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Effects of Food Treatment on the Nutritive Value and Sensory Properties of Giant Snail *Archarchatina marginata* Meat

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Abstract: Effect of food treatment on the nutritive value and the sensory properties of giant snail was investigated 36 hatchlings of one week old giant snail, were used for the experiment. There were 3 dietary treatments: Compounded (artificial food), mixture of natural and artificial food and natural food. There were 3 replicates of 4 snails in each. They were fed with water and feed *ad libitum* for 20 weeks. At 20 weeks 2 snails were randomly selected from each treatment and sacrificed by breaking the shell from the back. The visceral organs and the flesh were washed and carefully separated. Meat samples were used for proximate and sensory properties analysis. The meat samples were properly cooked without adding spices,using the same methods and same cooking materials. Sensory assessment was done by a panel of 10 members. The panelists were all in a state of good health and in the same age bracket The results show that all snails showed a steady growth with age and there was a significant difference ($p<0.05$) in weight gain among those snails fed artificial food and those fed the natural food. There was a significant difference ($p<0.05$) in crude protein content between those snails fed artificial and natural food. Snails on natural food had higher ash content, but there was no significant difference in ash and ether extract among the treatments. Snails on the compounded feed were more palatable than those on natural and mixture of natural and compounded food. Meat colour was best in those fed natural food. Cooking loss was highest in those on the compounded food. Meat tenderness was the highest in those on natural food. It was concluded that snail meat is very rich in nutrients and if properly fed good compounded diets the meat value and the sensory properties, will be greatly enhanced. The low values in palatability, nutritive value and weight gain obtained in those on natural food might be an indication that it is not rich enough to meet the basic nutrient requirements of the animal. Therefore, when snails are fed feeds fortified with adequate nutrients during growth, it enhances performance, yield and quality of the meat.

Key words: Food, snail, sensory, nutritive value, *Archarchatina marginata*, meat

INTRODUCTION

Food security is a major problem in the developing countries of the world. Diets of an average citizen in this region is carbohydrate based with little or no protein sources, with a great potential of reducing insulin level in the blood of the consumer. Moreover, consumption of animal protein which is known to be the a better source of this nutrient is extremely low in the region (Omole, 1999). Cases of malnutrition are more rampant in the developing countries than what it is in other parts of the world.Consequently, thousands of children die every year of starvation and malnutrition in the region (FAO, 1996).

Animal production is faced by many problems in the developing countries for instance, high cost of animal feed constitutes a major impediment in this project. Feed is the most expensive of the various factors of animal production and it represents 60% of the cost of this. Feed cost is high because of the continuous competition between man and animal for most of the ingredients (Adeyemo and Longe, 2001). The most expensive portion of the feed ingredient, are protein and energy sources. This has geared up research in this direction throughout the world.

Animal protein is superior to plant protein as it contains all the essential amino acids in adequate proportions (Tewe, 1997). Low consumption of animal protein in the developing countries is born out of poverty and ignorance. Unavailability and low production of livestock is indeed a major problem. It is very clear that livestock can no longer meet the demands of the fast growing population of the world. Therefore, there is an urgent need to encourage the production of the mini livestock such as snail, insects and rodents to supplementthe current livestock production (Afolayan, 1992).

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Snail is one of the mini livestock with great potentials. It is a wild animal that is commonly found under debris and shed plant leaves in different agricultural farms especially during the rainy season in different parts of the tropics (Adeyemo and Borire, 2002). The meat is a delicacy for many people both in the rural and urban centers of Nigeria and in many countries in Africa. It is a major source of meat to people in the rural communities where the majority can not afford the cost of livestock meat (Emevbore, 1990). Snail meat has a special taste and aroma. It is very rich in iron, calciumand phosphorus. It is low in fat and cholesterol (Afolayan, 1992). It is high in quality protein, as it contains all the essential amino acids in adequate proportions. In fact, the amino acid profile compares favourably with those of broiler, fish and pork (Omole, 1999). This makes its consumption beneficial and safe to the consumers.Apart from serving as a source of food, snail meat is very important in traditional medicine. In Africa, it is mixed with other ingredients to make concoctions for the treatment of many local ailments and diseases (Emevbore, 1990).

Snails feeds on plant leaves, fruits, shrubs and organic matter. They are readily available on the farms especially in the rain forest region of west Africa where they are picked by farmers under litters and debris. An adult snail can produce up to 10 hatchlings at a time. A mature adult weighs approximately 750 gm. Its flesh is about 30% of the whole weight (Ajayi *et al*., 1978) Although, snails are hermaphrodites, a mature pair is often needed for breeding. It is resistant to many diseases and parasites that commonly affect most livestock or other mini livestock (Adeyemo, 2005). The average live expectancy of snail is from 5 to 6 years, although, there are reports that they can live up to 9 years (Cobinah, 1992). This shows that the requirement of snail is relatively low hence it is a ready meat for every individual who could rear it both at a small or large scales. Consequently, snail farming if properly managed, could serve as a good means of promoting economic empowerment for both the rural and urban duelers in line with the current economic policies of FAO. Therefore, since the basic requirements are relatively low it could be reared at the back of a house with ease with little capital (Ngoupoul, 1992). This study is aimed at assessing the nutritive and sensory values of the snail meat. It is hoped that it will serve as a basis for further studies in snail production in the tropics.

MATERIALS AND METHODS

Thirty six hatchlings of giant snails were used for a twenty week feeding trial. There were 3 diets namely: Artificial feed made up of compounded ingredients, mixture of compounded diet and natural food. and lastly, natural food. The snails were of almost equal initial weights. There were 3 replicates of 4 snails per one. They were raised in the snail pens in the university domestication unit. The snail pens were kept in a house where a portion is open roofed for extensive rearing. In this portion, sweet potatoes and coco yam were planted to provide food and shelter to the snails reared under them. The other portion covered with the corrugated iron sheets. The floor was covered with concrete. The pens were of 40×40×40 cm, in size. The pens were one third filled with loamy soil. The outer part of the pens were covered with black cellophen paper to provide a cool damp environment as physiologically required by the snail. The pens were covered with wire mesh to prevent the entry of insects and reptiles. Feed and water were supplied daily to the animals. The pens were cleaned daily while the soil was changed weekly with clean loamy soil to avoid build up of pathogenic and parasitic organisms. The following parameters were determined throughout the experimental period: feed intake, weight gain, shell length increase and shell thickness. Feed intake was measured by subtracting feed offered from the feed left over using the measuring scale,weight gain by subtracting the initial weight from the final. The shell thickness was measured by using the veiner caliper while the shell length was measured by using a tape rule.

Sensory properties assessment: At the 20 week two snails, were randomly selected from each replicate and sacrificed by breaking the shell from the back and pulling out the flesh. Samples of the flesh were properly boiled without adding spices The boiled meats were given to a panel of 10 members of same age group who were certified to be in a good state of health. The meats were scored for palatability, cooking loss, flavoure, colour and tenderness. Meat colour was measured by colourimetric method for meat muscles as described by (Uijttenboogaart and Triziska, 1993). Meat tenderness was measured by taken samples of meats from each treatment and properly blend in a kitchen blender. This was done to expose the fibers and the myofibrils. Samples of the blend meat were then viewed under a high power microscope at 40 magnification. The fibre diameter and the sarcomere length on the selected myofibril were measured. Values obtained from these were then used to determine the meat tenderness. Percentage cooking loss was determined by boiling samples of the meat and subtracting the boiled weight from that of the fresh meat.

Proximate analysis: samples of the meat were used for proximate analysis following the methods described by AOAC. A factor of 6.25 was used to convert the nitrogen to protein fat, ash and dry matter were all determined following the standard procedures under the method.

Data analysis: The data collected were analysed using Analysis of Variance (ANOVA), while significant differences between the means were separated using LSD test.

RESULTS AND DISCUSSION

The results of this study are presented in Table 1-3. There was a general increase in feed intake in all the dietary treatments with age. There was a significant difference ($p<0.05$) in feed intake among dietary treatments. Snails on the artificial diet consumed most while the least feed intake was recorded in those fed natural diets. This might be an indication that artificial feed is more palatable than the compounded diet; as the more palatable a feed is the more the feed intake (Cowan and Michie, 1983). On the other hand, the sweet potato leaf is of low metabolizable energy than the the compounded diet and animals eat to meet their body energy requirement. Therefore, on this ground, one would have expected highest vales of feed intake from the sweet potato leaf diet (Ibeawuchi and Akinsoyinu, 1991).

Significant differences ($p<0.05$) were observed between snails raised on artificial diet and those on natural food in body weight gain, feed conversion and edible flesh weight. The result showed that body weight gain increased with age but the rate of gain was found to be a function of the nature of feed offered. There was a positive correlation ($r = 0.23$) between the body weight

Table 1: Proximate composition of the experimental diet

Nutrient	Natural fed	Mixture of natural and artificial food	Formulated
Crude protein	7.55	11.4	12.6
Crude fibre	13.69	7.41	11.20
Ether extra	3.20	10.21	6.34
Ash content	6.41	5.0	3.87
NFE	69.15	65.98	69.20
Dry matter	75.68	77.2	78.3

Table 2: Sensory evaluation of snail meat

Parameters	Natural food	Mixture of natural and artificial food	Artificial food
Palatability	8.4±1.2	6.3±0.12	7.1±1.22
Flavour	6.7±1.31	7.1±1.22	8.2±0.10
Aroma	6.0±1.26	8.6±0.21	8.9±0.10
Juiciness	5.1±1.13	8.0±1.30	7.1±1.23
Colour	5.4±1.11	5.4±2.1	5.1±3.1
Cooking loss	8.2±0.11	8.3±1.11	8.1±1.13

Table 3: Proximate composition of snail meat

Nutrient	Natural food	Mixture of natural and artificial food	Artificial food
Dry matter	81.5	84.6	86.7
Crude protein	23.6	25.0	25.3
Ether extract	18.0	19.2	19.8
Ash	15.6	10.8	10.4
NFE	63.8	52.3	44.5

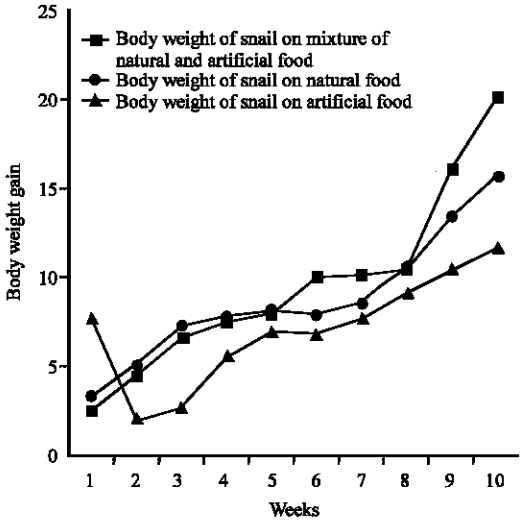

Fig. 1: Average body weight gain of snail fed with vary dietary treatment

gain and the nature of feed offered at the growing phase. This is in line with the findings of Donbranski *et al.* (2000).

Which reported significant growth differences in broiler fed different feed qualities at growing phase. The higher flesh weight observed in snails on artificial diet is an indication that when feed ingredients are properly mixed in the right proportions, it greatly enhance snail meat yield. However, there were no significant differences in flesh weight between snails fed artificial diets and those on compounded diets and the natural feed. It could therefore, be submitted that the low yield obtained in snails raised on natural diet implied that the natural feed was of lower quality. This indicates that every snail in the wild, feeding on their natural food, is stunted but with a great potential for faster growth if properly fed high quality diets. Feed conversion which is a measure of the amount of flesh deposited to the quantity of food consumed, followed the same order of the weight gain. Shell length and shell thickness increased with the age of the snail. Shell thickness is a measure of the state of health of the snail. Therefore, the higher thickness observed in those snails on the artificial feed is an indication that the quality of a feed dictates the state of health of the animal at growing phase (Adeyemo and Borire, 2002).Throughout the experimental period, there was no record of mortality. This is an indication that the dietary treatment had no detrimental effects on the snail.

Figure 1 shows the average weight gain of snails with age in the three dietary treatments. The result shows a steady rise in the body weight gain with age with the highest rise observed in those raised on compounded

diets and least in those on natural diets. This implies that those on compounded diet will reach market weight earlier. In fact, this might have great influence on sexual maturity or attainment of age of puberty.

Sensory evaluation of snail meat: Thermally cooked snail meat samples showed some variation in sensory properties (Table 3). Those snails raised on the compounded diet showed high values in flavor, aroma, palatability and juiciness and there was a significant difference ($p<0.05$) between snails raised on compounded diet and those on natural food but there was no significant differences observed in juiciness. The high palatability observed with increase in flavor and aroma is expected as these are sensory factors that induce palatability which eventually affects the choice, appetite and consumption of the consumers (Iroyorkati, 2003) Values for the percentage cooking loss were observed to be highest in snails raised on natural food, but the least value was observe in meat tenderness. That is, those raised on natural food had toughest meats. The more the tenderness of a meat, the higher the cooking loss.

Therefore, the significant differences ($p<0.05$) observed in percentage cooking loss and meat tenderness is expected. This type of meat may have a higher demand in this part of the globe as consumers here prefer meats that will stay longer in the mouth as a result of their toughness (Wieck-and Skomiat, 2000). Similarly, result of the taste panel indicated that the members preferred the meat with lower tenderness as it allows proper chewing in the mouth. This indicates that though, meats raised on compounded feed had highest flavor, aroma and palatability it did not have 100% acceptability as it has high tenderness. Therefore, feeds made up of a mixture of compounded and natural food might be more accepted as it combined the merits of both natural and compounded diets.

Meat quality assessment: Results of the proximate analysis of snail flesh was given in Table 1. It shows some noticeable variation in the values of the basic nutrients in the meat. The highest percentage crude protein was recorded in snails raised on compounded feed. There was a significant difference ($p<0.05$) in percentage crude protein between snails raised on compounded feed and those on natural foods but there was no significant differences between those on this food and those on mixture of natural and the compounded feed (Donbranski *et al.*, 2000). The highest percentage ash was recorded in snails raised on the natural food, however, this was not significant. Values for Ether extract followed the same other in all the treatments. The high protein recorded in snails raised on compounded feed might be a reflection of the quality of feed offered them during the experimental period as snails on this diet performed best in almost all the parameters tested. The high ash content is an indication that meats of snails on natural feed were richest in minerals.In the overall analysis, the snail meat is quite high in the basic food nutrients, as it is in the meats of livestock. This confirms the findings of Iroyorkati (2003) that snail meat is high in basic food nutrients and these values compete favorably with those obtained from chicken, beef, mutton and pork. Similarly, Wieck and Skomiat (2000) reported high performance and higher nutritive value of meat in pigs when fed higher quality feeds during growth.

It is very clear that the quality of feed available to a snail during growth greatly influence the nutritive value of its meat.

CONCLUSION

It was concluded that snails raised on adequately fortified compounded diets, performed best in almost all the parameters tested. This shows that although extensive snail rearing is cheap, it does not provide all the basic and nutrients required by the animal in adequate proportions hence, it leads to drastic reduction in yield and quality of meat through prolonged maturity age and that snail performance and meat quality can be greatly enhanced by upgrading the quality of the feed offered during growth.

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