Original Research Article

EFFECTS AND COST BENEFIT OF LOW AND HIGH PROTEIN LEVELS IN SNAIL DIETS WITH CONSTANT LEVELS OF ENERGY AND CALCIUM

ABSTRACT

A 12-week study was conducted to investigate the effect of low and high Crude protein (CP) level in snails' diets with constant level of energy and calcium on the growth performance of African giant land snail *(Archachatina marginata*). A total of 120 snails of the same weight and breed were randomly allotted to five (5) different treatments. PR1 diet with 20% CP, PR2 diet with 22%CP, PR3 diet with 24% CP, PR4 diet with 26%CP while PR5 diet with 28%CP with constant energy (2.6 Mcal/kg ME) and calcium level. The snails were reared in a cage of 12 compartments and each compartment with a dimension of 0.5x 0.5m^2. Results showed that body weight gain, feed intake, and dressing percentage yield were significantly ($P< 0.05$) increased at the 28%CP Cost of feed per kg weight gain were increased ($P < 0.05$). There were significant ($P < 0.05$) interactions between protein across the treatment on final body weight, average weight gain, average feed intake, feed conversion ratio, shell length, shell width, feed cost per kg weight gain and dressing percentage yield. Feed intake was significantly decrease ($P < 0.05$) at 20%CP levels, FCR values were decreased ($P < 0.05$) at 28 %CP levels. Shell length, width and thickness was enhanced ($P < 0.05$) at 20% CP levels to 28% CP with constant 2.6 Mcal/kg ME levels. Feed cost per kg weight gain was significantly ($P < 0.05$) reduced at the 24% CP and 2.6 Mcal/kg ME levels. The results obtained in the present study show that the dietary protein of 24CP%, with constant energy of 2.6Mcal/kg ME are optimum adequate for the growth of African giant land snails (*Archachatina marginata*) at reduced cost .

Key word:*Archachatina marginata, Crude protein, growth, Energy*

Comment [H1]: 1.Abstract should consists introduction, objective, methodology, result, discussion and conclusion.

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INTRODUCTION

Comment [H3]: 1Introduction not supported by reference.
2 There is no study objective.

The importance of protein in the diet of man cannot be over-emphasized. Protein is required for normal growth and repair of the body tissues. It is the principal constituent of the organs of the animals' body. Protein can be of plant or animal origin. Most plant protein is deficient in one amino acid or the other and may be associated with one anti- nutritional factor or another. Soyabean for instance is a vegetable protein source that contains trypsin inhibitor and is deficient in methionine. Animal protein is of high biological value and possesses all the essential amino acids in desirable quantities.

Snail production is a non-conventional livestock, found in the bush, inside the rock and in cool environment. Snails are common in Southern ecological zone of the country. Snail meat is highly nutritious, healthy to consume and contains high level of iron and calcium. This is why it is considered a delicacy by many and a choice meat for anaemic, hypertensive, coronary heart and diabetic patients. It is a major source of essential amino acids such as lysine, leucine, isoleucine, arginine, tryptophan, and phenylalanine. Snail meat provides more lysine and arginine than whole egg. These explain why the demand for snail meat in increasing and thus, the potential to earn more from snail production. There are lots of factors that affect snail production which include slow growth which could be due to feeding, genetic make up, environment among others. Feed is one of the major factor of production in livestock industry. Feed constitutes about 70% of total cost of production. Majority of macro livestock have standard feed in the market but snail feed is not commonly found in the market. Feed formulated to meet the snail's specific nutritional requirement has great effect in enhancing the growth performance of snails.

Methodology:

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1.What type of experimental design used in the study.
2.What is type of chemical position that analyse in this study.

The studywas carried out at the Snailery Unit of the Institute of Agricultural Research and Training, Moor plantaion Ibadan. A total of 120 snails of the same weight and breed were randomly allotted to Five (5) different groups. PR1 diet with 20% protein, PR2 diet with 22% protein, PR3 diet with 24% protein PR 4 diet with 26% protein while PR5 was diet with 28% protein respectively. The snails were reared in a cage of 12 compartments and each compartment with a dimension of 0.5x 0.5m^2. Feed intake and weight gain were measured on daily and weekly basis 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

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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. Feed cost and cost per weight gain were calculated. Carcass composition was carried out at the end of the feeding trial by randomly selecting 4 snails from each replicate and weighed separately. Each snail was killed by striking the shell with a club. The shell, foot and viscerals were separated and weighed separately. The feeding trial lasted for 12 weeks. The chemical composition of the experimental diets and the foot were done according to the method of A.O.A.C. (1990). All data were subjected to statistical analysis using analysis of variance and the means were separated, if they were significantly different using Duncan Multiple Range Test (SAS,2000).

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RESULT AND DISCUSSION

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2.Reference used is to old.
3.Lack of reference to support the discussion.

Table ~~I~~ 1shown the gross composition of diets which made up of different combinations of crude protein (20%, 22%,24% 26% and 28%) and constant energy levels of 2.6Mcal/kgMEwere used. The different combination of protein level and constant energy represented is as shown in table 1 from treatments 1 to 5. Table 2 shows the proximate composition of the experimental diets; while the performance of snails fed the experimental diets is shown in table 3. There were significant differences (P<0.0.5) among treatments in total weight gain. Snails on treatment 28% crude protein had significantly (P<0.05) higher total weight gain than snails on all other treatments. The least total weight gain was observed in snails on treatment 20% CP. It was observed that the increase in protein content across the treatment also affect the performance of the snails, body weight gain was significantly enhanced (P<0.05) at the highest crude protein levels (28% CP)

Comment [H11]: Table 1 and two should be place in the methodology section

There were significant differences (P<0.05) among treatments in average feed intake. Snails on PR5 (28%CP) diets had the highest average feed intake and this was significantly (P < 0.05) different from the average feed intake of snails on other treatments. Snails on treatments 20% and 22% CP had significantly (P<0.05) lower average feed intake than those on 24% and 26% CP treatments. Average feed intake as observed was significantly (P<0.05) reduced at PR1 and PR2,this was in corroboration with the study of Jackson *et al.* (1982a) which showed that body weight and feed efficiency were improved with higher amount of dietary protein and energy indicating the importance of balanced calorie- protein ratio. Snails are also known to utilize high energy and protein foods for good weight gain and optimum production (Hodasi, 1982). The higher performance observed in snails fed the 28%CP and

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constant energy of 2.6Mcal/kgMEdiet was not surprising, therefore, since this diet contained the highest protein and energy levels and this would have met the snails' optimal requirement for growth. Moreover, the snails could have utilized the available protein very efficiently for enhanced growth performance. This was in support of Omole (2001a) that diets containing 28% CP and 2200Kcal/kgME were optimal for the growth of snail. The implication of the present observation is that growing snails require more than 20 % dietary protein for optimum performance.

There were significant differences (P<0.05) among treatments in feed conversion ratio (FCR). Snails on treatments PR3 and PR5 had comparable FCR (P>0.05) and this was significantly (P < 0.05) lower and better than the feed conversion ratios of snails on other treatments. The highest feed conversion ratio was observed in snails on treatment PR1 (20%CP). Feed conversion ratio was significantly enhanced (P<0.05) at PR4 and PR5 with 26 and 28 % crude protein level respectively. This was in support of Elliot, (2002) that when the protein level of the diet is increased in relation to the energy, there is increase in feed consumption thereby resulting in better efficiency of feed conversion as observed across the treatment in the study. There were no significant differences (P<0.05) among treatments in shell length, width and thickness increment as observed in the study, however they had comparable shell length,width and thickness across the treatment (P>0.05).Data on carcass analysis of snails are presented in table 6 show that there were significant (P<0.05) differences among treatments in all the parameters measured. Snails on treatment PR5 had significantly (P<0.05) higher mean live weight, shell weight, foot weight and visceral weight than snails on other treatments. The least mean live weight, shell weight, foot weight and offal/live weight were observed in treatment PR1. Snails on treatments PR2, PR3, PR4 and PR5 had comparable (P>0.05) values of mean live weight, shell weight, edible weight and ofal/livel weight. There were also significant interactions (P<0.05) between dietary protein and constant energy levels on live body weight, shell weight, foot weight and offal/live weight of snails. The mean live body weight, shell weight, foot weight and offal/ live weight of snails were significantly (P<0.05) increased at the 28 % crude protein and 2.6 Mcal/kg ME levels. Table 5 shows the cost implication of feeding snails with diets containing varying protein and constant energy levels. There were significant (P<0.05) differences among treatments in the cost of total feed consumed and feed cost per kg weight gain. Snails fed diet PR5 (28 % crude protein and2.6 Mcal/kg ME) had significantly (P<0.05) higher cost of total feed consumed than snails fed other diets. Snails fed diet PR1(20% CP) had the least cost of

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total feed consumed, while the highest feed cost per kg weight gain was observed in treatment with PR5 (28% CP and 2.6 Mcal/kg ME) Table 5. There were also significant ($P<0.05$) interactions between dietary protein and energy levels on the cost of total feed consumed and feed cost per kg weight gain. While the cost of total feed consumed was significantly ($P<0.05$) reduced at the 20%CP and 2.6Mcal/kg ME levels, feed cost per kg weight gain was reduced at the PR3 (24%)crude protein level. The diet containing 24% CP and 2.6Mcal /kg ME supported higher growth rate, feed intake and produced better feed conversion ratio, higher foot weight, shell weight and visceral weight than other diets. This tends to suggest that 24% CP and 2.6 Mcal/kgME may be the optimum crude protein and energy requirement of*Archachatina marginata*for normal growth.

In conclusion, considering the major effects of dietary protein and energy levels and the interaction between the dietary crude protein and energy levels on growth performance, carcass yield and feed cost per kg weight gain, the best protein and energy combination for the optimum growth of African giant land snail (*Archachatina marginata*) is 24% CP and 2.6Mcal/kgME. It is therefore possible to recommend the diet containing 24% CP and 2.6Mcal/kgME as being adequate for the optimum growth of African giant land snail (*Archachatina marginata)*

References

Comment [H15]: 4.Majority of the comments not cited in the text.
5.Reference not follow the standard reference format.

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Table 1: Gross Composition of Experimental Diets.

Ingredient (%)	**PR_1 (20%)**	**PR_1 (22%)**	**PR_2 (24%)**	**PR_3 (26%)**	**PR_4 (28%)**
Maize	23.75	22.0	20.0	18.0	18.0
Soya bean meal	24.0	24.5	26.0	27.25	28.5
Fish meal (Local)	1.5	2.5	3.0	4.0	4.0
G.N.C	17.0	17.25	19.25	21.0	25.0
Rice-bran	12.0	12.0	11.0	8.0	3.0
Brewer Dry grain	9.0	9.0	8.0	9.0	6.25
Bone meal	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
Oyster shell	**9.7**	**9.7**	**9.7**	**9.7**	**9.7**
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.1	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1	0.1
Salt	0.1	0.1	0.1	0.1	0.1
Calculated Composition					
Crude protein (%)	20.22	20.22	20.22	20.22	20.22
Metabolizable energy	2605.2	2605.2	2605.2	2605.2	2605.2

(kcal/KgME)

Table 2: Determined Proximate Composition of the SSM and the Experimental diets

Parameters	**SSM**	**PR_1 (20%)**	**PR_1 (22%)**	**PR_2 (24%)**	**PR_3 (26%)**	**PR_4 (28%)**
Dry matter	97.72	96.24	93.77	93.78	94.15	93.23
Crude Protein	48.87	45.36	23.35	23.45	23.89	24.18
Crude Fibre	2.75	3.28	9.35	9.79	10.59	10.75
Ether Extract	4.23	5.56	4.28	4.67	4.72	4.88
Ash	6.64	7.78	9.68	9.69	9.79	10.12
Nitrogen Free Extract	37.51	40.02	53.34	52.40	51.01	50.07

Table 3 Summary of Growth performance of growing snails fed varying levels of Protein in the diets

Comment [H16]: "*p*" the probability value not mention in the table.

Parameters (Means)	**PR_1 (20%)**	**PR_2 (22%)**	**PR_3 (24%)**	**PR_4 (26%)**	**PR_5 (28%)**	**±SEM**
Initial weight (g)	126.41	126.47	126.12	1126.01	126.11	2.67
Final weight (g)	356.67^{b}	376.32^{b}	392.44^{a}	394.21^{a}	398.17^{a}	4.67
Total weight gain (g)	230.26^{d}	249.85^{c}	266.32^{b}	268.2^{ab}	272.06^{a}	5.39
Total feed intake (g)	953.28^{c}	959.42^{c}	985.39^{b}	995.02^{a}	1006.62^{a}	9.45

Feed conversion ratio	4.14 [a]	3.84[b]	3.70[c]	3.71[c]	3.70[c]	0.12
Shell length increment (mm)	9.88 [a]	9.89 [a]	9.89 [a]	9.91 [a]	9.91 [a]	1.03
Shell width increment (mm)	8.35 [a]	8.35 [a]	8.38 [a]	8.39 [a]	8.39 [a]	0.78
Shell thickness increment (mm)	0.11 [a]	0.11 [a]	0.11 [a]	0.12 [a]	0.12 [a]	0.61
Mortality (Number)	0.00	0.00	0	1	0	

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Table 4Carcass analysis of growing snails fed varying levels of Protein in the diets

Comment [H17]: 1."*p*" the probability value not mention in the table.
2.Table 4 not cited in the text

Parameters (Means)	**PR_1 (20%)**	**PR_2 (22%)**	**PR_3 (24%)**	**PR_4 (26%)**	**PR_5 (28%)**	**±SEM**
Live weight (g)	353.14	366.78	392.44	394.21	398.17	
Shell weight (g)	81.40	85.20	91.59	92.32	93.77	4.13
Offal weight (g)	70.83 [c]	74.68[b]	80.25 [b]	84.36 [a]	85.20 [a]	2.45
Foot weight (g)	158.91 [c]	166.70 [b]	184.37 [b]	187.41 [ab]	189.58 [a]	4.86
Dressing percent (%)	45.01 [c]	45.45 [c]	46.28 [b]	47.54 [a]	47.61 [a]	1.13
Offal/live weight (%)	20.06 [a]	20.36 [a]	20.45 [a]	21.21 [a]	21.41 [a]	1.78
Shell/live weight (%)	23.05 [a]	23.23 [a]	23.34 [a]	23.42 [a]	23.55 [a]	1.32

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Table 5: Cost analysis of growing snails fed varying levels of Protein in the diets

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Parameters (Means)	PR_1 (20%)	PR_2 (22%)	PR_3 (24%)	PR_4 (26%)	PR_5 (28%)	±SEM
Total weight gain (kg)	0.23	0.25	0.27	0.27	0.27	-
Total feed intake (kg)	0.95	0.96	0.99	1.00	1.01	-
Cost/kg feed (N)	130.12 [d]	132.23 [d]	137.17 [c]	140.4 [b]	144.89 [a]	2.02
Total feed cost (N/kg)	123.62 [d]	132.23 [c]	135.80 [c]	140.4 [b]	146.34 [a]	2.12
Cost/weight gain (N/kg)	537.45 [b]	528.92 [b c]	502.9 [d]	520.0 [c]	541.9 [a]	5.24