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Research Article

Substitution Value of Water Hyacinth (*Eichornia crassipies* – Mart.) Solms Meal in The Diet of African Giant Land Snail (*Archachatina marginata*) Swainson

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Abstract

A total of 36 juvenile sized African giant land snails (Archachatina marginata) were fed with water hyacinth meal at 0%, 5%, 10% and 15% respectively to give T_0, T_1, T_2, and T3. Performance characteristics such as weight gain, feed intake, feed efficiency, shell length, groove diameter and shell circumference were assessed. The feeding trials lasted for eight weeks with three treatments in 3 replicate while 3 snails constituted a replicate. Readings were taken weekly. Data collected was subjected to analysis of variance (ANOVA) using completely randomized design. The highest feed intake was observed in T_0 (11.30g) while the least fed intake is T_3 (7.80g). The weight loss of T_0 (-2.9) was the lowest while the weight loss of T_3 was the highest. There was no significant difference at 0.5% probability level in the feed efficiency of the animals (0.90) but there was significant difference in the weight gain (0.00). The shell length of T_3 was the highest (10.99cm) while T_1 and T_2 had the lowest (10.90). There was no significant difference in shell circumference, shell length, diameter and feed intake of the snails. Snails fed with T_1 had the lowest dressing percentage (57.10%) while T_2 and T_3 had equal dressing percentage (71.40%). Conclusively, incorporation of water hyacinth meal (WHM) into the diet of snails at 5% level could be recommended to snails farmers though it should only be given to snails only in terms of scarcity of food

Keywords: Water hyacinth, Feed, Diet, African giant land snail.

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Introduction

African giant land snail *Archachatina marginata* of the family Achatinidae whose common name is West African snail is a species of the air breathing, tropical land snails and it is one of the largest snail in the Achatinidae family found in West Africa (Akintomide, 2004). *Archachatina marginata* snails have their best performance when they are kept in a temperature of around 20°c (Ejidike. 2002). The dryness of the snails can cause crack of their shell which would subsequently lead to their death. Therefore direct exposure of the snails to sunlight should be totally avoided. Obateru (2008) said that snails are a nocturnal animal which means that they are most active at night; their activeness is greatly reduced during the day thus causing a great reduction to their feed consumption. According to Ajayi *et al.* (2002), the greatest problem of snails is water loss from the body. Snails feed on a wide variety of foods which are mainly of plant origin. These foods include breadfruit, cassava leaves, pawpaw parts (leaves, stem, and fruit), cabbages e.t.c. The snails have a remarkable ability of converting dead and decaying plant matter into high nutritional weight. Their food also includes flowers, tubers and fruits of diverse plants and supplementary feeds called concentrate (Agbogidi *et al.,* 2008). In the foods of snails, there are specific elements required for their growth. Example of such elements is calcium; this is a major element required by snails because it helps in building the shell of the snails and also improve the general growth of the snails which would directly increase their size.

Water hyacinth *Eichhornia crassipies* is an aquatic plant native to the Amazon basin and is often considered as highly problematic invasive species outside its native range. It is one of the fastest growing plants known, water hyacinth reproduces primarily by ways of runners or stolon. Each plant can produce thousand of seeds each year and these seed can remain viable for more than 28 years (Sulivan *et al.,* 2012). Some water hyacinth was found to grow up to 2 to 5m a day in some sites in Southern Africa. *Eichhornia crassipies* which is the most common water hyacinth species is a vigorous grower which is known to double its population in two weeks (Matai and Bagchi, 1981).

This fast growing troublesome, indestructible plant however has positive uses. Studies have shown that plant serves as industrial raw material for paper making, biogas production, animal feed, organic manure (compost), fibre, potash and fish formulation. Water hyacinth is an aquatic plant which has *been* identified to contain *a* high percentage of elements which can be useful in feed composition for snails and other livestock animals. This weed is a weed of great potential value (hat is productive and requires no tillage, fertilizer, seed or cultivation.

The snails farmers around water bodies (lakes, rivers, streams), the introduction of water hyacinth into their food of *Archachatina marginata* could serves a means of reducing the cost of procuring feed of the snails and the controlling the weed.

Materials and Method

Experimental Site

The experiment was carried out in the Agriculture and Extension Teaching and Research Farm, Federal College of Forestry, Jericho, Ibadan. The site (7°26"N, 3°22"E) is located in the rainforest vegetation of the South west part of Nigeria. It receives a mean annual rainfall of about 1300mm-1500mm and average relative humidity of about 80- 85% (FR1N, 2006).

Materials Used

Thirty six (36) juvenile size of *Archachatina marginata*, feed concentrate (growers mash), water hyacinth meal, sensitive scale, sensitive venier caliper, wooden cage, loamy soil, water, meter rule, thread, writing materials

Procurement of Materials

The African Giant Land Snail *Archachatina marginata* was procured from Forestry Research Institute of Nigeria. The concentrate feed was procured from a feed seller in Ologuneru and also water hyacinth was procured from Eleyele dam, Ibadan. The loamy soil was obtained from the practical site of the College.

Method

A total of thirty six (36) juvenile African Giant Land Snails *(Archachatina marginata)* were purchased from Forestry Research Institute of Nigeria and were housed in an already prepared pen. They were fed with pawpaw leaves before introducing the experimental diets.

Experimental Diets

Three different concentrate percentages and one control was used to carry out this experiment, each diet represent the treatment that was used and each treatment was replicated thrice. The treatment used consists of:

T_0 = Concentrate + Water hyacinth meal at *0%*
T | = Concentrate + Water hyacinth meal at 5%
T_2 = Concentrate + Water hyacinth meal at 10%
T3 = Concentrate -t Water hyacinth meal at 15%

Parameters Assessed
The following parameters were considered and *recorded* on weekly basis: Weight of the Snails**-** This was recorded by measuring the weight of the snails with the use of sensitive scale.

Shell Length- This was done by using a thread and ruler to measure *fro*m the tip to the groove of each snail.

Shell Circumference – This is measured by using a thread and ruler to measure the width of the shell.

Feed Intake- This amount of diet eaten by snail per treatment was determined by subtracting the amount of feed left in the trough or feeder from the total amount of feed given as

Thus: Quantity given (g) - Quantity left (g)

This method was then used to determine the total amount of feed eaten per snail throughout the duration of the experiment.

Feed Efficiency- The feed efficiency was calculated using this formula:

$$\frac{\text{Feed intake}}{\text{Weight gain}}$$

Groove Diameter- The groove diameter was measured by using thread and ruler to measure ventrally the length of the groove. The individual reading were summed together and divided by three for each treatment weekly.

Methods of Processing the Test Ingredients
The water hyacinth leaves after procurement was dried for a week and a half to remove the water present in it after drying, the water hyacinth leaves was ground into powdered form and then sieved to remove any coarse fibre present in it. The weight of the powdered water hyacinth meal was weighed and tied in a polythene bag and kept from the reach of rat, rainfall and other rodents.

The grower mash after procurement was weighed. The concentrate was substituted at 5%, 10% and 15% with the water hyacinth meal. The mixture of the percentages of the water hyacinth meal and the concentrate feed was given to the snails on daily basis.

Experimental Design
The experimental design used was Complete Randomized Design (CRD). A total of 36 snails was subjected to three replicates per treatment and would have three snails. The control which represents the water hyacinth meal diet at 0% was designated as T_0, while T_1, T_2, T_3 respectively would represent the water hyacinth meal diet at 5%, 10% and 15% concentrate respectively.

Results and Discussion

The proximate analysis of water hyacinth showed that water hyacinth is high in fiber than in protein. The analysis further revealed that water hyacinth is high in digestible carbohydrate which is the nitrogen free extract- The ash content of water hyacinth is lower than the moisture content and finally the gross energy produced by the plant is shown to be high as presented in Table 1a.

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Table 1a: Proximate Analysis of Water Hyacinth

Composition	%
Crude protein	13.57
Crude fiber	21.60
Ash	2.71
Ether extract	4.49
Nitrogen free extract	47.33
Moisture	10.50
Gross energy kcal/100g	309.24

Table 1b: Proximate Composition of Growers Mash

Mineral	**Composition** (%)
Maize	40.00
Com barn	15.00
GNC	5.00
PKC	6.00
Oyster shell	5.00
Bone	2.50
Menionine	0.10
Lysine	0.10
Growers	0.40
Salt (NaCl)	0.30
Crude fibre	5.40
Crude protein	16.00

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The result showed that there is significant difference in the initial, final and weight gained while there was no significant difference in the total feed intake, feed efficiency, shell circumference. Shell length and oral groove as revealed in Table 2. Table 2 shows the performance characteristics of *Archachatina marginata* fed with water hyacinth meals.

Table 2: Performance Characteristics of ***Archachatina marginata*** **Fed with WHM Based Diets**

Parameters	T_0	T,	T_2	T_3	SEM
Av. Initial weight (g)	125.50 ^{b}	125.80^{a}	125.30^{c}	125.40^{c}	0.12
Av. Final weight (g)	122.60^{a}	118.40^{b}	115.80^{c}	111.40^{d}	0.00
Av. Weight gained (g)	-2.90^{8}	-7.40^{b}	-9.50^{c}	-11.00^{d}	0.01
Total feed intake (g)	11.30^{a}	10.90^{b}	10.40^{c}	7.80^{d}	0.12
Av. Feed efficiency (g)	0.03^{a}	0.03^{a}	0.03^{c}	0.03^{a}	0.90
Av. Shell length (cm)	10.99^{a}	10.90 ^{b}	10.90^{c}	10.94^{d}	0.95
Av. Shell circumference	102.04^{a}	101.67^{b}	101.47^{c}	100.26	0.79
Av. Oral groove (cm)	5.61^{c}	5.51^{d}	5.63^{b}	5.67^{a}	0.48
Dressing percentage (%)	71.10^{b}	57.10^{c}	71.40^{b}	71.40^{a}	

abcd: means on the same row with different superscripts are significant by ($p>0.05$).

All the snails used to carry out the experiment had weight loss but snails fed with T_0 had lowest weight loss (-2.9g) while snails fed with T_3 had the highest weight loss (-11.0). The reason for the high loss of weigh in snails fed with T_3 can be related to the sharp calcium oxalate present in the water hyacinth that cause irritation in the mouth of animals fed with it (Babu *et al.,* 1988). Also another reason that could be attributed to the weight loss of snails fed with T_3 is the high level of toxic substance present in the plant (Abdelhamid

et al., 1991). In terms of feed intake, snails feed with T_0 had more feed intake than others. The decline in the feed intake can be attributed to the non-palatability of water hyacinth. Also, the high crude fibre of water hyacinth is also a factor that reduces the feed intake of the T_1, T_2 and T_3. This agrees with the work of Babalola and Akinsoyinu (2009) which showed depressed growth rate when diets of various energy plants were fed to *Archachatina marginata* and *Archatina achatina.* Snails fed with T_1 had the lowest dressing percentage (57.10%) while those of T_2 and T_3 had 71.40% and 71.40% respectively. However, there were no significance difference ($p > 0.05$) in shell circumference, oral groove, feed efficiency and total feed intake as presented in table 2.

CONCLUSION

From the result gotten, it showed that the substitution of water hyacinth in the diets of *Archachatina marginata* caused the animal to have weight loss. The highest average weight loss is by snails fed with T_3 which the diet is containing 15% of water hyacinth while the least was simply snails fed with 0% water hyacinth. This can be due to the low palatability of water hyacinth and the oxalate crystal present in the plant.

Recommendation

Based on the result gotten, the following recommendation can be deduced from the result.

Pure feed concentrate should be given to snails and if water hyacinth is to be added, it should be added in small quantities.

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REFERENCES

Agbogidi O.M, Okunta B.C and Ezeani E.L. (2008): Effect of two edible fruit on the growth performance of African Giant Land Snails *Archachatina marginata. Journal of Agricultural Biological Sciences* 2(3)*:* 26-29.

Abdelhamid, A. M. and Gabr, A. A. (1991): Evaluation of water hyacinth as a feed for ruminants. Arch. Tierenahr., 41 (7/8), 745-756.

Ajayi S.S, Tewe, O.O. Moriety, C and Awesu, M.O (2002): Observation on the bioloy and nutritional value of African Giant Land Snails *Archachatina marginata. East African wildlife Journal* 16: 85-95.

Akintomide. I. A. (2004): Tropical Snail Farming, Oak venture publishers, Lagos.

Babalola O. O and Akinsoyinu A. O (2009): Proximate composition and mineral profile of snail meat from different breeds of land snail in Nigeria. *Pakistan Journal of Nutrition* 8(12): 1842-1844.

Ejidike R.N. (2012): Snail rearing practices in southern Nigeria. In proceeding of the 27th Annual conference of the NSAP held in Akure Pp 307-310.

FRIN (2006): Agro-metrological station report, Forestry Research Institute of Nigeria, Ibadan. Pp 96-120.

Matai, D.K and Bagchi T. (1980): Water hyacinth, a plant with prolific bio-productivity and photosynthesis Pp 144-148.

Obateru, T. (2008): utilization of Giant Land Snails *Archachatina marginata* in Oshimili South Local Government of Delta State. Unpublished B.Sc. project submitted to the Department of Forestry and Wildlife, Delta State University, Asaba Campus.

Sulivan, Pari R. and Wood, Rod (2012): Water hyacinth *Eichhornia crassipies,* seed longevity and implications for management 18th Australasian, Weed Conference. Melbourne Conference proceeding.