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The Use of Poultry Dropping as Snail Feed

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Abstract: The use of poultry dropping as snail (*Archachatina marginata*) feed was investigated in a six-month experiment. Diet I contain poultry dropping as protein source at 20%, while Diet II was pawpaw leaves. Growth parameters (weight gain, feed intake, shell length gain, shell circumference gain and feed conversion ratio), haemolymph and flesh minerals and proximate composition of the snails were determined. Snails fed diet I had a higher weight gain than snails on diet (II). The snails converted diet (II) better than (I). the feed intake of snails on snails on diet II, was significantly higher ($p<0.05$) than snails on diet I. Diet II contributed more to the shell length gain than diet I, while diet I contributed more to the shell circumference gain, though not stastically different ($p<0.05$). Analysis of the haemolymph and flesh for mineral composition revealed that snails fed diet II had higher total value than snails on diet I. As shown by the proximate analysis, diet I supplies more protein to the snails than diet II.

Key words: Snail, Feed, Mineral and proximate composition, Poultry dropping, Pawpaw leaves

Introduction

The African giant land snail, *Archachatina marginata*, is a common gastropod mollusc in the high forest and in the derived Guinea Savannah region in West Africa (Yoloye, 1994). Snail meat is a high quality food that is rich in protein, low in fats and a source of iron (orisawayi, 1989 and Adeyeye, 1986). Imevbore and Ademosun (1988) assessed the nutritive value of snail meat in relation to some popular conventional animal protein sources. They discovered that snail meat has a high protein content of 88.37%, a value which compare favourably with conventional animal protein sources whose value ranged from 82.42% (Pork) to 92.75% (beef).

The popularity of giant land snail in the world is increasingly reduced by indiscriminate hunting and deforestation, which destroy the snails habitat. Rearing of the giant land snails as a domestic animal would therefore help in some measures to satisfy the demand for the meat and ensure the survival of the species. However, one problem facing rearing of snail is formulating an improved diet that will meet the nutrient requirements of the snails, especially in the dry season when pawpaw leaves and other food plants of snails will not be available.

The aim of this work was therefore to investigate there effect of poultry dropping (a poultry farm waste) on the performance of giant land snail *Archachatina marginata*.

Materials and Methods

This research was carried out in the Animal House of Department of Biological Sciences, University of Agriculture, Abeokuta (7 10'N and 3 2'E). Its measurement is 2.7x1.8x2.1 m and the window allows for cross ventilation. The house was shaded by pawpaw leaves as the mean daily temperature during the experiment was 26.5±0.5°C.

Sixty (60) snails with average weight of 10.37+0.9 g (one month old) were obtained from snail pen of the department of forestry and wildlife management in the University of Agriculture, Abeokuta.

Sixty snails used in this experiment were allotted randomly to two diets of thirty snails per treatment. Each treatment was further sub divided into three replicate groups of 10 snails each.

Diet (I) was formulated containing poultry dropping as the protein source at 20%; pawpaw leaves serves as the control (diet II), Table 1.

The diets were presented to the snails in the plastic troughs inside their respective cages. The snails were fed ad-libitum with feeds being provided everyday between the hour of 4-5 pm for 24 weeks. Water was also made available to the snails in the plastic trough present in each cage.

Data were collected weekly on the following parameters body weight shell length (measured in cm using ruler) shell circum ference (measured in Centimeters by coiling the canvas tape round the snail), feed intake.

Chemical Analysis: Nine snails from each treatment were randomly picked and the shell broken at the apex to collect the haemolymph after which the flesh was removed. Haemolymph and flesh collected were analysed for potassium and sodium by means of flame photometer (corning UK model 405). Calcium, Magnesium, Iron and Zinc were analysed by means of Atomic Absorption Spectrophotometry (AAS) (Pye unican, UK model sp 9). Chloride was determined using spectrophotometry method (SQ 118 photometer).

Table 1: Composition of the experimental diet (G/100 g)

Ingrediets	Diet I	Diet II
Poultry dropping	70.67	-
Corn starch	26.03	-
Oyster shell	1.50	-
Bone meal	1.50	-
Minerals/Vitamins	0.30	-
Fresh pawpaw leaves	-	100

Chemical analysis for the proximate composition of the flesh, that is crude protein, crude fibre, Ash, moisture content and fat content were carried out according to the method of Association of analytical chemists (AOAC), 1990.

Stastical Analysis: The results obtained were analysed using one-way analysis of variance (ANOVA). Duncan multiple range test (Steel and Torries, 1980) was also used to separate significant difference among means, regression analysis, was also used to determine the relationship between the measured parameters.

Results and Discussion

The observation made in the present study revealed that the experimental snails fed at mainly at night. Even though diets were presented to the animal around 5.pm, feeding did not start until late in the night around 10pm and continues till 1.00am. Before the consumption of the diet, however, the snails used the tentacles to explore the feed and later protruded their lips to taste the food.

The two diets were received and eaten by the snails. However, there was a significant difference ($p<0.05$) in the amount of different diets consume by the snails (Table 2).

There was appreciable weight gain by the experimental snails. Statistical analysis showed a significant difference in the weight gained by the snail fed the two diets (Table 2).

There was remarkable shell circumference gained by the experimental snails. Snails fed on diet (II) had a higher shell length gain than snails on diets (I), while diet (I) contributed more to the shell circumference than diet (II) though, this is not stastically different. (Table 3). Correlation coefficient showed strong positive relationship between the weight and the shell parameters (Table 4).

The results of the analysis of the mineral composition of the flesh and the haemolymph showed the presence of Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Zn^{+}, Fe^{2+} and cl^{-} in both the flesh and haemolymph.

Table 2: Feeding performance of *A. marginata* fed on different diets

Parameter	Diet I	Diet II
Feed intake	$495.37+2.93^{b}$	$902.23+0.30^{a}$
Feed conversion ratio	$2.83+0.10^{a}$	$1.33+0.02^{b}$
Weight gain (g)	$14.02+0.60^{a}$	$11.97+0.40^{b}$

* Mean values in each row with the same superscript are not significantly different ($p<0.05$)

Table 3: The shell parameters of snails fed different diets

Parameter	Diet I	Diet II
Initial average shell length (cm)	$3.80+0.04^{a}$	$3.58+0.04^{b}$
Final average shell length (cm)	$4.96+0.04^{b}$	$5.05+0.05^{a}$
Shell length gain	$1.16+0.20^{b}$	$1.47+0.01^{b}$
Initial average shell circumference	$8.66+0.07^{a}$	$8.56+0.06^{a}$
Final average shell circumference	$10.50+0.02^{a}$	$10.06+0.06^{a}$
Shell circumference gain (cm)	$1.84+0.02^{a}$	$1.50+0.02^{a}$

* Mean values in each row with the same superscript are not significantly different ($p<0.05$)

Table 4: Correlation coefficient between weight(s) and shell parameters (cm) at 0.01 level of significants

Diets	Shell length	Shell circumference	Significant
I	0.9374	0.9830	**
II	0.9761	0.9687	**

** Significant at 99% ($p<0.01$)

Table 5: Minerals composition of the haemolymph of Snails, *A. marginata* fed different diets (mg mL^{-1})

Parameter	Diet I	Diet II
Calcium	0.20^b	5.00^a
Magnesium	1.93^b	3.58^a
Sodium	6.00^b	9.00^a
Potassium	0.50^a	0.00^a
Zinc	0.10^a	0.36^a
Iron	30.70^b	69.30^a
Chloride	35.00^a	10.00^b
Total value of mineral tasted	74.45	97.26

* Mean values in some row having the same superscript are not significantly different (p<0.05).

Table 6: Flesh mineral composition of snail meat fed with different diets (mg/100 g)

Parameter	Diet I	Diet II
Calcium	53.82^b	783.53^a
Magnesium	50.25^a	51.35^a
Sodium	83.75^a	86.00^a
Potassium	22.50^a	26.25^a
Zinc	6.78^a	8.20^a
Iron	184.50^b	20.70^a
Chloride	12.50^b	37.50^a
Total value of mineral tasted	2074.60	3062.80

* Mean values in some row having the same superscript are not significantly different (p<0.05)

Table 7: Proximate composition of snails, *Archachatina marginata* fed different diets

Parameter	Diet I	Diet II
Moisture content	81.66^a	82.93^a
Crone protein	87.94^a	70.63^b
Crone fibre	0.03^b	0.15^a
FAT	1.18^b	1.62^a
ASH	1.18^b	1.42^a

* Mean values in some row having the same superscript are not significantly different (p<0.05)

Statistical analysis showed a significant difference (p<0.05) in the concentration of the mineral present in the experimental snails. Snails on diet (II) had a higher sodium concentration in both the flesh and haemolymph.

In summary, snails on diet II had a higher total mineral concentration in their flesh and haemolymph (Table 5 and 6). The result of the proximate analysis of the flesh of the experimental snails revealed a significant different (p<0.50) in the proximate composition of the experimental snails. Snails placed on diet (I) have a higher crude protein (87.94) a snails on diet (II) (70.63). The fat content of snails on diet (I) was lower than flesh on diet (II). The same is true about the ash content of the experimental snails (Table 7).

The results of the study showed that snails (*Archachatina marginata*) emerged to feed only at night between the hours of 10:00 pm and 1:00 am, even though the diets were presented to them earlier in the day. This observation agrees with the findings of Amusan and Omidiji (1998) and Akinnusi (2002). Feeding was preceded by exploration of the diet by the snails with their tentacles and lips which is an indication that the snails depend on their olfactory and gustatory cues to explore their environment before ingesting food (South, 1992). The experimental snails followed this pattern, as there was no definite trend in feeding among snails during the experiment.

Pawpaw leaves (diet II) was more preferred to the poultry dropping based diet (diet I), just as observed earlier by FAO (1989) and Amusan and Omidiji (1998). Also, the result of feed conversion ratio revealed that pawpaw leaves was better converted by the experimental snails. Although, the reason for the higher feed intake of pawpaw leaves cannot be ascertained, it is possible to say that the presence of fibre in the pawpaw leaves that aids digestion and motility of alimentary canal may be responsible. Snails on diet (II) recorded the highest shell length gain and this observation runs in conformity with the report of Okonkwo *et al.* (2000) that snails fed on pawpaw leaves had better shell growth than those fed on other diet.

The mineral analysis of the experimental snails flesh shows that snails fed pawpaw leaves had higher mineral composition (Table 6). Romoser and Staffalano (1998) also observed that phytophagous insects do have higher mineral composition in their body than zoophytophagous insects.

On the other hand, snails on poulty dropping had less total mineral composition. Elbously and Vendor Poel (1984) had earlier reported that uric acid from poultry dropping could inhibit microbial synthesis of vitamins or other mineral nutrients being essential to the host.

The concentration of iron was the highest of all the mineral analyzed in the haemolymph of snails. The high concentration of iron and presence of other vital minerals like ca^{2+}, mg^{2+} and Zn^{+} may be responsible for the intake of snails haemolymph by pregnant women as reported by Adeyeye (1996).

The highest mineral concentration in experimental snail flesh was iron. This is supported by the report of Adeyeye (1996) and Ayodele and Asimolowo (1999) that snails body contains a high concentration of iron which contribute significantly to prevention of anaemia, a disease widespread in developing countries like Nigeria, (Bender, 1992).

The result of mineral analysis of snails' flesh and haemolymph showed that snails with high haemolymph mineral composition also have high flesh mineral composition (that is snails on diet II). This observation was also made by Akinloye and Olorode (2000) that haemolymph is the fluid that bathes snails and any physiological process taking placed in the body must be reflected by the haemolymph. This also confirmed report made by Gullen and Craston (1994) that all chemical exchanges between insect tissues are mediated via haemolymph.

Snails fed poultry dropping based diet recorded a higher weight gain and higher flesh circumference gain. This good performance of poultry dropping as opined by Elbously and Vender Poel (1994) may be due to the fact that poultry dropping contains undigested feed and metabolic excretory product which contains an unknown growth factor (UGF) that may enhance the growth of the consumers.

Result of the proximate analysis of experimental snails showed that snails fed poultry dropping had higher crude protein. Studies have shown that poultry dropping has a moderate nitrogen content, which could be utilized by animals (Elbously and Vander Poel, 1994). This observation revealed that snails have the ability to convert animal waste into body protein (Adeyeye, 2000).

The results of this study indicated that higher growth performance was favoured by poultry dropping based diet, while pawpaw leaves positively affected the haemolymph and flesh mineral composition. Therefore, the use of poultry and pawpaw leaves in formulation of feed for *Archachatina marginata* will positively affect the performance and the nutritive value of the snails, especially in the dry season.

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