Nutritional and Mineral Evaluation of Meat and Haemolymph of African Land Snail (*Archachatina marginata* Swainson)

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ABSTRACT

Thirty adult snails, with an average weight of 328±2.0g were randomly allotted to two treatment groups for the evaluation of proximate and mineral elements composition of *Archachatina marginata* (AM) in a complete randomized design at 15 snail per treatment, while each treatment was replicated thrice. Proximate constituents evaluated were crude protein, crude fiber, ether extract, ash and NFE, while mineral elements such as Ca, K, Fe, P, Cu, and Mg were also assessed. Snail meat and haemolymph were the two treatment. All data were analyzed using ANOVA, while significant difference among means were separated using Duncan multiple range test.

The outcome of the trial revealed that snail meat was higher ($P<0.05$) in dry matter (93.90%) crude protein (18.15%), crude fiber (0.13%), ash (16.20%), NFE (58,12%) and mineral elements like Ca, K, P, Na, and Mg. the haemolymph was higher ($P<0.05$) in Cu (4.10mg/100g) and Fe (3.30mg/100g). the evaluation revealed that snail meat and haemolymph are nutritious and not deleterious to human health, their consumption is advocated.

(Keywords: snail, mineral elements, proximate composition, haemolymph)

INTRODUCTION

Snail is a good source of animal protein and often consumed as a delicacy and used for the treatment of ailments in traditional medicine (Omole 2002). It is very common in the rural areas to find women and children collecting snails at night immediately after rainfall. Akinnusi, et al. (2019) and Kehinde (2019) identified four common species of snails in Nigeria; they are *Archachatina marginata* (AM), *Achatina achatina* (AA), *Achatina fulica* (AF), and *Limicolaria sp.* (LS). All researchers regarded AM as the commonest species.

There is increasing awareness on the need to ascertain the quality of snail meat and haemolmph consumed by Nigerians (Ajibola, et al., 2018) in order to reduce the occurrence of food related ailments, because snails are always in contact with forages and soil in the wild, coupled with the increasing menace of bad sewage and garbage disposal and pollution from oil and incomplete combustion of hydrocarbons (Ejidike and Ojekunle, 2019). Conflicting chemical composition of snail meat and haemolymph has been reported in the literature. This study will provide a good basis to confirm or disregard such information in the study area. It has been reported by Kingsley, 2019, Edem, 2019, and Etuk and Ebenso, 2019 that snail meat is rich in crude protein (13.42 – 20.26%), iron (49.07mg/kg), zinc (15.40mg/kg), manganese (3.90mg/kg), magnesium (455.90mg/kg), and calcium, it is however low in sodium and fat, with negligible levels of fiber.

The haemolymph is also of significant importance and an indicator of snail well-being. This is the bluish fluid collected from snail when the apex of the shell is carefully perforated. It is low in quantity during aestivation dry season and starvation (Oropo, et al., 2019 and Akinnusi, et al., 2019). It aids snail movement and also serves as a reservoir for mineral elements, such as calcium and phosphorus. It is also important in boosting the level of blood iron and hemoglobin when taken and it is always consumed as collected, hence good care must be ensured to maintain the best levels of hygiene in the

collection process to prevent contamination. This trial therefore tried to assess the proximate and mineral contents of snail meat and haemolymph of AM.

MATERIAL AND METHODS

Experimental Site and Animals

The trial was conducted at the Forestry Research Institute of Nigeria Wildlife Department. Adult snail (n = 30) with an average weight of 328 ± 2.0g were sourced from snail collectors at Idi Ayunre sector of Oluyole Local Government Area of Oyo State.

Experimental Treatments

There were two treatments represented by snail meat (SM) and snail haemolymph (SH). Thirty snail used were randomly divided into two groups for the collection of snail meat and haemolymph.

Meat and Haemolymph Sample Collection

The snails were cleaned to remove dirt and prevent contamination of sample, they were eviscerated using standard procedure described by Omole (2002). The samples were collected in triplicate for subsequent proximate and mineral analysis.

Proximate Constituents Determination

The meat and haemolymph proximate composition were determined by the methodologies of A.O.A.C. (2005) to elicit percentage dry matter, crude protein, crude fiber, ether extract, ash, and NFE.

Mineral Composition Determination

The meat and haemolymph mineral element composition were analyzed for Ca, K, and Na using flame photometry method; phosphorus by spectrophotometer; and Mg, Fe and Cu were determined by using a Buck 210 VGP Atomic Absorption Spectrophotometer.

Statistical Analysis

Data collected were analyzed using one-way ANOVA, while significant means separation was done by Duncans Multiple Range Test (1955). P value was set at 0.05.

Table 1 shows the proximate composition of SM and SH, which elicited the percentage dry matter, crude fiber ether extract, ash and NFE. All proximate parameters were higher ($P<0.05$) in SM. The dry matter values recorded were significantly varied, with higher ($P<0.05$) value (93.90%) recorded for SM compared to (8.91%) for SH.

Table 1: Proximate Composition of SM and SH.

Proximate parameters %	Treatment		
	SM	SH	SEM±
Dry matter	93.90[a]	8.91[b]	5.00
Crude protein	18.15[a]	3.78[b]	1.15
Crude fiber	0.13[a]	0.00[b]	0.02
Ether Extract	1.30[a]	0.02[b]	0.50
Ash	16.20[a]	0.56[b]	0.20
NFE	58.12[a]	4.55[b]	2.60

SEM: Standard error of Mean

Ab: means along the same row with different superscripts are significantly ($P<0.05$) different.

Table 2: Mineral Profile of snail meat (SM) and Snail Haemolymph (SH).

Mineral Element (ME) (mg/100g)	Treatment		
	SM	SH	SEM±
Ca	10.80[a]	45.00`[b]	5.0
K	0.15[a]	0.14[b]	1.10
Fe	2.00[a]	3.30[b]	1.00
P	28.15[a]	10.00[b]	2.15
Cu	1.00[b]	4.10[a]	1.00
Na	1.27[a]	0.10[b]	0.02
Mg	266.90[a]	0.16[b]	0.01

SEM: Standard error of Mean

Ab: means along the same row with different superscripts are significantly (P<0.05) different.

Result of the Proximate and Mineral Evaluation of Snail Meat and Haemolymph

Table1 revealed the levels of Ca, K, Fe, P, Cu, Na, and Mg in SM and SH. The result showed that all the mineral elements were significantly varied, SM recorded higher (P<0.05) levels of Ca (109.80mg/kg), K (0.51mg/kg), P (28.15mg/kg), Na (1.27mg/kg), and Mg (266.90 mg/100g); while SH was higher in Fe (3.30mg/100g) and Cu (4.10mg/100g).

Discussion of the Proximate and Mineral of SM and SH

Land snail are non-conventional dietary protein source in Nigeria and some parts of Africa, it is a delicacy that is highly cherished, with good complement of amino-acids, and particularly rich in lysine (Babalola and Akinsoyinu, 2009 and Chris, 2018). The proximate and mineral evaluation of the meat and haemolymph of AM will provide information for nutritionists and research scientists on the benefit of consuming AM meat and haemolymph.

The proximate values revealed higher (P<0.05) dry matter and proximate constituents in snail meat, with desirable levels of crude protein (18.15%), which compared with values obtained for broiler meat, mutton goat meat and beef this corroborated the findings of Omole (2002) and Sodipe (2018), when they reported snail as a delicacy and cherished source of quality animal protein, these good qualities were ascribed to the high price of snail meat when compared to beef and goat meat, the level of fat (1.30%) in SM is lower, compared to 9.60, 21.40, and 23.0% for egg, mutton, and broiler products, respectively. This corroborated the findings of Omole (2002) and Hamzat and Longe (2002), when they obtained a range of 0.82 to 1.00% for the levels of fat in snail meat.

Many authors have regarded snail meat (AM) as juicy, nutritious, and a delicacy because of its low level of fiber and good contents of other nutrients, such as fat and protein. Kehinde, et al. (2008), Ademolu, et al. (2009), and Akinnusi, et al. (2019) commented on the insignificant level of crude fiber in SM. This evaluation also revealed snail meat (AM) to be rich in ash, which is an indication of its richness in mineral elements, this may be erroneous in areas with high level of silicon (Sam, et al. 2018), however, the level of ash in snail meat will directly relate to the mineral salt and type of vegetation in area of snail collection.

The calcium content of AM meat in this trial (109.8mg/100g) was higher than 4.0, 6.0, and 7.0mg/100g reported for poultry, goat liver, and beef, respectively and was lower than 120mg/100g reported for cow's milk. These mineral elements are important for bone and teeth formation and blood clotting. Kehinde (2009) reported that snail meat level of calcium increased with the age of AM, because of the physiological need for shell growth and thickness enhancement. Calcium is an important constituent of most anti-hypertensive and control be responsible for the consumption of snail meat to control blood pressure, arteriosclerosis, and other blood related ailments (Ademosun, et al., 2004).

The level of phosphorus recorded in snail meat (AM) was 28.15mg/100g, which was higher than 22.91mg/100g reported by Babalola and Akinsoyinu, (2009), however other authors have recorded much lower levels. Snail meat is regarded as supplementary source of phosphorus which is an important part of phosphatase and it is involve in oxidative phosphurylation in aerobic and anaerobic cellular energy production (Mcdonald, et al., 1987).

The level of Mg reported for AM meat was higher than 200.71 and 213.25mg/100g obtained for wet and dry season snail meat by Babalola and Akinsoyin (2009). Magnesium, like calcium and phosphorus, are required for bone and teeth formation (Akinnusi, et al., 2019).

The level of iron in AM meat is helpful for the control of anemia (Omole, 2002). The level of Cu, Na, and Mg were within the standard values reported by Sam, et al. (2019) and Ejidike and Oyekunle (2019).

Haemolymph is commonly consumed in traditional treatment of hypertension, and as supply of copper and iron for human well-being (Omole, 2002). The evaluation of snail haemolymph (AM) revealed the presence of all the constituents present in the meat, which were higher ($P<0.05$) in the meat than the haemolymph, except for Cu and Fe, which were higher ($P<0.05$) in the haemolymph. This corroborated the findings of (Babalola and Akinyosu, 2004 and Ademolu, et al., 2004) that Fe and Cu are more abundant in the haemolymph and could richly meet the human body requirement for these mineral elements. Fe is an important part of the blood which attracts oxygen for cellular oxidation of anemia, while Cu is part of body chemical reaction related to respiration and tyrosine oxidation.

CONCLUSION AND RECOMMENDATION

Snail meat and haemolymph (AM) are good sources of nutrients (proximate and mineral) for human growth, boosting of body immunity and supply of nutrients. Snail haemolymph is particularly higher ($P<0.05$) in Cu and Fe. The farming and consumption of snail for poverty alleviation and good health is recommended.

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