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Effects of Supplemented Leafy Diets on the Meat Quality of the Giant Land Snail (*Archachatina marginata*) of Different Age Groups

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Abstract

The giant land snail, *A. marginata* is protein-rich and widely used in human nutrition. Most people in Nigeria usually go for mature big ones for food. This study was undertaken to see whether age affects the nutrient quality of the snail meat. Four different age groups- 6,8,15 and 23 months and designated progeny progeny, (offspring of progeny1) progeny2, progeny1 and original breeders, respectively, were used. Replicates in each age group were fed the different "supplemented" diets, while the controls, also in each age group were fed the "unsupplemented" leafy diets only, both for 6 months. The results on snails fed the "supplemented" diets showed that snails aged 6 months had highest mean crude protein content of 40.85±0.01% in T_2, those aged 8 months had highest mean crude protein content of 36.28±0.01% in T_3, while those aged 15 and 23 months had highest crude protein contents of 41.13 ± 0.01% in T_4 and 44 .27 ± 0.02% in T_2,. There was no significant difference ($P>0.05$) between the ages of the snails in crude protein content. Among the control snails fed the "unsupplemented" diets, snails aged 15 months had highest crude protein content of 24.37 ± 0.02% in CT_4, while those aged 23 months had highest crude protein content of 24.20 ± 0.02% in CT_2,. There was significant difference ($P<0.05$) between the mean effect of the treatments and the control diets on crude protein content. The observed difference may be attributed to the supplements added to the single leafy diets fed to the treatment group, while the controls received the single leafy diets only. The study showed that age has no negative effect on the nutrient quality of the snail meat which further enhances the high quality food value of the snail. Consumers therefore can go for snail of any age group reared with supplemented diets.

Keywords: Nutrient, *A. marginata*, "Supplemented," "unsupplemented", Diets

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Introduction

The giant land snail, *A. marginata*, is a protein-rich mollusc widely utilized as human food *(Buchsbaum*, 1973). In the West African sub-region, it is highly cherished as various delicacies are prepared with the meat such that it forms a substantial part of the meat in the diet of the local people (Cobbinah, 1993). In Nigeria, it is usually collected from the wild because it is a forest product of the rain forest zone of Southern Nigeria (Esonu and Nwoko, 1999). However, it is recently being farmed in Nigeria. It is essentially a vegetarian (Cobbinah, 1993; Riter *et al*.,1996).Various soups are made with the meat. Some of the preparations are the "Ofe Owerri", "Ofe Ukazi", et cetera which command high marketing value in restaurants. In the United Kingdom, recent studies conducted by the Ministry of Agriculture, Fisheries and Food have shown that juvenile *A. achatina* (another West African giant land snail) is meatier and more tender than the more common European species, *H. aspersa* (Cobbinah, 1993). Accordingly, if this demand increases, it means that African giant land snails will enjoy lucrative export markets in Europe. In view of the fact that farmers in Nigeria now produce snails, and the fact that it is generally known that Nigerians in their ostentatious food habits prefer bigger fish, bigger chicken, bigger livestock, et cetera, this study was geared towards assessing the nutrient quality of the meat of snails of different age groups fed"Supplemented"and"Unsupplemente" leafy diets.

Percentage protein and fat contents of the snail meat were used for this assessment because snails are protein- rich molluscs and of low fat (Alexander, 1979). Akobundu (1999) described them as belonging to what he called "Healthy Foods". These are foods rich in protein and low in fat. The knowledge of the protein/fat contents of the meat of *A. marginata* of different age groups will help snail farmers to either grow them to sexually mature adults or sell them off at juvenile stage. If it is no use to grow to mature adults before sales are made, it will be an economic breakthrough for the farmers. It will result in "quick return on investment", because they will no longer wait for the long sexual maturity periods that range between 14-20 months (Cobinnah, 1993), before they market their products.

Materials and Methods

In this study, snails belonging to four different age groups; 6, 8, 15 and 23 months and designated progeny progeny (offspring of progeny1), progeny2, progeny1and original breeders, respectively, were used. Replicates in each age group, were fed the different "supplemented" diets, while their controls were fed the "unsuplemented" single leafy diets for 6 months. Three leaves, cocoyam (*Xanthosoma sagittifolium*), paw-paw (*Carica papaya*) and siam weed (*Chromolaena odorata*) utilized in the wild as nutrition by snails were used in the feed formulations. After harvest, five (5) snails from the different age groups (both treatments and controls) were slaughtered. Proximate analysis was carried out using the Official Methods of Analysis (AOAC, 1995) to determine the crude protein/fat contents of the various meats. Five (5) snails in each age group from the snail populations for the experiment were slaughtered, meat dried in the sun and ground to powder using Corona hand mill. Proximate analysis of the snail meat was determined by the Official Methods of Analysis (AOAC, 1995).

Concrete cages with highly insulated and controlled environments were used to rear the snails. Each cage measured 150.0cm x 70.0cm x 80.0 cm, built of 5" solid blocks in a snail farm at Ndiakweke, Okigwe, Imo State. The tops of the cages were covered with nylon mosquito gauze-framed lids that could open and close as well as locked at will. The tops of the dwarf walls of the cages were rimmed with 30 centimeter-wide hard wood. It projected 15cm into the center of the cages to provide refuge for the snails during hot weather or heavy rains when the ground was flooded. The floor base of each cage was covered with humus soil 30cm thick. Centrally placed inside the cages were flat feeding trays, one in each cage, in which the snail feeds were placed.

Three popular leaves used in the wild as nutrition for snails were used in formulating the "supplemented" leafy diets. They were cocoyam (*Xanthosoma sagittifolium)*. Paw-paw (*Carica papaya*) and siam weed (*Chromolaena odorata*). These leaves were collected from the wild and dried is the sun. They were then squeezed between the palms to near milled products. They were bagged and kept in a cool dry place for use when needed. Proximate analysis of the leaves was determined before they were mixed with the feed supplements (Table 1). Two versions of the snail feeds were formulated. The first was designated "Supplemented" treatment diets because they contained the supplements added to the single leaves. The second version, the single leaves only; not containing the supplements was designated "Usupplemented" control diets.

8g each of the three leaves were separately added to 20g soybean as protein source, 70g whole corn as carbohydrate source (both ground to powder) and 2g growth additives (minerals, vitamins and antibiotics), all thoroughly mixed to produce 100g "supplemented" leafy diet of each of the three leaves designated T_1, T_2, and T_3,. A fourth "supplemented" leafy diet T_4, was obtained by mixing the three leaves in proportions before adding the same quantities of the supplements. The "unsupplemented" control diets had 100g of each of the three leaves to get control diets CT_1, CT_2, and CT_3. A fourth "unsupplemented" leafy diet CT_4, was obtained by mixing the three leaves in proportions. The treatment diets (T_1- T_4) and the control diets (CT_1 – CT_4) were randomly assigned to the rearing cages in the open field using randomized complete block design (RCBD), Gomez and Gomez (1981).

Ten (10) snails in each age group with mean weights of 30.2g, 59.3g, 141.1g and 192.0 representing the age groups of 6,8,15 and 23 months, respectively, were stocked in each of the appropriate cages in three replicates randomly, both for the treatment and the control groups, fed the "supplemented" and the "usupplemented" diets, respectively. Stocking was done at 1800 hours. The snails were then covered with wet dried plantain leaves to provide cool cage environments. The diets were fed to the snails at 100g multiples or fractions, depending on the rate of consumption. Feeding was daily in the evenings since snails are essentially nocturnal. Each cage environment was watered by the rains as the experiment was conducted during the wet months of the year (April- September). Smaller quantities of water were

sprinkled during the dry spells in these wet months. A rain guage was also installed in the open in the farm to monitor the rainfall. Both soil and atmospheric temperatures were monitored with Celsius thermometer daily.

Results and Discussion

The proximate compositions of the leafy diets showed that the highest mean crude protein content of 19.20±0.08% was observed in cocoyam leaves (*Xanthosoma sagitifolium*) (T_1), followed by 15.30±0.01% in siam weed (*Chromolaena odorata*) (T_3). The lowest crude protein value of 0.43±0.04% was seen in paw-paw leaves (*Carica papaya*) (T_2). The results (Table 1) showed that crude protein content in T_1 *Xanthosoma sagittifolium*) was ($P<0.05$) as compared to others. The highest mean carbohydrate content of 63.07±0.04% was observed in T_2, (*Carica papaya*), followed by 52.23±0.02% in T_3. (*Chomolaena odorata*). The lowest value of 48.80±0.04% was recorded in T_1 (*Xanthosoma sagittifolium*) (Table 1). The results showed that carbohydrate content in T_2 was significantly different ($P<0.05$) as compared to others. Among the treatment group, results showed that snails aged 6 months had the highest mean crude protein content of 40.85 ± 0.01% in T_2; those aged 8 months had highest mean crude protein content of 36.28 ± 0.01% in T_3, while those aged 15 and 23 months had highest crude protein contents of 41.13 ± 0.01% in T_4, and 44.27±0.02% in T_2,. There was no significant difference ($P> 0.05$) in the protein content of the snails of different age groups.

Among the control snails fed the "unsupplemented" leafy diets, those aged 15 months had highest crude protein of 24.37 ± 0.02% in CT_4, while those aged 23 months had highest crude protein content of 25.20 ± 0.02% in CT_2. Those aged 8 months had 17.20±0.01% in CT_4 and those aged 6 months had 22.30±0.01% in CT_2. There was a significant difference ($P<0.05$) between the mean effect of the treatment and the control diets on crude protein content. The observed difference may be attributed to the supplements added to the single leafy diets and fed to the treatment group, while the control group received only the leafy diets without supplements added. Correlation tests showed that there was a positive significant correlation ($r = 0.84$) between the crude protein quality and feed consumed by progeny progeny. (aged 6 months). Among progeny 2, (aged 8 months), it was a positive but not significant correlation ($r=0.65$) between protein quality and feed consumed by the group. Among progeny1, (aged 15 months), correlation test was also positive but not significant ($r=0.71$) between the protein quality and feed consumed by this age group too. Among the original breeders, (aged 23 months), correlation tests showed that there was a positive significant correlation ($r=0.90$) between the protein quality and feed consumed by this age group. These positive results in all age groups – 6, 8, 15 and 23 months showed that age had no negative influence on the protein quality of the snail meat.

Among snails aged 6 months the highest fat content was 7.58±0.02% in T_2; among those aged 8 months, the highest fat content was 9.13±0.02% also in T_2, while those aged 15 months and 23 months had highest fat contents of 8.17±0.02% in T_2 and 8.03±0.02% in T_1,. They were all of low fat content (Table 2). In all the sampled age groups-the original breeders, progeny1, progeny2, progeny progeny, and their control-counterparts, the findings showed high percentage protein and low fat contents in the snail meat. There was a higher protein content among the snails that received the supplemented diets. This showed that the supplements enhanced the meat quality of the snails, irrespective of age. The high protein values in this treatment sample group are in consonance with the findings of Udedibie, (1989) who asserted that protein in snails has been estimated in the range of 37.0-51.0g per 100g dry matter. The findings also show that age has no negative influence in the meat quality of snails.

The youngest group progeny progeny, had comparative values with the original breeders that gave birth to their mothers-the progeny1. Also the high protein and low fat contents in all the age groups confirm that snails belong to what Akobundu (1999) called "Healthy Foods". These are foods with high protein and low fat contents. The low fat contents in all age groups also agreed with Alexander (1979) that snails contain little fat. The low fat content and low cholesterol level according to Adetero *et al*(1999) make snail meat a good antidote for vascular diseases such as hypertension and heart attack.

Conclusion and Recommendations

The findings of this study shows that age has no negative influence on the nutrient quality of snail meat fed supplemented diets. They rather enhance the meat quality of snails irrespective of age. It is therefore recommended that consumers go for snails of any age group reared with supplemented diets. Farmers on the other hand can harvest both juveniles and adults for the market. This will enhance their economy as "return on investment" can be recouped in a shorter time than when harvest is made at the adult stage that takes several months to come about.

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Tables

Table 1: Proximate Compositions of the Leafy Diets Used in Feed Formulation

Sample	Mean % Crude Protein	Mean % Ash	Mean% Fat	Mean% Fibre	Mean% Moisture	Mean% Carbohydrate
Xanthosoma sagitifolium (T_1)	19.20±0.08^a	13.10±0.17^a	3.12±0.03^c	3.88±0.03^b	11.90±0.12^c	48.80±0.04^c
Carica papaya (T_2)	0.43±0.04^c	10.50±0.02^c	4.68±0.02^a	4.62±0.03^a	16.70±0.02^a	63.07±0.07^a
Chromolaena odorata (T_3)	15.30±0.01^b	12.50±0.02^b	4.24±0.02^b	3.93±0.07^a	12.80±0.02^b	52.23±0.02^b

abc: Any two means in a column with different superscripts are significantly different ($P<0.05$)

Table 2: Effect of the treatments on the nutrient quality of the meat of *A. marginata* of different age groups fed on different "supplemented" and "un-supplemented" leafy diets

Snail/Age (Mo)	Mean % Nutrient	Treatments T_1	T_2	T_3	T_4	Controls CT_1	CT_2	CT_3	CT_4
Original	Crude protein								
Breeders	Initial	28.66± 0.02	28.66±0.02	28.66±0.02	28.66±0.02	28.66±0.02	28.66±0.02	28.66±0.02	28.66±0.02
(23)	After harvest	29.97±0.01	44.27±0.02	28.85±0.01	36.62±0.03	23.0±0.04	25.20±0.02	24.38±0.02	24.10±0.11
Controls	Fat								
(23)	Initial	10.70±0.01	10.70±0.01	10.70±0.01	10.70±0.01	10.70±0.01	10.70±0.01	10.70±0.01	10.70±0.01
	After harvest	8.03±0.02	7.95±0.01	7.71±0.01	7.63±0.11	7.51±0.11	6.14±0.12	7.42±0.01	8.0±0.01
Progeny 1	Crude protein								
(15)	After harvest	26.16±0.02	35.48±0.01	26.50±0.02	41.13±0.01	23.10±0.2	23.60±0.02	23.50±0.01	24.37±0.02
	Fat							7.60±0.01	8.08±0.02
	After harvest	7.32±0.01	8.17±0.02	7.0±0.04	7.98±02	7.02±0.01	7.0±0.02		
Progeny 2	Crude protein								
(8)	After harvest	25.56±0.01	23.28±0.02	36.28±0.02	25.53±0.01	14.01±0.02	15.20±0.01	16.40±0.02	17.20±0.01
	Fat	7.15±0.02	9.13± 0.02	7.14± 0.01	8.42±0.02	6.20 ±0.01	7.10 ±0.02	6.01±0.01	7.24±0.02
	After harvest								
Progeny	Crude protein								
Progeny	After harvest	30.49±0.02	40.85±0.01	29.41±0.02	35.77±0.01	21.10±0.02	22.30±0.01	23.14±0.02	21.50±0.01
(6)	Fat								
	After harvest	6.34±0.04	7.58±0.03	6.46±0.02	6.47±0.01	5.10±0.01	4.20±0.01	4.50±0.01	4.65±0.02