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Effect of Increasing the Level of Calcium Supplementation in the Diets of Growing Snail on Performance Characteristics

[1]J.A. Oluokun, [1]A.J. Omole and [2]O. Fapounda

[1]Obafemi Awolowo University, Ile Ife, Nigeria. Institute of Agricultural Research and Training Moor Plantation, Ibadan, Nigeria.
[2]Federal College of Animal Health and Production Technology, I.A.R.&T., Ibadan, Nigeria.

Abstract: The effect of different levels of calcium in the diet of growing snails (*Archachatina marginata)* was investigated for 16 weeks. A total of 72 growing snails were randomly allotted to 3 groups and within each group, replicated 4 times at 6 snails per replicate in a completely randomized design. Feed were formulated to contain 4.0% calcium (T_1), 6.0%Ca (T_2), and 8.0% Ca (T_3). The results show that feed intake, weight gain, shell length, width and thickness and efficiency of feed utilization improved from T_1 to T_3. Similarly, Calcium retention increased from 0.18g in T_1 to 0.45g in T_3. The dressing percent was also affected by dietary treatments($P<0.05$). It improved from 38.2% in T_1 to 39.72 in T_3. However, varying levels of calcium had no significant effect on mortality. Comparatively, snail require high level of calcium (6-8%) for improved performance in term of weight gain, shell development and feed utilization.

Key words: Snail, calcium, weight gain, Dressing percent Shell growth, Nigeria

INTRODUCTION

Snail farming has become an interesting venture in Nigeria. The relatively low capital in setting up the business coupled with low fat and cholesterol content has made snail farming a promising one[11,7,14] Among the various challenges facing intensive snail farming is slow growth which could be attributed to unfavourable weather condition, genetic make-up, stocking density and nutrition[10,1]. Nutrition is one of the major factors that affect the performance of livestock and snail in particular. For optimum performance, the requirement of the animal in term of protein, energy and minerals, etc. must be met. Calcium is one the major minerals found in bone and shell of an animal. It is essential constituent of the living cell and tissue fluid. The shell of snail is made of calcium and it constitutes about 30% of the total live weight hence the importance of calcium cannot be over-emphasized. In Helix aspersa, 4% of calcium has been recommended[16,5]. Ricket, Osteomalacia, abnormal appetite (PICA), chewing of wood and foreign and poor shell development have been reported for the deficiency of calcium in the diet[3,9,8]. In snail farming, it has been confirmed that snail may be rasping paint or wall of the building if calcium intake is low. It has also been observed that low calcium intake lead to slow growth of snail[2]. This study was conducted to evaluate the performance of growing snail fed varying levels of calcium in the diets (Low, Medium and High).

MATERIALS AND METHODS

The experiment was carried out at the Snailery Unit of the Institute of Agricultural Research and Training Moor Plantation, Ibadan, Nigeria. A total of 72 growing snails were used for the study. Three diets were formulated to contain 3 different levels of calcium (4, 6 and 8%). The snails were randomly distributed to 3 treatments in a completely randomized design, replicated thrice with 6 snails per replicate. The snails were reared in a cage of 0.5 x 0.5 x 0.5 m^3 compartments placed inside a well ventilated open sided house roofed with adex asbestos located under a tree. Sandy loam soil was put inside the cage to a depth of 7cm. The diet was formulated to contain 24% crude protein and energy level of 2400 Kcal ME /Kg (Table 1). The feed and water were given *ad libitum.* The feed intake and weight gain were measured on daily and weekly basis respectively with the use of electric weighing balance while shell length and width were measured on weekly basis with the use of vernier calliper. The shell thickness was measured with a micrometer screw gauge on weekly basis. The experiment lasted for 4 months. At the end of the feeding trial, 8

Corresponding Author: Omole Adeboye, Obafemi Awolowo University, Ile Ife, Nigeria. Institute of Agricultural Research and Training Moor Plantation, Ibadan, Nigeria.

Table 1: Gross Composition of the Experimental diets (%)

Ingredients	T_1	T_2	T_3
Maize	24	22.5	22
BDG	10	10	10
W/Bran	12.5	10.5	7.25
PkC	5	5	5
SBM	186	20.7	21
GNC	14.2	10	8
F/Meal	4	4	4
Oyster-shell	9.4	13.7	17.5
Bone meal	2.15	3.35	4.5
Premix	0.25	0.25	0.25
Calculated Analysis			
Protein	24.25	24.10	23.94
Ca (%)	4.29	6.16	8.21
P (%)	1.03	1.21	1.37

snails were randomly selected from each treatment for carcass analysis. The snails were killed by breaking the shell with an hard object. The foot (edible portion), the shell and the visceral were then separated and weighed separately with electric weighing balance. The dressing percent was calculated as ratio of the foot to the live-weight. For the nutrient retention study, One snail per replicate was randomly selected and house individually making a total of 4 snails per treatment. The snails were fed with the same diet fed during the feeding trial. Record on daily feed intake was taken while excreta was collected daily from each replicate. The daily excreta from each treatment was dried to constant weight of 105EC in the hot air oven. The calcium retention study lasted 10 days, 3 days for acclimatization and 7 days for excreta collection. Sample of each diet was analyzed for proximate composition according to the method of A.O.AC.(1990). Calcium contents for each diet and excreta samples were determined by first weighing 5g sample and drying it for 16 hours at 104°C to determine by dry matter. It was then ashed in a muffle furnace for 4 hours at 600°C. The ash was extracted in aqua regia (18% nitric acid and 82% hydrochloric acid). The concentration of calcium were measured by atomic absorption spectrometer. All data were subjected to analysis of variance and significant means were separated by Duncan multiple range test[18].

RESULTS AND DISCUSSION

The result of the chemical composition of the experimental diets is sown in Table 2. The calcium contents of the diets increased from 4.1% in the control diet to 8.1% in diets 3 while protein, ether extract and fibre content of the feed are relatively similar. Calcium content of the diets increased as the level of Ash content too increased. Table 3 shows the response of snails to varying levels of calcium in the diets. The monthly feed intake improved from 173.5g in the control diet to 190.25g in T_3 ($P<0.05$), although T_2 and T_3 were not significantly different from each other ($P>0.05$). The same trend was followed in monthly weight gain as the monthly weight gain increased from 27.15g in T_1 to 35.42g in T_2 and 36.24g in T_3 ($P<0.05$). The increment in growth performance as the level of calcium in the diets increased is in agreement with other authors[6,2]. Moreover, shell constitutes about 30% of the total live weight[13] and calcium is the major constituent of snail shell; the latter will continue to grow or develop as the level of calcium in the diet increased.The monthly shell length, width and thickness (Table 3) increased as the level of calcium in the diets increased. The results on shell growth and development also buttress the earlier discussion that calcium intake have positive effect on shell length, width and thickness. The efficiency of feed utilization was better in diets 2 and 3 6 than in the control diet (T_1). It indicates that T_2 and T_3 were better converter of feed to edible meat. The zero mortality recorded in all the treatment (Table 3) indicates the safety of inclusion of calcium up to 8% in the diet, again, the result supports the fact that snails are hardy and well adapted to the environment. Snails have also reported to have relatively low mortality rate if proper management is observed compared to other conventional livestock[1,14].

Considering the nutrients retention study (Table 4), it could be seen that there were significant differences in the calcium retention ($P<0.05$), it increased from 0.18% in the control diet to 0.32 and 0.45% in T_2 and T_3 respectively. The better performance in T_3 compared to T_1 could also be attributed to higher calcium retention.

The mean dressing percent also was affected by the dietary treatments ($P<0.05$) (Table 5). The dressing percent improved from 38.2% in T_1 to 39.5, 39.72% in T_2 and T_3 respectively. The dressing percent recorded in T_3 was higher than what was reported by Omole[13] and Hamzat *et al*[7] and this could be due to the fact that the level of calcium in the diet i.e. (Plant based diets) was very low compared to calcium content of the present study.

Table 2. Chemical Composition of the Experimental Diets (%).

Parameters	T_1	T_2	T_3
Dry Matter	92.0	93.05	92.15
Crude Protein	24.25	24.01	23.95
Ash 10.85	12.98	14.16	
Ether Extracts	3.35	3.30	3.24
Crude Fibre	7.76	7.82	7.85
Nitrogen free extract	53.79	51.89	50.8
Calcium %	4.15	6.06	8.11

Table 3: Effect of varying dietary calcium level of growing snails on feed intake, weight gain, shell increment and feed conversion ratio.

Parameters (Mean Values)	T_1	T_2	T_3	±SEM
Total Feed intake (g)	694.0[b]	759.6[a]	761.0[a]	15.8
Monthly Feed intake (g)	173.5[b]	189.9[a]	190.25[a]	3.95
Initial weight (g)	89.91[a]	89.10[a]	88.96[a]	2.01
Final weight (g)	198.36[b]	230.78[a]	233.92[a]	8.41
Total weight gain (g)	108.45[b]	141.68[a]	144.96[a]	3.88
Monthly weight gain (g)	27.15[b]	35.42[a]	36.24[a]	2.14
Monthly Shell Length Increment	5.85[b]	7.14[a]	7.25[a]	1.02
Monthly shell width increment	4.38[b]	5.32[a]	5.36[a]	0.51
Monthly Shell Thickness	0.12[a]	0.14[a]	0.14[a]	0.06
Feed Conversion Ratio	6.39[b]	5.36[a]	5.25[a]	0.34
Mortality	0.00	0.00	0.00	0.00

Means with different superscripts along the same row are significantly different (P< 0.05)

Table 4 Effect of dietary calcium level of growing snails on calcium retention.

Parameters(mean values/day)	T_1	T_2	T_3	±SEM
Dry Matter Intake (g)	5.39[b]	6.05[a]	6.06[a]	0.35
Dry Matter Excreta (g)	1.73	1.47	1.46	
Nutrient Dry Matter Retained (g)	3.66[b]	4.58[a]	4.60[a]	0.24
Calcium Intake (g)	0.22[b]	0.36[a]	0.49[a]	0.15
Calcium Excreta (g)	0.037	0.039	0.039	
Calcium Retention (g)	0.18[c]	0.32[b]	0.45[a]	0.14

Means with different superscripts along the same row are significantly different (P< 0.05)

Table 5: Effect of dietary calcium level of growing snails on carcass traits.

Parameters (Mean values)	T_1	T_2	T_3	± SEM
Live weight (g)	197.2[b]	230.4[a]	232.4[a]	4.35
Foot (g)	75.33[b]	91.19[a]	92.30[a]	2.86
Shell (g)	44.17[b]	53.34[a]	55.59[a]	2.02
Visceral (g)	37.9[b]	44.70[a]	45.18[a]	1.95
Dressing %	38.2[b]	39.58[a]	39.72[a]	1.05
Shell/Live weight	22.4[b]	23.15[a]	23.92[a]	0.68
Visceral/Live weight	19.26[a]	19.40[a]	19.44[a]	0.58

Means with different superscripts along the same row are significantly different (P< 0.05)

In conclusion, considering weight gain, efficiency of feed utilization and dressing percent reported in the three treatments in this study, snail requires high level of calcium of 6 – 8% in their diets.

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