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Nutritional status of four species of giant land snails in Nigeria

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Abstract: Four species of African giant land snails (*Archachatina marginata* (ovum) Pfeiffer, *Archachatina marginata* (saturalis) Philippi, *Achatina achatina* and *Limicolaria* spp.) were assessed for their proximate and mineral compositions aimed at establishing their nutritive values on wet weight basis. Analysis of muscle revealed that composition of crude protein varied from 18.66%±0.57% in *Limicolaria* spp. and 20.56%±0.05% in *Archachatina marginata* (ovum) Pfeiffer; moisture content was 76.56%±0.04% in *Archachatina marginata* (ovum) Pfeiffer and 78.68%±0.68% in *Limicolaria* spp. and ash was 1.34%±0.02% in *Achatina achatina* and 1.44%±0.01% in *Archachatina marginata* (ovum) Pfeiffer. These values were statistically different from each other ($P<0.05$). Carbohydrate and fat content were generally low. Crude fibre was not detected in any of the species.

The concentrations of zinc, iron, manganese, magnesium, calcium, phosphorus, sulphur, potassium and sodium in the flesh of the snails were determined. Values of iron, magnesium, calcium, phosphorus, potassium and sodium were consistently high while cobalt, copper and lead were not detected. Snails complement the required trace and minor elements needed for proper growth and development in human being, so it is recommended for regular consumption.

Key words: Snail, Nutrition, Proximate, Minerals
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INTRODUCTION

The major sources of meat protein for the Nigerian populace come mainly from livestock in the form of poultry, beef, mutton and pork. These major sources are being decreased by persistent drought, diseases, high cost of feed, primitive animal husbandry techniques and low productivity of local animal breeds. The increasing growth of human populations (Oyenuga, 1968) together with the rising standard of living has also placed great pressure on the existing sources of animal protein.

According to Yoloye (1984) snails are the largest groups of molluscs constituting the largest animal group after arthropods. Land snails' habitat ranges from the dense tropical high forest in southern Nigeria to the fringing riparian forests of the derived Guinea Savanna (Ajayi *et al*., 1980; Odaibo, 1997). From November to March each year, Nigerian snails aestivate because of the hot dry weather.

During this aestivation period, the aperture is temporarily closed by a calcified material known as epiphragm which is a whitish, fragile material (Nisbet, 1974). During aestivation, the snails bury themselves in the soil or hide beneath stones in order to avoid direct solar radiation (Schmidt-Nielsen *et al*., 1971). When rainfall the epiphragm breaks and very cold water stored before aestivation pours out of the aperture (Ajayi *et al*., 1980), and the snails emerge to eat the new plant growth and the soft soil (Ajayi *et al*., 1980; Odaibo, 1997).

The land snails are non-conventional wildlife protein source in Nigeria and some parts of Africa. Snail meat is now becoming a highly relished delicacy (also known as "Congo meat") in Nigeria. Snails constitute an important source of animal protein for many coastal communities in Nigeria. This study is aimed at determining the nutritional value of 4 commonest species of giant land snails (*Archachatina marginata* Swaison pf, *Achatina* sp. and *Limicolaria*

sp.) in Nigeria. Many Nigerians have concentrated on the conventional sources of wildlife as their main sources of animal protein.

MATERIALS AND METHODS

Species of *Archachatina*, *Achatina* and *Limicolaria* from the wild were purchased from King's market Ado Ekiti, Ekiti State, South Western Nigeria.

The shells were carefully removed so that the edible parts could be removed and dried. The powders were subjected to different processing methods of consumption. Moisture, ash and crude fibre contents of the flesh were determined by the method of the Association of Official Analytical Chemists (AOAC, 1990). Nitrogen was determined by the Micro-Kjeldahl method as described by Pearson (1976) and the percentage nitrogen was converted to crude protein by multiplying by 6.25. Lipid content was determined by the method of Bligh and Dyer (1959). Carbohydrate was determined by the difference between 100% (accepted total value of nutritional status) and the sum of the values of protein, moisture, fibre, fat and ash.

The minerals were analyzed from solutions obtained by first dry-ashing the samples at 550 °C and dissolving the ash in standard flasks with distilled, de-ionized water containing a few drops of concentrated hydrochloric acid. Phosphorus was determined colorimetrically using spectronic-20 (Gallenkamp, UK) as described by Pearson (1976) with KH_2PO_4 as a standard. Sodium and potassium were determined using a flame photometer (Model 405, Corning, UK), using NaCl and KCl to prepare the standards. All other metals in this report were determined by means of an atomic absorption spectrophotometer (Models SP 9, Pye Unican, UK). The results obtained were analyzed using one-way analysis of variance (ANOVA). Least significant difference (LSD) (Steel and Torrie, 1960) was also used to separate significant differences among means.

RESULTS AND DISCUSSION

Data on the proximate composition of the flesh of four species of giant land snails is shown in Table 1. Values of protein, moisture, and ash and crude fat vary according to sample species. The highest composition of 20.56%±0.05% of crude protein was recorded in *Archachatina marginata* (ovum) Pfeiffer while the least percentage value of 18.66%±0.57% was recorded in *Limicolaria* spp. The highest percentage crude protein was significantly different from the least percentage ($P<0.05$). The protein values recorded in all the investigated species were similar to the value reported by Adeyeye (1996). The moisture content of the four species ranged between 76.56%± 0.04% in *Archachatina marginata* (ovum) Pfeiffer and 78.68%±0.68% in *Limicolaria* spp. The two values were significantly different from each other ($P<0.05$). The moisture content in the snail was lower than the value reported for Cod (*Gadus morhua* L.) (81.22%) but higher than the value reported for Whelk (Buccinidae) (66.60%) which are consumed in Northern Europe, North America and Asia as reported by Exler (1987). The reported protein value of Cod was 17.81% (Exler, 1987). This value was lower than those reported for all the four species of snails, with the protein value of Whelk (23.84%) being higher than the value for all of the snails. The percentage

Table 1 Proximate composition of the flesh of four species of giant land snails on percentage weight basis*

Composition	Species of snail			
	Archachatina marginata (ovum) Pfeiffer	*Archachatina marginata* (saturalis) Philippi	*Achatina achatina*	*Limicolaria* spp.
Crude protein (%)	20.56±0.05[a]	20.34±0.15[a]	19.27±0.29[a]	18.66±0.57[b]
Moisture content (%)	76.56±0.04[b]	76.67±0.02[b]	77.54±0.02[a]	78.68±0.68[a]
Fat (%)	1.38±0.03[a]	1.23±0.01[a]	1.43±0.01[a]	1.17±0.14[a]
Carbohydrate (%)	0.007±0.05[a]	0.37±0.13[a]	0.42±0.30[a]	0.15±0.02[a]
Fibre (%)	ND	ND	ND	ND
Ash (%)	1.44±0.01[a]	1.40±0.01[b]	1.34±0.02[c]	1.35±0.01[c]

Mean values in the same row having the same superscript are not significantly different ($P<0.05$); *Average of duplicate analysis; ND: Not detected

values for ash and fat were low correspondingly. But the proximate values were similar for all the parameters in all the samples. Crude fibre was not detected in any of the samples.

The snail samples are good sources of protein (18.66%±0.57%)~(20.56%±0.05%) on a wet weight basis compared with 8.00%~12.00% in cereals (Bender, 1992). In Nigeria, about 25 g of meat will supply 45% of a child's daily need for protein. In other African countries for example, the addition of 100 g of meat to the average Zambia diet would increase the protein by 50% while about 300 g of meat will be added to the Niger republican diet to increase the protein by 50%. 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.

Nowadays in Nigeria, molluscs serve as a significant and essential part of the daily diet of Calabars, Itsekiris, Yorubas and many other coastal tribes. Molluscs constitute the major and cheapest sources of protein in Nigeria (Yoloye, 1984; Ademolu *et al.*, 2004).

Table 2 shows mineral composition of four species of giant land snails, zinc, iron, magnesium, calcium, phosphorus, potassium and sodium were highly concentrated in all the four species investigated. Although, zinc, manganese and sulphur were relatively very low in values, they were almost evenly distributed in the samples. Cobalt, copper and lead were not detected in any of the samples. Non-detection of lead confirms that none of the snail species had been exposed to any sort of pollution.

According to Bender (1992), half of the iron in meat is present as haeme iron (in haemoglobin). This is well absorbed with about 15%~35%, a figure that can be contrasted with other forms of iron, such as that from plant foods, at 1%~10%. The iron from 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 prevents anaemia, which is so widespread in the developing countries such as Nigeria.

Iron also facilitates the oxidation of carbohydrates, proteins and fats. Zinc is present in virtually all tissues of the body and is a component with more than 50 enzymes (Bender, 1992). Red meat is the richest source of zinc in the diet and supplies one third to half of the total zinc intake of meat-eaters. Zinc dietary deficiency has been found in adolescent boys in the Middle East and recently in Niger republic for eating a poor diet (personal communication). Families and individuals who may be using vegetable and cereal sources of protein because of low incomes or as an attempt to cope with hard times may not be able to meet the zinc requirements which is about 15~20 mg per day.

Manganese has an important role in bone structure, reproduction and normal functioning of the nervous system and is also a part of the enzyme system. Meat and poultry production contribute a little to this micro-mineral (Fleck, 1976).

Calcium plays an important role in blood clotting in human body. The high concentration of calcium found in all the species of snails investigated, shows that consumption of snail will increase the

Table 2 Mineral composition of the flesh of four species of giant land snails wet weight (mg/100 g)

Mineral composition	Species of snail			
	Archachatina marginata (ovum) Pfeiffer	*Archachatina marginata* (saturalis) Philippi	*Achatina achatina*	*Limicolaria* spp.
Zinc	1.54	1.69	1.76	1.51
Iron	8.69	9.41	9.43	9.46
Manganese	0.39	0.38	0.39	0.38
Magnesium	45.59	45.34	46.15	45.99
Calcium	201.08	207.53	204.63	208.75
Phosphorus	123.43	123.23	131.38	153.89
Sulphur	1.93	1.88	2.95	3.79
Potassium	192.78	209.95	193.74	197.57
Sodium	50.80	52.93	60.94	65.10
Cobalt	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Lead	ND	ND	ND	ND

ND: Not detected

calcium level in the body and contribute tremendously to the blood clotting.

All the four species of snails are good sources of magnesium, sodium and potassium. All these traceable elements play important roles in the healthy body. This finding shows that consumption of snails will definitely increase the level of these major elements in the body.

The current report provides information on mineral elements which compared favourably with the reported values of some lean domestic livestock meats as reported by Bender (1992). Favourable nutrition elements are reported for protein, fat, phosphorus, sodium, potassium and magnesium. The higher content of calcium in this report when compared to other values may be due to the consumption of soil by land snails.

Consumption of giant land snail is therefore recommended for both old and young, as this will combine effectively with other food components in providing the required essential elements to the body.

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