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Full Length Research Paper

Evaluating the Cultural Preferences for Black Snail (*Archachatina marginata*) and White Snail (*Achatina achatina*): A Scientific Inquiry

***F. E. Uboh, P. E. Ebong and E. Mbi**

Biochemistry Department, Faculty of Basic Medical Sciences, College of Medical Sciences, University of Calabar, P.M.B. 1115, Calabar, Nigeria.

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There is a strong cultural discrimination in the consumption of white snail (*Achatina achatina*) against black snail (*Archachatina marginata*) in several tribes in Nigeria and other tropical regions in West African Countries.The proximate(crude fibre,ash,fat,protein and carbohydrates),minerals(calcium, potassium,magnesium,sodium,iron,zinc and phosphorus) and toxicants(hydrocyanic acid,phytate, total and soluble oxalate) compositions of *A. achatina* and *A. marginata* were analysed in this study to validate or reject the cultural discrimination in the consumption of these species of giant land snails. Results revealed no statistical significant differences (P 0.05) in the proximate, mineral and toxicant compositions of *A. marginata* compared to *A. achatina.*Results indicated that both species have relatively high contents of protein, carbohydrate, calcium, potassium magnesium and sodium; and relatively low crude fibre,ash,fat,iron,zinc,phosphorus,hydrocyanic acid,phytate,total and soluble oxalate concentrations.Considering the similar proximate, minerals and toxicants compositions of *A. achatina* and *A. marginata,*there is no scientific basis or justification for any cultural discrimination in the consumption of either of the species of snails.In particular,both species are recommended as a good and alternative source of protein for consumption.

Key word: *Achatina achatina, Archachatina marginata*, proximate composition, minerals, toxicants

INTRODUCTION

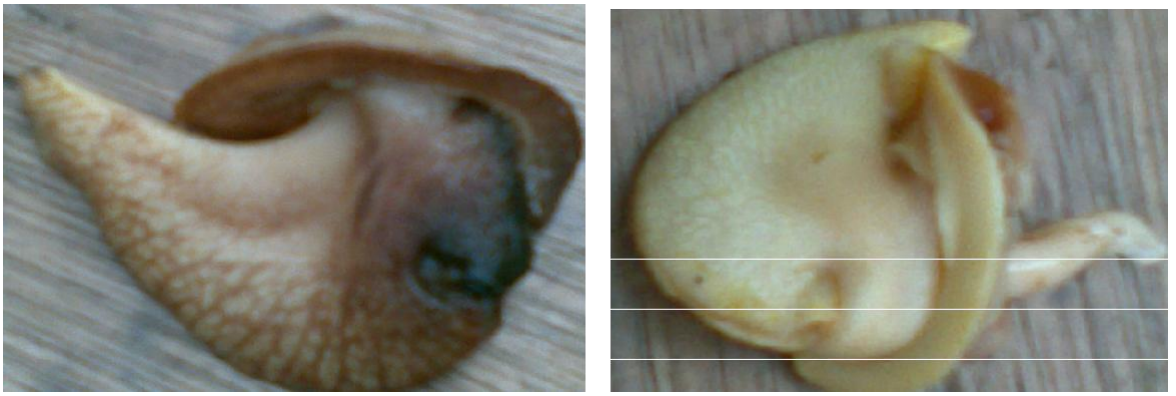
Among the various species of African giant land snails, black snail (*Archachatina marginata*) and white snail (*Achatina achatina*) (Linnaeus,1758) are commonly found in the Southern part of Nigeria where the tropical weather and vegetation conditions are most favourable for their proliferationThese species are also found in the infringing forest of the derived Guinea Savannah in West Africa (Odaibo,1997).According to Yoloye (1984) snails are the largest groups of molluscs constituting the largest animal group after arthropods.The major distinctive feature between the two snail types is the colour of the body (i.e., the edible part).While black snail (*A. marginata*) has a brownish body colour,the white snail (*A. achatina*) is whitish in body colour (Figures 1 and 2). Nigerian snails usually aestivate from November to March,because of the hot dry weather.During aest-ivation, the shell aperture is temporarily closed by a cal-cified, whitish and fragile material known as epiphragm. During this period, the snails bury themselves in the soil or hide beneath stones in order to avoid direct solar rad-iation.After rainfall, the epiphragm breaks and the cold water stored before aestivation pours out of the aperture, and the snails emerge to eat the new plant grown in the soft soil (Odaibo,1997).The indiscriminate hunting and deforestation destroys the habitat and reduces the abundance of giant land snails. Rearing of the giant land snails as a domestic animal would therefore help in some measure, to ensure the survival of the species and satisfy the demand for the meat.

The major sources of meat protein for the Nigerian population come mainly from livestock in the form of pou-

*Corresponding author e-mail: fridayuboh@yahoo.com

(a) (b)

Figure 1. Dorsal view of crawling (a) black snail (*A. marginata*) and (b) white snail (*A. achatina*)



(a) (b)

Figure 2. Edible part (i.e., the body) of (a) black snail (*A. marginata*) and (b) white snail (*A. achatina*)

ltry, beef, mutton and pork.These sources have been decreasing 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.Snail meat is reported to be a high quality food that is rich in protein, low in fats and a source of iron (Ademolu *et al.*, 2004).

The land snails,particularly the *A. marginata,* are alternative and non-conventional animal protein source in Nigeria and some other parts of Africa.The snail meat is now becoming a highly relished delicacy (also known as "Congo meat") in some part of Nigeria.Snails are therefore supposed to constitute an additional source of animal protein for some populations in the world.Un-fortunately, in some communities in southern Nigeria and perhaps in other regions, there is a strong cultural dis-crimination in the consumption of *A. achatina*, while *A. marginata* is generally accepted for consumption, without any scientific justification that could explain this tradition

In this context,this study aimed to assess the proximate, mineral and toxicant compositions of the black and white snails,in order to scientifically validate,or otherwise reject this cultural discrimination in the consumption of these two species of terrestrial gastropods.

MATERIALS AND METHODS

Collection and Preparation of Samples

A total of 100 snails of each species were sampled in this study. *A. achatina* were randomly picked within the University campus, while *A. marginata* were purchased from a local market in Odukpani, Cross River State, Nigeria. The shells were carefully removed so that the edible parts (i.e., the body) (Figure 2) could be extracted and analysed for the proximate, mineral and toxicant compositions.

Proximate Composition Analysis

Ash and crude fibre compositions of the edible portion of the flesh were determined by the method of the Association of Official

Table 1. Proximate composition of black snail (*Archachatina marginata*) and white snail (*Achatina achatina*)

Proximate Composition(g%)	*A. marginata*	*A. achatina*
Crude Fibre	3.01 ± 0.01	2.88 ± 0.03*
Ash	2.08 ± 0.01	1.97 ± 0.01*
Fat	2.40 ± 0.02	2.85 ± 0.04*
Protein	63.46 ± 2.56	63.45 ± 3.06*
Carbohydrate	22.53 ± 1.08	24.38 ± 1.29*

Values are presented as mean ± SD of five determinations, *insignificantly different from *A. marginata* (P 0.05).

Table 2. Mineral composition of black snail (*Archachatina marginata*) and white snail (*Achatina achatina*)

Mineral (mg/100g)	*A. marginata*	*A. achatina*
Na^{+}	30.89 ± 3.25	31.34 ± 2 95*
K^{+}	98.47 ± 2.87	99.43 ± 1.22*
Ca^{++}	199.26 ± 15.32	201.36 ± 12.45*
Fe^{++}	0.64 ± 0.01	0.64 ± 0.03*
Mg^{++}	31.00 ± 3.02	31.01 ± 3.04*
Zn^{++}	2.01 ± 1.01	2.01 ± 1.03*
P^{++}	3.40 ± 1.11	3.41 ± 1.01*

Values are presented as mean ± SD of five determinations, * nsignificantly different from *A. marginata* (P 0.05).

Table 3. Toxicant composition of black snail (*Archachatina marginata*) and white snail (*Achatina achatina*)

Toxicant (mg/100g)	*A. marginata*	*A. achatina*
Hydrocyanic acid	4.45 ± 0.14	4.58 ± 0.15*
Phytate	0.03 ± 0.01	0.04 ± 0.02*
Total Oxalate	2.93 ± 0.17	3.00 ± 0.05*
Soluble Oxalate	2.50 ± 0.05	2.55 ± 0.01*

Values are presented as mean ± SD of five determinations, * insignificantly different from *A. marginata* (P 0.05).

Analytical Chemists (AOAC, 1990). Nitrogen was determined by the Micro-Kjeldahl method as described by Pearson (1976) and the percentage nitrogen was converted into crude protein by multiplying by 6.25. Lipid content was determined by the method of Bligh and Dyer (1959). Carbohydrate was estimated by the difference between the sum of the values of the previous nutritional components (protein, moisture, fibre, fat and ash) and 100% (accepted overall value of nutritional components).

Minerals Analysis

The mineral compositions of the edible portion of the flesh were analyzed from solutions obtained by first dry-ashing the fleshy 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 from the prepared sample using spectronic-20 (Gallenkamp, UK) as described by Pearson (1976) with KH_2PO_4 as a standard. Sodium and potassium were analysed by means of flame photometer (Model 405, Corning, UK), using NaCl and KCl to prepare the standards. Calcium, magnesium, iron and zinc were analysed by means of atomic absorption spectrophotometry (Models SP 9, Pye Unicam, UK).

Toxicants

The toxicants (hydrocyanic acid, phytate, total and soluble oxalate) composition of the samples of the edible portion were determined by the method described by AOAC(1975)

Statistical Analysis

The comparison of the proximate, mineral and toxicant compositions between *A. achatina* and *A. marginata* was performed. The results obtained were analyzed using Student's t-test with statistical significance considered for P 0.05.

RESULTS

Data on the proximate, mineral and toxicant compositions of the two species of the land snails are compiled in Tables 1, 2 and 3 respectively. Results showed that both species of snails have relatively high contents of protein, carbohydrate, calcium, potassium magnesium and sodium, while crude fibre, ash, fat, iron, zinc and phosphorus contents were relatively low. In addition, the toxicants composition (hydrocyanic acid, phytate, total and soluble oxalate) of the two species were considerably low. The analyses of the proximate, mineral and toxicant compositions did not detect any statistically significant difference (t-test, P 0.05) between A. marginata and A. achatina.

DISCUSSION

Snail meat is reported to be a high quality food that is rich in protein, low fats and a source of many vital minerals required for normal tissue development and maintenance (Orisawuyi, 1989; Ademolu *et al.*, 2004; Fagbuaro *et al.*, 2006; Funmilayo, 2008) . The present study revealed that the protein content of the two species, which did not vary between *A. marginata* and *A. achatina* is comparable with the values obtained for donkey meat (Ademolu *et al.*, 2004), and higher than the values obtained for beef meat (Aganga *et al.*, 2003). With the similar protein composition of both species, the result of this study disagrees with the results of the study by Fagbuaro *et al.*(2006), who reported that the protein compositions of snails differed among the four species of African giant land snails; (*A. marginata* (ovum) Pfeiffer, *A. marginata* (saturalis) Philippi, *A. achatina* and *Limicolaria* spp.). According to their report, analyses of the muscle of four species of African giant land snails (*A. marginata* (ovum) Pfeiffer, *A. marginata* (saturalis) Philippi, *A. achatina* and *Limicolaria* spp.) for their proximate and mineral compositions,on wet weight basis, revealed that

composition of crude protein varied from 18.66%±0.57% in *Limicolaria* spp. and 20.56%±0.05% in *A. marginata* (ovum) Pfeiffer; moisture content of 76.56%±0.04% in *A. marginata* (ovum) Pfeiffer and 78.68%±0.68% in *Limicolaria* spp. and ash content of 1.34%±0.02% in *A. achatina* and 1.44%±0.01% in *A. marginata* (ovum) Pfeiffer (Fagbuaro *et al.*, 2006). Also the concentration of iron, magnesium, calcium, phosphorus, potassium and sodium concentrations were reported to be consistently high while cobalt, copper and lead were not detected. These indicate that snails may be used to complement the required trace and minor elements needed for proper growth and development in human being.

The present study confirmed that the two species of snails are good sources of protein, supporting the earlier reports by Ademolu *et al.*(2004) and Fagbuaro *et al.*(2006). Imevbore and Ademosun (1988) reported that snail meat has a protein content of 88.37%. This value, although higher than that obtained in our study, compares favourably with most conventional animal protein sources, whose value ranges from 82.42% (pork) to 92.75% (beef). Hence, due to high cost of poultry and beef meat, snails that can be obtained at minimal cost may be used as a substitute source of protein. In addition, the result of this study also revealed that both snails are rich in their mineral contents. This observation supports the previous report that the mineral composition (zinc, iron, magnesium, calcium, phosphorus, potassium and sodium) was highly concentrated in the four species of giant land snails (Fagbuaro *et al.*, 2006). The current study provides information on mineral elements that compared favourably with the mineral contents of some lean domestic livestock meats (Aganga *et al.*, 2003). Minerals play a crucial role in the maintenance of various biochemical activities. For instance, calcium, present in high concentrations in the two species of snails, is known to play an important role in blood clotting and bone development in humans. Pearson and Gillet (1999) reported that calcium is the most abundant mineral element in the animal body and considered it as an important constituent of the skeleton and teeth, in which around 99% of the total calcium in the body is found. Calcium is also essential for the activity of a number of enzyme systems, including those necessary for the transmission of nerve impulses.

The two species of snails also constitute good sources of magnesium, sodium and potassium, indicating that consumption of these snails could increase the levels of these elements in the human body. Magnesium is a key element in cellular biochemistry and function. Magnesium is closely associated with calcium and phosphorus and about 70% of the total Mg is found in the skeleton.Magnesium is an enzyme activator, for example in systems with thiamine pyrophosphate as a co-factor and oxidative phosphorylation is reduced in Mg deficiency. It is an essential activator of phosphate transferase, activates pyruvate carboxylase, pyruvate oxidase and the reactions of the tricarboxylic acid cycle. Potassium is also known to play an important role in osmotic regulation of the body fluids and in acid base-balance in the animal. It also participates in nerve and muscle excitability as well as in carbohydrate metabolism (Aganga *et al.,*2003). In addition, the phytate and oxalate levels obtained for both species of snails were relatively low, compared to the concentrations of phytate (34.4mg /100g) and oxalate (187.5mg / 100g) obtained in the processed *Pentaclethra macrophylla (ugba)* seeds, which are commonly consumed in south-eastern Nigeria (Onwuliri *et al.*,2004).The level of hydrocyanic acid was also significantly low, compared to the value of 56.56mg / 100g reported for *Garsinia kola* (Monago and Akhidue, 2002). According to Monago and Akhidue (2002), and Osabor *et al.* (2008), the lethal doses of hydrocyanic acid and oxalate for human beings have been reported to be 36mg / 100g and 2-5g / 100g of sample, respectively. Therefore, the toxicants composition in *A. achatina* and *A. marginata* make the consumption of either species of the snails perfectly safe and without threat of exposure to high levels of toxicants.

In conclusion, the results of this present showed that the two species of snails are equally good sources of protein and basic minerals, and that none of the species is more toxic than the other. Hence,there is no scientific justification for any cultural discrimination in the consumption of *A. achatina* and *A. marginata.* Indeed, the consumption of any of the two species of giant land snails is highly recommended for both ayoung and old, constituting an alternative source of essential nutritional elements at a lower cost.

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