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Proximate Composition and Mineral Profile of Snail Meat from Different Breeds of Land Snail in Nigeria

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Abstract: Four different breeds of snail, *Archachatina Marginata* (AM), *Achatina Achatina* (AA), *Achatina Fulica* (AF) and *Limicolaria* species (LM) were analyzed for proximate composition and mineral profile of the snail flesh (foot or edible potion). Proximate analysis of the snail flesh revealed that moisture was highest in LM (84.91%) and least in AM (73.67%). The crude protein contents of the breeds were significantly different from one another ($p<0.05$). The values ranged from 19.53% for AM to 5.86% for LM. The ash and ether extract of AM and AA were significantly higher ($p<0.05$) than that of AF, while LM had the least. AF had the highest Nitrogen Free Extract (NFE) while the least was observed in AM. The NFE and ether extract (fat) contents were generally low. The result of the mineral profile showed that AM recorded highest value (mg/100 g) in Calcium (126.40), Iron (2.29), Phosphorous (22.91), Magnesium (25.01) and Copper (1.03) while LM had the least values of 36.20, 0.72, 8.98, 5.28 and 0.29 respectively. These values across breeds for all the minerals analyzed were significantly different ($p<0.05$) from one another with the following trend AM>AA>AF>LM. There was no detection of lead and mercury in any of the samples. The result of the study showed that the African giant land snail, *Archachatina marginata*, apart from having size advantage is the favoured breed based on its nutritional superiority.

Key words: Proximate composition, mineral profile, snail flesh, land snail

INTRODUCTION

The land snails are non conventional wildlife dietary protein source in Nigeria and some parts of Africa. Its meat known as "Congo meat" is a delicacy highly relished by Nigerians. Ajayi *et al*. (1978) indicated that snail meat is particularly rich in protein and iron. Bender (1992) reported that the amino acids in the protein of snail would complement the cereal sources of protein by making good their relative deficiency of lysine. The low fat content and low cholesterol level make snail meat a good antidote for vascular diseases such as heart attack, cardiac arrest, hypertension and stroke. The amount of minerals in other meat samples like beef, broiler, goat meat, mutton and pork have been found to be lower than is present in snail meat (Imevbore and Ademosun, 1988).

There are different breeds of edible land snails found in Nigeria. The two giant land snails common to Nigeria are *Archachatina marginata* and *Achatina achatina*. *A. marginata* has no definite shell coloration and it is wider at the posterior end compared to others. The foot is usually dark brown in color. It is the most common breed found in south western Nigeria. *A. achatina* has a brown shell with conspicuous zigzag streaks and a narrow apex. The foot is grey in color. Other breeds are *Achatina fulica* and *Limicolaria* species. *A. fulica* is of small size and the fleshy part could be whitish or dark brown. It has low economic value compared to the two giant land snails. The *Limicolaria* species is the smallest breed of common edible land snails. It is also known as garden snails.

This study was designed to assess the nutritional value of four breeds of land snail commonly found in Nigeria.

MATERIALS AND METHODS

*A. Marginata (AM), A. Achatina (*AA) and *A. Fulica* (AF) were purchased from three different markets within Ibadan metropolis in Oyo state, Nigeria. The *Limicolaria* species (LM) was collected after rainfall from three different residential gardens located in Ibadan.

The snails were killed by striking iron rod on the shell carefully. The foot was then separated, dried in the oven at 60°C to constant weight and then analyzed for its contents of moisture, crude protein, ether extract, ash, nitrogen free extract, calcium, iron, magnesium, copper, phosphorus, lead and mercury.

Chemical analysis: Moisture, crude protein, ether extract, and ash contents of the flesh were determined by the method of the Association of Official Analytical Chemists (AOAC, 2005). Value for the nitrogen free extract was obtained by subtracting the sum of the values of moisture, crude protein, ether extract and ash from 100%.

Phosphorus was determined with vanadomolybdate and the concentration assessed with a UV spectrophotometer at a wavelength of 470 nm. Calcium was determined by flame photometry. Other minerals

were determined by means of Atomic Absorption Spectrophotometry (AAS) at a wavelength of 324.7 nm for copper, 285.2 nm for magnesium, 248.3 nm for iron, 283.3 nm for lead and 198.5 nm for mercury.

Statistical analysis: All data obtained were subjected to analysis of variance using SAS (1999), while significant treatment means were separated using Duncan option of the same package.

RESULTS

Proximate analysis of the snail flesh revealed that moisture was highest in LM (84.91%) and least in AM (73.67%) which was not significantly different from that of AA which was 75.28% (Table 1). The crude protein contents of the breeds were significantly different from one another ($p<0.05$). The values ranged from 19.53% for AM to 5.86% for LM. The ash and ether extract of AM and AA were significantly higher ($p<0.05$) than that of AF, while LM had the least. AF had the highest Nitrogen Free Extract (NFE) while the least was observed in AM. The NFE and ether extract (fat) contents were generally low. The result of the mineral profile (Table 2) showed that AM recorded highest value (mg/100 g) in calcium (126.40), iron (2.29), phosphorus (22.91), magnesium (25.01) and copper (1.03) while LM had the least values of 36.20, 0.72, 8.98, 5.28 and 0.29 respectively. These values across breeds for all the minerals analyzed were significantly different ($p<0.05$) from one another with the following trend AM > AA > FL> LM. There was no detection of lead and mercury in any of the samples.

Table 1: Proximate composition (g/100 g of fresh meat) of snail meat from different breeds of snail

Nutrient (%)	LM	AF	AA	AM	SEM
Moisture	84.91^{a}	79.28^{b}	75.28^{c}	73.67^{c}	1.62
Crude Protein	5.86^{d}	10.08^{c}	17.20^{b}	19.53^{a}	1.34
Ash	1.27^{c}	1.78^{b}	2.33^{a}	2.56^{a}	0.12
Ether Extract	1.05^{c}	1.61^{b}	2.21^{a}	2.44^{a}	0.13
Nitrogen Free Extract	6.91^{a}	7.25^{a}	2.98^{b}	1.80^{c}	0.25

^{a,b,c,d}Means along the same row with different superscripts are significantly different ($p<0.05$). LM-*Limicolaria* species; AF-*Achatina Fulica;* AA-*Achatina Achatina;* AM-*Archachatina Marginata*; SEM-Standard Error of Means

Table 2: Mineral profile (mg/100 g of fresh meat) of snail meat from different breeds of snail

Mineral	LM	AF	AA	AM	SEM
Calcium	36.20^{d}	66.30^{c}	106.30^{b}	126.40^{a}	8.49
Iron	0.72^{d}	1.30^{c}	1.88^{b}	2.29^{a}	0.15
Phosphorus	8.98^{d}	14.79^{c}	19.01^{b}	22.91^{a}	1.27
Magnesium	5.28^{d}	15.13^{c}	19.28^{b}	25.01^{a}	1.77
Copper	0.29^{d}	0.58^{c}	0.77^{b}	1.03^{a}	0.07

^{a,b,c,d}Means along the same row with different superscripts are significantly different ($p<0.05$). LM-*Limicolaria* species; AF-*Achatina Fulica*; AA-*Achatina Achatina;* AM-*Archachatina Marginata*; SEM-Standard Error of Means

DISCUSSION

The crude protein contents (g/100 g of fresh meat) of the two giant land snails *A. marginata* (AM) and *A. achatina* (AA) were 19.53 and 17.20 respectively. These values were found to be comparable with values obtained for conventional livestock (FAO, 2001). The foot of AM contained between 17-18% crude protein (Awesu, 1980; Odukoya, 1998 and Omole, 2003). Fagbuaro *et al.* (2006) obtained a value of 20.56 for AM. The crude protein value compared well with other livestock meat like mutton, duck and chicken which have crude protein contents of 16.9, 18.6 and 20.5% respectively (FAO, 1969). The crude protein contents of *A. fulica* (AF) and *Limicolaria* (LM) which were 10.08 and 5.86 respectively were below the values recorded for most livestock in literature (FAO, 1969; FAO, 2001).

The fat contents of 2.44% and 2.21% obtained for AM and AA respectively were higher than 1.36% obtained by Awesu (1980); 1.3-1.5% by Asibey and Eyeson (1975); 0.005-0.8% by Cobbinah (1993) and 0.82-0.95% by Hamzat (2004). However the fat content obtained in this study was low when compared with 9.6, 21.4 and 23.0% found in egg, mutton and duck products respectively (FAO, 1969). The low fat content makes snail meat a good antidote for the hypertensive patient and those that have fat related diseases i.e. arteriosclerosis (Bright, 1999).

Snail meat is rich in calcium. A value of 126.40 mg/ 100 g gotten for AM is a pointer to this. Adeyeye (1996) also obtained a value of 212.38 mg/100 g. A comparison with other animal products like beef whose calcium content is 7, liver, 6; eggs, 54 and milk, 120, further lend credence to the richness of snail meat most especially AM with regards to calcium. Calcium is involved in calcification of bones and teeth. Its shortage therefore can affect the structure of bones which become weakened. Calcium ions are needed for blood clotting and successful functioning of nerves and muscles (Fox and Cameron, 1980). The high content of calcium in the breeds of snail investigated suggests that consumption of snail can increase the calcium in the body and contribute tremendously to the blood clotting process.

Phosphorous like calcium is also involved in calcification of bones and teeth. It plays a vital part in the oxidation of nutrients in the form of phosphate groups in ATP (Fox and Cameron, 1980). Its values of 22.91 in AM and 19.01 in AA are low when compared to the values obtained for beef (156); liver (313); eggs (218) and milk (95) (mg/100 g) (Fox and Cameron, 1980). Snails are therefore not a good source of phosphorus.

Magnesium like calcium and phosphorus is also involved in the formation of the bone structure of the body. The values too like phosphorus were generally low in the breeds of snail assessed.

The iron content (mg/100 g) of 2.29 in AM and 1.88 in AA compare favourably well with corresponding values in conventional animal products like kidney (6), liver (11.4),

sardines (2.9), beef (1.9), eggs (2.1) and milk (0.1) (Fox and Cameron, 1980). Imevbore and Ademosun (1988) obtained values ranging from 2.7-3.05 mg/100 g and compared it with the iron of egg (1.6), mutton (2.0) and duck (1.08) (mg/100 g). Iron facilitates the oxidation of carbohydrates, proteins and fats. Half of the iron in meat is present as heme in hemoglobin. The iron in meat does not only enhance the absorption of iron from other sources such as cereal but increases considerably the level of iron absorption in the blood and prevent anemia which is so widespread in the developing countries such as Nigeria (Bender, 1992). Iron is one of the mineral elements which may be lacking in an average diet and so there is need to be conscious of taking diets rich in iron most especially the vulnerable group of people that is women who are in child-bearing age, pregnant and nursing women.

The Cu content of AM was (1.03 mg/100 g). The requirement per day is 1-3 mg per day (Fox and Cameron, 1980). Therefore, consumption of 100 g of snail per day is able to supply the daily requirement for copper. Copper is an essential trace element that forms part of several enzyme systems including cytochrome oxidase and tyrosinase. Copper is associated with iron and catalyses oxidation-reduction mechanisms concerned with tissue respiration. Tyrosinase is concerned with the oxidation of tyrosine (Fox and Cameron, 1980).

The result of the study therefore showed that of the four breeds of snail analyzed for nutrient composition, *A. marginata* had the best nutrient value and its consumption is therefore recommended for both old and young as this will combine effectively with other food components in providing the required essential element to the body. It is also recommended for use in nutritional studies of the waste to wealth program whereby plant/crop wastes of no dietary importance to man are turned into nutritionally desirable meat products like snail meat.

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