

Proximate analysis and mineral profile of aquatic and upland snail

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ABSTRACT

Sixty (60) each of wild *Archachatina marginata* and aquatic snails sourced from three major markets in Okitipupa Local Government Area of Ondo State, Nigeria, and sixty (60) captive *Archachatina marginata* bought from the Institute of Agricultural Research and Training (IAR&T) in Ibadan, Nigeria, were used for this study. The meats from the snails were processed and analyzed for proximate composition and mineral profile in the Analytical Laboratory of Ondo State University of Science and Technology, Okitipupa. Data obtained were subjected to statistical analysis. Snail treatments (sources) had significant effect ($p < 0.05$) on the proximate compositions and the mineral components, except on moisture content whose values were 9.56 %, 9.56 % and 9.47 % for wild, aquatic and captive snails, respectively. Highest values were recorded for wild snail in ash (4.82 %), crude protein (76.78 %) and fat (6.27%) while the highest value for fibre (0.66 %) was recorded in captive snail and the highest for carbohydrate (7.11 %) was obtained in the aquatic snail. The lowest values: ash (4.27 %) was found in captive snail, crude protein (72.16 %), fat (6.02 %) and fibre (0.51 %) were found in aquatic snail and carbohydrate (1.94 %) obtained in wild snail. Wild snail had the highest values for iron (5.62), calcium (426.67), copper (4.83), zinc (4.62), manganese (1.14), nickel (1.71) and phosphorous (411.75). Aquatic snail had the lowest values in iron (2.34), copper (2.54), zinc (2.99), manganese (0.20) and phosphorous (232.57) while captive snail had lowest values in calcium (299.20) and nickel (0.27).

Keywords: Proximate analysis, Mineral composition, *Archachatina marginata*.

INTRODUCTION

Several groups of mollusks are known to be available in nature, with snails constituting the largest group (Hodasi, 1979). They are found at various locations, inhabiting in log of decayed woods, rock underneath, tree trunks and leaf litters forest floors and water. They are also made up of several species and are commonly found in those areas where the tropical weather, temperate climates and vegetation conditions are most

favorable for their proliferation. Generally, these species of snails are reported to be found in the infringing forest of the derived Guinea Savannah in West Africa (Yoloye, 1994). Natively, this species does not cause any appreciable damage to native crops and is actually considered an economic asset among many native peoples who include it in their diet.

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Snail is also one of the micro livestock that has attracted attention among farmers in Nigeria (Adesope, 2000; Akinnusi, 2002) and products from snail belong to foodstuff with high nutritional value containing food energy, high quality proteins, vitamins and minerals (Tremlova, 2001). According to Aboua (1995), *Archachatina marginata* meat contains 1.41% calcium while the shell contains 0.53% calcium and is a good source of magnesium and potassium (Awesu, 1990; Adeyeye, 1996; Akinnusi, 2002 and Ejidike, 2002). The consumption of snail meat by rural communities is governed more by culture than by social status (Ebenso, 2003). Snail meat is high in protein (37-51%) compared to that of guinea pig (20.3%), poultry (18.3%), fish (18%), cattle 17.5%, sheep (16.4%), and swine (14.5%). Apart from the conventional sources of protein; which are mainly meat and fish, snails (molluscs) are excellent sources of protein and mineral elements for many families. According to Akinnusi (2002), snail meat is high in protein, iron, calcium and phosphorus, but low in sodium, fat and cholesterol, and contains almost all the amino acids. The edible portion has 88.37% proteins (Imevbore, *et al.*, 1988) and calcium, magnesium, zinc, iron, with very low fat content (Adeola, *et al.*, 2010). Its protein contains all the essential amino acids needed by man, such as lysine, leucine, isoleucine and phenylalanine, they are needed by the body for its metabolic activities, (Aboua, 1995). In addition, there are claims that snail meat has medicinal value and can be used to treat ailments including whooping cough, anaemia, asthma, and high blood pressure due to their relatively low cholesterol level but high mineral content (Akinnusi, 1998). Therefore, the objective of this study was to determine the nutritional value of snails sourced from the captive, wild and aquatic.

MATERIALS AND METHODS

The wild snails, *Archachatina marginata* (Upland snails and aquatic snails) used for this study were sourced from three major markets in Okitipupa Local Government of Ondo State (Twenty (20) per market per snail type) while sixty (60) captive snails (*Archachatina marginata*) were bought from Institute of Agricultural Research and Training (IAR&T) in Ibadan. The snails from the three sources were washed separately with clean water and heated in water at 60°C for 10 minutes to aid evisceration and dried in an oven to crisp dry. The dried snail meat was milled into fine powder and then analyzed for proximate contents and mineral contents at the analytical laboratory of the Department of Biological Sciences in Ondo State University of Science and Technology, Okitipupa.

Chemical analysis

Moisture, crude protein, ether extract and ash contents of the snail meat were determined by the method of the Association of Official Chemists (AOAC, 2005). Value for the nitrogen 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, 248.3nm for iron and 283.3nm for lead .

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

The results of the proximate analysis of the edible parts of snail, *Achachatina*

marginata, from the wide and the captive and the snail from the aquatic are shown in Table 1. No significant difference ($p>0.05$) was observed in the moisture content among the snail's treatments. Highest value of 4.82% observed in the wide was significantly different ($p<0.05$) from the value (4.27%) observed in the captive for ash. Similar trend was also observed in

crude protein and fat but least values were observed in the aquatic. However, there was no significant difference ($p>0.05$) between the wide and the captive for fibre. The carbohydrate content of the wide was significantly ($p<0.05$) lower (1.94 %) to 7.11 % observed in aquatic and 3.54% observed in captive.

Table 1. Proximate analysis of the aquatic, captive and wild snails

Proximate	Wild	Aquatic	captive	S.E.M
Moisture %	9.56	9.56	9.47	0.02
Ash %	4.82 ^a	4.64 ^b	4.27 ^c	0.10
Crude protein %	76.78 ^a	72.16 ^c	75.92 ^b	0.89
Fat %	6.27 ^a	0.03 ^b	6.14 ^b	0.05
Fibre %	0.63 ^a	0.51 ^b	0.66 ^a	0.03
Carbohydrate %	1.94 ^c	7.11 ^a	3.54 ^b	0.97

a,b,c: means with different superscript on the same row are significantly different ($p<0.05$)

Table 2: shows the mineral distribution among the different snail treatments. Significant difference ($p<0.05$) was observed in all the mineral compositions with higher values observed in the wild snail. In iron 5.62, 3.48 and 2.34 were observed in the wild, captive and aquatic respectively. In the same trend, 426.67,

299.20 and 2.54 were observed for Calcium while 4.83, 3.31 and 2.54 was observed for copper. In zinc (2.99), manganese (0.02) and Potassium (232.57) were observed in aquatic while in Nickel, lower value (0.22) was observed in captive. Lead and cadmium was below detection level in all the treatments.

Table 2. Mineral profile of aquatic, captive and wild snails

Parameters(mg/100g)	Wild	Captive	Aquatic	S.E.M
Fe	5.62 ^a	3.48 ^b	2.34 ^c	0.61
Ca	426.67 ^a	299.20 ^b	375.91 ^{a,b}	24.71
Cu	4.83 ^a	3.31 ^b	2.54 ^c	0.43
Zn	4.62 ^a	3.84 ^b	2.99 ^c	0.29
Mn	1.14 ^a	0.43 ^b	0.20 ^c	0.18
Ni	1.71 ^a	0.27 ^b	0.31 ^b	0.30
P	411.75 ^a	322.79 ^b	232.57 ^c	32.71
Pd	ND	ND	ND	
Cd	ND	ND	ND	

a,b,c: means with different superscript on the same row are significantly different ($p<0.05$)

ND: Not detected

DISCUSSION

The non- significant difference observed in the moisture content among the meats of the three snails indicates that, they have similar water holding capacity, this observation is similar to the report of Okon, *et al.*, (2016), though it is contrary to what was reported by Babalola and Akinsoyinu (2009) who reported significant difference in the moisture content of meat from different breeds of land snail in Nigeria. The mean values obtained in ash content of the three snails are within 4.00 – 7.00% reported by Eneji, *et al.*, (2008) and compared favorably with 4.5- 4.90 % reported by Eruvbetine (2012), but higher than 1.40% and 3.22% reported by Engmann, *et al.*, (2013) for giant African land snail.

The crude protein in the wild snail was significantly higher than that of aquatic and captive. This could be attributed to the differences in their diets. The value (76.78 %) observed in the wild is lower to 82.35 % reported by Okon, *et al.*, (2016) but higher than 63.43 % reported by Ademolu, *et al.*, (2004). The values of fat content observed for the three snails can be compared with 6.17% reported by Okon, *et al.*, (2016). Fibre content (0.66 %) in the captive was significantly higher than the aquatic and the wild. The values obtained for the three snail are lower than those reported by Ademolu, *et al.*, (2004) but within the range reported by Okon, *et al.*, (2016). The aquatic snail was significantly higher ($P<0.05$) in carbohydrate than wild and captive snails. These results disagreed with the range values of 6.57 – 15.50% and 24.81 – 30.95% reported by Eneji, *et al.*, (2008).

The value of iron obtained for the captive snails can be compared with 5.51 reported by Okon, *et al.*, (2016). However, the values for the three snails are higher than the reported range of 0.9 – 1.5 mg (Okon and Ibom, 2012). The presence of iron in snail meat at high concentration could be

attributed to its abundance in soil sample and feed consumed by the snails. Highest values obtained in Calcium (426.67), Copper (4.83), Zinc (4.62), Manganese (1.14) and Nickel (1.71) in wild snail shows that it had more minerals than the captive and the aquatic. The values reported for the minerals agree with the findings of Okon, *et al.*, 2016. Lead and Cadmium were not detected in the three snails. This is similar to the reports of Fagbuaro, *et al.*, (2006). The highest values of the nutrients and minerals found in the wild snail compare with the captive and aquatic snail show that the wild snail had more nutrients and minerals than the captive and aquatic. This could be attributed to the richness of food resources in their various environments.

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