

PROXIMATE AND METAL COMPOSITION OF ARCHATINA ARCHATINA, ARCHATINA MARGINATA AND ARCHATINA FULICA SPECIES IN ISOKO, DELTA STATE, NIGERIA

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ABSTRACT

The proximate and metal composition of *Archatina archatina*, *Archatina marginata* and *Archatina fulica* species in Owhelogbo, Isoko North Local Government Area of Delta State, Nigeria were investigated. Moisture content was determined by drying to constant weight before subjecting for ashing. Oil content by Soxhlet extraction, protein by kjeldahl method and crude fibre by the acid and alkaline digestive methods. The total carbohydrate content was estimated by difference obtained after subtracting protein, fat, moisture, crude fibre and ash percentage from one hundred. Minerals content was determined by Atomic Absorption Spectrometry. The result for the proximate analysis in duplicate reveals that the moisture content range from 74.23% to 75.36%, crude protein range from 21.17% to 22.42%, fat ranges from 1.27% to 1.56% and carbohydrate ranges from 0.43% to 0.66%. crude fibre was not detected in any the species. Zinc, iron, manganese, magnesium, calcium, phosphorus, sulphur, potassium and sodium were detected in the flesh of the snail. Lead, zinc, copper, nickel and chromium were below the WHO and the International / National Standard for heavy metal in food except for Cd which is above permissible limit. The importance of minerals in our diet cannot be over emphasized given their roles in metabolic reactions, rigid bone formation and osmoregulation among others. This study owes its significance to the fact that snails are highly tolerant to many pollutants and exhibit high accumulation to them especially heavy metal. Thus, it is not only safe to consume snails purchased from Owhelogbo community, it is also safe to consume farm product cultivated within her immediate environment.

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KEYWORDS: snails, species, nutrition, proximate, minerals, heavy metals, owhelogbo, isoko north

INTRODUCTION

Snails have been seen to be a major source of protein to the Nigerian populace and some part of Africa. The snail's meat popularly called "Congo meat", now becoming a highly relished delicacy, is visibly sold both as spiced meat and in its raw form in nearly every market point in the southern part of Nigeria and in strategic locations in traffic points linking major Nigerian cities in the Niger Delta region. Literature reveals that the snails' meat is particularly rich in protein and iron. Babalola and Akinsoyinu (2009) 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. It was further reported that the low fat content and cholesterol level make the snail meat a good antidote for vascular diseases such as heart attack, cardiac arrest, hypertension and stroke. Also, the mineral content in the snail meat is found to be higher than those of pork, mutton, beef and broiler. Report from general survey reveals that snails are abundant during the raining season; they are easily gathered especially at night and before dawn. It was reported by Ebenso

(2003) that snails are not only easily domesticated and controlled nor their consumption in the rural area's govern by cultural than social statues, but that snails consumed in the Niger Delta region of southern Nigeria are gathered from the wild and that this area is prone to environmental pollution. Irerhievwie *et. al.*, (2014) reported that the environmental situation is predicated on the poor economic disposition of the region, poor vehicular maintenance culture and the importation of old vehicle which culminate in an automobile fleet, thus leading to ill plan mechanic workshop situated in nearly every major junction in the region. The implication is the release of metals into the environment and thus, resulting to metal pollution.

Although, metals are released from both natural source and human activities, they are non biodegradable unlike most organic pollutant, they cannot be broken down into a less toxic or harmful components. While metal toxicity is a serious concern to human, (Shuhaimi - Othman *et. al.*, 2012; Akpogheli *et. al.*, 2015) in their study reported the

nutritional benefit of metals such as Zn, Fe and Cu. Zinc was reported to be an essential component of at least 150 enzymes. Akpogheli *et. al.*, (2015) reported that the metal stimulate the activities of vitamins, formation of red blood cell and white corpuscles. Cu is responsible for the absorption of iron, important for cellular defense and the protection of the mucus membrane (Akpogheli and Irehievwie 2015). Snails feed on variety of items found in their natural habitat especially decay plants, fruits, vegetables and algae. Okoh *et. al.*, (2015) reported that water bodies are contaminated with sewage, defecation and contaminant from the industries. Most farmers in Delta State use rivers and lakes for irrigation purposes and source of water for plant. Should these industrial contaminant contains metal pollutant, then those dead decaying plant and animal, fruit and vegetables submerged in water should be contaminated with metal pollution. Owhelogbo is virgin to both industrial and commercial activities but has few mechanic workshops, good road network linking neighboring communities. This automatically encourages the movement of agricultural product within communities. At journey intervals, farmers and commuters stop over to purchase farm produce, and snail is one of dietary product purchased for consumption purpose. In this regard, this study owes its significance to the fact that snails are highly tolerant to many pollutants and exhibit high accumulation to them especially heavy metal. Hence, the aims of this study is to determine and examine the nutritional and metal composition of three edible land snails species picked up in farmyard in the Owhelogbo community in Isoko North local government area in Delta State, Nigeria.

MATERIALS AND METHODS

Species of *Archatina archatina*, *Archatina marginata* and *Archatina fulica* were picked up in the farmyard and garden at dark and early in the morning minutes after rain fall in the Owhelogbo community in Isoko North and local government area in Delta State, Nigeria. The snails' species were thus transported to the laboratory where analysis was carried out in composite.

Sample Preparation

The snail species were washed with de-ionized water before the shells were carefully removed immediately after identification. The edible part was then separated, dried in an oven at 60°C to a constant weight and then grounded to powder before being analyzed for its content of moisture, lipid, ash, crude fibre, protein, carbohydrate and for other mineral analysis.

Proximate Analysis

Moisture content was determined by drying 5g of the flesh of the snail samples to a constant weight at 60°C

– 80°C in a circulating oven, for ash, 5g of the prepared samples were placed in the ceramics crucibles that had been previously heated and cooled until a constant weight was obtained. The samples were then subjected to ashing in the muffle furnace maintained at about 550°C until a constant weight for ash was achieved. Oil content was determined by soxhlet extraction with hexane as solvent, protein by kjeldahl method and crude fibre of the flesh were determined by the method of the Association of Official Analytical Chemists (AOAC, 1990). The total carbohydrate content was estimated by difference obtained after subtracting protein, fat, moisture, crude fibre and ash percentage from one hundred.

Mineral Analysis

Minerals were analyzed when 5g of the prepared samples were weighted into a flask. 20mL of HNO₃ was added to it and the resulting mixture was allowed to cake on a hot plate. 30mL of distil water was added to it and the resulting mixture was allowed to boil for another 20min. after this time, the samples was removed from the hot plate and filtered into a 50mL capacity measuring cylinder. The residue was rinsed with distilled water several times and the volumes of the 40mL mark with distill water. Ca, Na, K and Mg were determined by flame photometric method using NaCl and KCl to prepare standard for Na and K respectively while Fe, Zn, Mn, Cu, and Cr were determined by the atomic absorption spectrophotometric method.

RESULTS AND DISCUSSION

The results of the proximate, nutritional and metal composition of three snails species is shown in table 1 – 3

Table 1: Proximate composition of the flesh of three land snails' species on percentage weight basis

Materials	AA	AM	AF
Crude Protein	22.42	21.17	22.21
Moisture	74.23	75.36	74.94
Fat	1.56	1.39	1.27
Carbohydrate	0.66	0.47	0.43
Fibre	ND	ND	ND
Ash	1.12	1.51	1.13

Table 2: Mineral composition of the flesh of three snail species wet weight mg/100g

Mineral composition	AA	AM	AF
Fe	9.92	8.39	8.63
Mn	0.31	0.33	0.31
Mg	206.18	203.92	206.10
Ca	209.18	201.19	203.67
P	129.11	122.26	122.01
S	2.36	2.07	1.98
K	192.17	187.83	188.46
Na	58.22	54.37	50.19

Table 3: Metal composition of the flesh of three snail species in mg/kg

Metals	AA	AM	AF
Pb	0.200	0.160	0.080
Cd	0.440	0.240	0.200
Zn	0.557	1.672	0.139
Cu	0.536	0.267	0.267
Ni	0.006	0.013	0.006
Cr	0.240	0.016	0.016

Results of analysis of snail species from Owhelogbo, in Isoko north local government area of Delta State is showed in table 1, 2 and 3. Data on the proximate composition of the flesh of snail species on percentage by weight basis in table 1 reveals that crude protein content for AA, AM and AF are 22.42, 21.17 and 22.21. These values were found to be comparable with values obtained for conventional livestock as reported by (Babalola and Akinsoyinu, 2009). The result reveals that the snail meat is a rich source of protein, low fat, ash and carbohydrate content. This implies that the snail meat could be used as a better source for low calories protein for individual that look for easy source of protein. Protein is critical for building muscle and body mass, supporting neurological function, aiding digestion and helping to balance hormone naturally. Little protein in the body could result to a sluggish metabolic activity, trouble losing weight, low energy levels and fatigue, poor concentration and learning, moodiness and mood swings, muscle, bone and joint pain, blood sugar changes that can lead to diabetes, slow wound healing and low immunity. The values obtained in duplicate for an individual snail species for moisture, fat, carbohydrate and ash content varies with species wise. The fat content obtained in this study was low compare to 9.6%, 21.4% and 23.0% found in egg, mutton and duck product (FAO, 1989; FAO, 2001).

The low fat content makes the snail meat a good antidote for those with fat related disease. Also, results from table 2 reveal that the meat of snail is rich in Fe with 9.92mg/100g, 8.39mg/100g and 8.36mg/100g for AA, AM and AF species. Fe is the main component of hemoglobin; it is responsible for the formation of the red blood cell. Deficiency of Fe leads to anemia. Anemia develops due to an inadequate amount of iron in the diet or poor iron absorption. Iron deficiencies can be caused or exacerbated by injury, blood loss, hemorrhage or gastrointestinal diseases that impair iron absorption. The Mn content for the snail species recorded in table 2 are 0.31mg/100g, 0.33mg/100g and 0.31mg/100g for the AA, AM and AF species. Manganese is a mineral naturally occurring in our bodies in very small amounts. Mn is responsible for healthy bone structure, bone metabolism, and helping to create essential enzymes for building bones. It also acts as

co-enzyme to assist metabolic activity in the human body, formation of connective tissues, absorption of calcium, proper functioning of the thyroid gland and sex hormones, regulation of blood sugar level, and metabolism of fat and carbohydrates. Manganese is an actual component of manganese super oxide dismutase enzyme. It is a powerful antioxidant that seeks out the free radicals in the human body and neutralizes these damaging particles, thereby preventing many of the potential dangers they cause. Manganese deficiency result to high blood pressure, heart ailments, muscular contraction, bone malformation, high cholesterol, poor eyesight, hearing trouble, severe memory loss, shivers and tremors (Akpogheli and Ierhievwie, 2015).

Furthermore, eye problems, sweating, fast heartbeats, weakness, and severe cramps may be some of the deficiency symptoms. Severe deficiency may cause infertility in women, pancreatic damage, heart ailments and osteoporosis. Magnesium plays an important role in over 300 enzymatic reactions within the body, including the metabolism of food and synthesis of fatty acids and proteins. Magnesium is involved in neuromuscular transmission and activity and muscle relaxation. Magnesium deficiency, especially prevalent in older populations, is linked to insulin resistance, metabolic syndrome, coronary heart disease and osteoporosis. The mineral Ca is well-known for its key role in bone health. It also helps maintain heart rhythm, muscle function. General survey reveals that Ca is recommended by doctors to control high levels of Mg, P, and K. in the blood. It was reported by (Akpogheli *et. Al.*, 2015; Fagbuaro *et. al.*, 2006) that Calcium play important role in blood clotting. The concentration of calcium found in this study reveals that the consumption of snail will increase the calcium level in the blood. Sulfur is a part of some of the amino acids in the body and it is involved in protein synthesis, as well as several enzyme reactions. It helps with the production of collagen, which is a substance that forms connective tissues, cell structure and artery walls.

Additionally, it is a part of keratin, giving strength to hair, skin and nails. Phosphorus works with calcium to help build bones. hypophosphatemia occurs when phosphorus levels in the blood get too low. These result to the drop of energy levels in the body and thus leading to muscle weakness, fatigue, and a low tolerance for exercise. When not enough, phosphorus coincides with low levels of calcium and vitamin D and thus, lead to weaker, softer bones over long periods of time thereby resulting to joint and muscle pain. It was reported by (Akpogheli *et. at.*, 2015; Akpogheli and Ierhievwie, 2015) in their study that the presence of K and Na was an added advantage because while Na is essential for normal heart and

muscle function, K helps in muscle contract, maintain fluid balance and maintain normal blood pressure. They further reported that potassium may also help reduce kidney stone and bone loss as you age but too much sodium has adverse effect on your heart and direct relationship with hypertension in human. Data's from table 3 further reveals that the metal under investigation were below the WHO and the International / National Standard for heavy metal in food except for Cd which is above permissible limit. Cadmium is a highly toxic metal which naturally occur in the soils, and is naturally spread in the environment due to human activity. Excess exposure to cadmium may results to renal, pulmonary, hepatic, skeletal, reproductive effects and cancer. While Zn is needed for cell growth and to boost the immune system, Cu is an essential trace element that forms enzyme systems including cytochrome, oxidase and tyrosinase (Babalola and Akinsoyinu, 2009). It was further reported that copper is associated with iron and catalyses oxidation – reduction mechanism concerned with the oxidation of tyrosine. The importance of minerals in our diet cannot be over emphasized given their roles in metabolic reactions, rigid bone formation and osmoregulation among others, thus, it is not only safe to consume snails purchased from the Owhelegbo community, it is also safe to consume farm product cultivated within her immediate environment.

CONCLUSION

Snails are one of those harmless creatures that could be found in any countries of the world. They tend to feed on a variety of item found in their natural habitat. This implies that the amount of toxic metal present in the snail meat is proportional to the ecological contamination with heavy metal. Though, the study clearly show that the snail meat have great potential in supplementing the protein and mineral deficiency prevalent in developing nations in general and Nigeria in particular with her large population, it is thus recommended for both the young and the old, as this will effectively supplement other food component in providing the required essential element to the body.

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