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GROWTH PERFORMANCE OF GIANT AFRICAN LAND SNAIL FED DIFFERENT CALCIUM SOURCES

[1]Aminu, S.A., [2]Falade, L.O. and [3]Badmus, K.A.
[1]Department of Forestry and Wildlife Management, Faculty of Agriculture
Federal University Gashua, Yobe State
[2]Department of Forestry, Wildlife and Ecotourism, Faculty of Agriculture, Shabu-Lafia Campus Nasarawa State University, Keffi
[3]Department of Animal Science Faculty of Agriculture
Federal University Gashua, Yobe State
Corresponding Author: *E-Mail*: alameen1508@gmail.com

Abstract
The effect of wood ash, bone meal, egg shell and calcium carbonate as different calcium sources were investigated in the diet of growing snails for 8 weeks. A total of 100 growing snails were randomly allotted to 5 groups, each group replicated 4 times at 5 snails per replicate making 20 snails per treatment in a completely randomized design. Feeds were formulated to contain 10% of each of the different calcium sources while the fifth group was left as control with none of the investigated calcium sources. The results showed that wood ash (58.81±12.15) g and bone meal (58.46±11.84) g dietary supplement gave the best weight gain, while the calcium carbonate (55.84±13.26)g dietary supplement gave the least weight gain. The study has shown that the inclusion wood dash or bone meal as a dietary supplement in snail feed can enhance snail production. Therefore, the inclusion of 10% wood ash or bone meal in dietary supplement in the snail feed is recommended to snail farmers for effective production.

Keyword: *Wood ash, Bone meal, Calcium carbonate, Egg shell, Archachatina marginata*

INTRODUCTION
The scarcity of meat for human protein requirement has necessitated the need for intensive rearing of some unconventional livestock such as the snail (Onoja, 2005) stated that snail meat tastes good and is of high nutritive value. It serves special delicacies at homes and restaurants (Oyenike, 2008). The giant African land snail (*Archachatina marginata)* constitutes a vital aspect of the diet of many people in Nigeria as well as other areas of the world. Domesticated snails provide cheap sources of animal protein required for healthy living thus preventing some nutrient deficiencies. Snail meat is tasty, tender and highly nutritional (Eruvbetine *et al.,* 1997). Snail meat is particularly rich in protein and iron while other minerals including calcium, potassium, copper, phosphorus are found in appreciable quantities in the snail. Snails are also low in cholesterol hence recommended for the treatment of arteriosclerosis and hypertension (Ejidike, 2000). Snails are invertebrates, nocturnal animals with soft bodies that are covered with shell (exoskeleton) (Ayodele and Asimalowo 1999; Wosu, 2003). Eruvbetine *et al.* (1997) noted that snails eat predominantly vegetables and can utilize a number of feeds for growth.

General observation have shown that snails can survive on most food taken by man and can also be fed on compounded or supplemented ration. Adult snails according to Akinnusi (1997). can eat tender flower, vegetable plants including lettuce, cabbage, egg plant, banana, pawpaw, pineapple, cooked potatoes, cocoyam, oranges etc. The shell of the edible giant African land snail, regarded as the snail‘s home, is a very vital component

of its body. It enables the snail to maintain a constant water balance between its tissues and the environment with regard to the relative humidity for its life (Tell Communication and Songhai centre, 2006). The shell represents, approximately, one-third of the total weight of the snail with about 98% of its composition made of calcium carbonate (Akinnusi, 2004; Thompson and Cheney, 2004; Tell Communication and Songhai Centre, 2006). Mineral supplementation (calcium carbonate supply) in the diet of snail is an important component of snail farming systems (Akinnusi, 2002; Thompson and Cheney, 2004). Although there are several sources of calcium for snails, most of the research efforts aimed at identifying such cost-effective sources for mineral supplementation or calcium carbonate supplies to snails through their diets have always focused on the use of egg shell. As a result, egg shell has for long remained the major dietary calcium source recommended to heliciculturists (snail farmers). This study therefore aimed to assess the effect of different calcium sources on the growth performance of giant African Land Snail.

MATERIALS AND METHODS

Description of the Study Area

Site of the study is Wildlife Domestication unit of the Department of Forestry, Wildlife and Fisheries, Faculty of Agriculture Shabu-Lafia campus, Nasarawa State University, Keffi. Lafia is a town in north central Nigeria. It is the capital city of Nasarawa State. The area is located on latitude 8^0 29`30`` N and longitude $8^0$ 31`0`` E (Encyclopedia, 2009).

Climate and Weather

The average annual rainfall is 204 mm. The wet season is within the month of May through October, with heaviest rainfall generally in August. The prevailing winds are from east west at this time and temperature ranges between 23^0(min) and 37^0 C (max). Relative humidity is 66.25% at 0900z and mean evaporation 2.8 (NIMET, 2011). The dry season begins early November and ends in April of subsequent year (NIMET, 2011).

Experimental Materials

Experimental snails: One hundred (100) grower snails were procured from Mada station, Nasarawa Eggon, Nasarawa State with average weight of 7.7±1g On arrival at the Experimental site, the snails were allowed an acclimatization period of two (2) weeks at the snailery pen of Wildlife Domestication Unit of Department of Forestry, Wildlife and Fisheries, Faculty of Agriculture Shabu-Lafia Campus, Nasarawa State University, Keffi and were generally fed and provided with water daily.

Experimental diets: A bag of growers mash weighing 25kg was divided into five portions; four out of these were formulated to contain different calcium sources (egg shell, $CaCO_3$, wood ash, and bone meal) each, while the fifth one was left as the control with none of the calcium sources. The snails were fed *ad-libitum* and water was sprinkled twice a day (morning and evening) to avoid aestivation by the snails. The materials used in compounding the feed mash are as shown in table 1.

Experimental design: The experimental snails were housed in a constructed tent. The tent was built under trees (which provided constant shade). Wooden cage was constructed having 20 units each of size 12 inch x 13 inch to contain 5 snails each making the total of 100 snails. Snails were randomly divided into 20 with 5 in each unit, making 20 snails per treatment. Two shallow plastic plates (for easy accessibility) were provided for food and water in each unit.

Data Collection

The weight of the snails and feed intake were taken with the aid of an electric sensitive scale. The measurements were repeated on weekly basis for 8 consecutive weeks to monitor the growth rate of the snails in response to the different calcium sources.

Data Analysis

Mean values of weekly weight gain for each snail were calculated and subjected to analysis of variance according to complete randomized design. Source of variation is calcium, Differences among means and feed intake were assessed using LSD multiple comparisons with statistical package for social science (SPSS 16).

RESULTS AND DISCUSSION

No mortality was recorded in this study, contrary to reports of Ireland, (1991) that mortality occurred only in snails fed the lower calcium diets. Comparing other treatments with the control in the present study (Table 2), the results revealed that the influence by the different feed impacted the snails giving an average weight gained of 57.66 ± 12. 02g. However, the snails fed with wood ash had the highest weight gain of 58.81 ± 12.15g. This was closely followed by the snails fed with bone meal which had a weight gain of 58.46 ± 11.84g. The control experiment had mean weight gain of 58.33 ± 10.19g, while the least weight gain 55.84 ± 13.26g was observed in the snail fed with calcium carbonate.

The observation made in the present study revealed that the experimental snails ate mainly at night. Even though the diets were presented to the animal around 5 p.m., feeding did not start until late evening. Before the consumption of the diet, however the snails used their tentacles to explore the feed and later protruded their lips to taste the food. All the diets were well received and eaten by the snails. The present study agrees with Hodasi (1995) in respect of oyster shell and bone meal fed to *Helix aspersa*, though egg shell, limestone ($CaCO_3$) and wood-ash supported inferior gains. However, the result presented agrees with Hodasi (1995) the control had higher weight gain than snails given egg shell and limestone as calcium source. In this study, 10% wood ash calcium source supplement resulted in the highest body weight gained; the least weight gained was recorded in calcium carbonate. It could be argued that the loss of calcium into the tissue would result in weight increases, when the whole snail is weighed. In effect, calcium metabolism in the body is in dynamic action as the element is used up for tissue metabolism with losses through faeces thereby explaining the weight loss. Snail farmers often seek information on the rate of calcium inclusion in snail diets. Thompson and Cheney (1996) reported that 40% limestone flour promoted good growth in *H. aspersa.* Amubode and Ogogo (1995) used 20% bone meal and 30% oyster shell in diets for *Archachatina marginata* though in our study 10% each of wood ash and bone meal showed a good growth performance in the snails.

Table 2 showed the result of the mean separation using LSD on the feed intake of the test samples (snails). The average feed intake for the treatments was 13.71 ± 1.15g. The bone meal dietary supplement had the highest feed intake of 17.50 ± 1.16g this was closely followed by the egg shell dietary supplement with 14.45 ± 1.10g while wood ash dietary supplement had the least feed intake of 9.38 ± 1.24g. However, the result of ANOVA showed that there was significant difference in the feed intake between the treatment at $P< 0.05$.

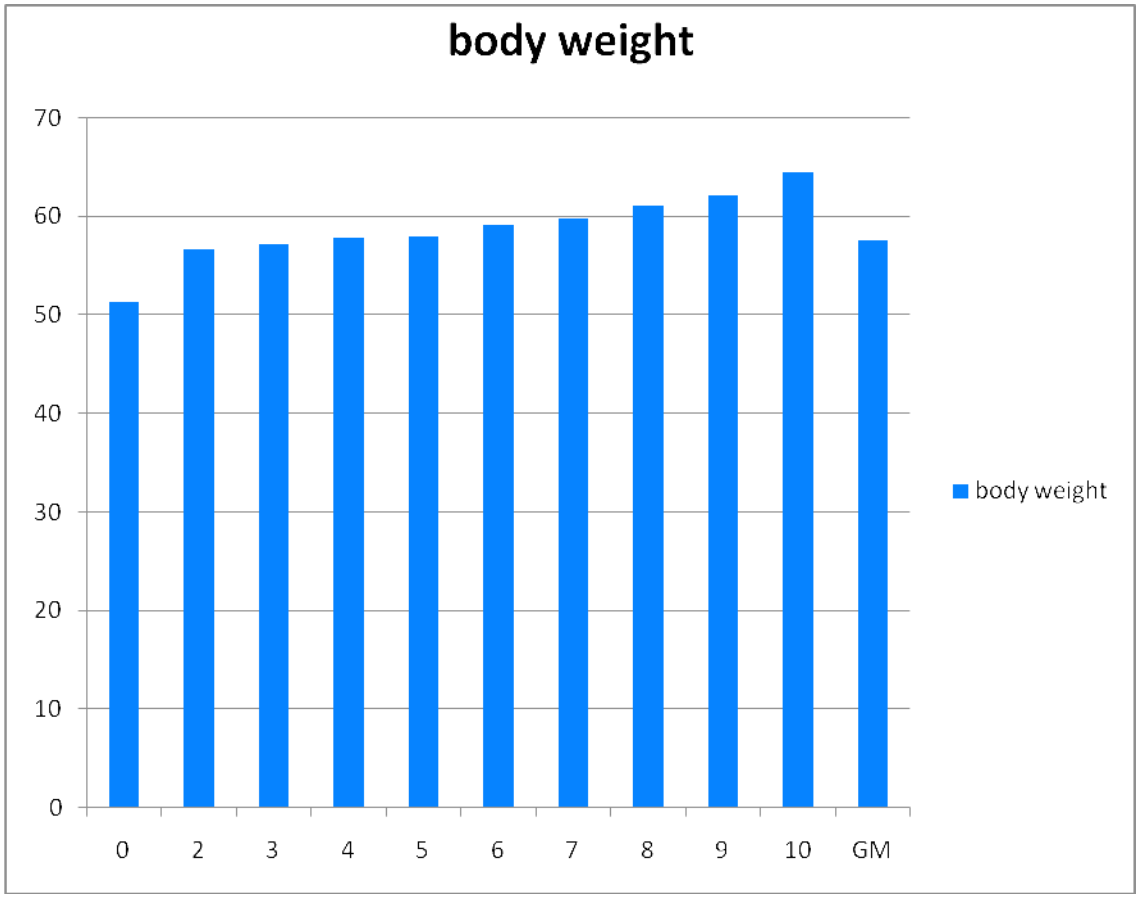

Figure 1: Chart of the body weight gained per week

CONCLUSIONS AND RECOMMENDATION

The experiment was designed to evaluate the effects of various calcium sources on the performance of growing snail. The results of this study showed that higher growth performance was recorded in diet containing wood ash followed by bone meal, egg shell and calcium carbonate. The result also showed that the entire calcium sources used as experimental diet (bone meal, wood ash, egg shell and calcium carbonate) could be use successfully for snail production without adverse effect.

It is suggested that snail farmers should include 10% powdered wood ash or bone meal in combination with growers mash as diet to obtain the needed calcium required for effective growth of snails. With this, farmers would be able to fatten their snails within a short period and increase the rate of snail meat production and financial gain.

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Table 1: Materials used in compounding feed mash

Feeding ingredients	Nutrients supplied	Quantity (gram)
Wheat offal	Energy	320
Maize gluten	Protein	110
Fish meal (local)	Protein	55
Bone meal	Mineral	15
Salt	Mineral	2.5
Premix	Vitamin	2.5

Table 2: Mean feed intake and live weight gain of snails as influenced by source of calcium

Treatment	Feed intake(g)	Weight (g)
Control	12.22 ± 1.15^{c}	58.33 ± 10.19^{b}
Bone meal	17.50 ± 1.16^{a}	58.46 ± 11.84^{b}
Egg shell	14.45 ± 1.10^{b}	56.81 ± 12.53^{ab}
Calcium carbonate	12.50 ± 1.08^{bc}	55.84 ± 13.26^{a}
Wood ash	9.38 ± 1.24^{d}	58.81 ± 12.15^{b}
Grand mean	13.71 ± 1.15	57.66 ± 12.02

[a,b,c] Mean values with the same alphabets along columns are not significantly different ($P>0.05$).