels in diets for abalone. Bull. Jpn Soc. Sci. Fish, 52.1005-1012.