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Proximate Composition and Mineral Contents of the Flesh and Shell of *Tympanotonus Fuscatus* (Linnaeus, 1758*)* (Gastropoda: Potamididae) of the Cross River, Nigeria

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ABSTRACT: *Tympanotonus fuscatus var .radula* (L) is a species of periwinkle living in the black mud of the mangrove swamp forest along the brackish water mangrove swamp forest area of the West Africa rivers and in the Cross river in Nigeria. The proximate and mineral contents of it flesh and shell were investigated using techniques recommended by AOAC. The moisture, crude protein, ash, fat contents of the flesh were 50.00 mg/100gm, 22.32mg/100gm, 1.22 mg/100gm, and 10.02 mg/100gm respectively. The respective values of 20.05 mg/100gm, 2.63 mg/100gm, 8.1 mg/100gm and 0.3 mg/100gm were determined in the shell. Energy values of 245.17 Kcal and 294 Kcal were measured from the flesh and shell of the species. Carbohydrate in the flesh was 16.42 mg/100gm while 68.41 mg/100gm was measured in the shell. Minerals ranged from 66.47 mg for calcium, phosphorus 13.5 mg for shell and 33.27 mg and 6.82 mg in the flesh. Mineral concentrations were high in the shell than in the flesh.

Keywords: Periwinkle, Cross River, Food Value, Minerals

Introduction

Tympanotonus fuscatus var *fuscatus* (Linneaus, 1758) is a West African mud creeper living in the black mud which sometimes contains H_2S in brackish water within the salinity range of 0.15% during the rains up to 25% in the dry season when its habitat is dried (Egonmwan, 2008). They are mainly found on the fringes or edges of the system and not in the main water body. This species is the only extant species of the genus. They feed on microscopic algae, detritus, and diatoms. This species is a delicacy and are obtained and sold as food by the female dwellers of riverine areas of Nigeria

T.fuscatus var *fuscatus* (L) is believed to be rich in food contents and in some minerals. Egonmwan (1980) asserted that it has high protein content of 21.04% and Jay (1978) stated that its muscle also has concentration of arginine, aspartic acid, glutamic acid with carbohydrate level of about 3.4% and total nitrogen of 2.5% in its flesh. Bright (1999) in his report asserted that *T. fuscatus* is a variable source of minerals and vitamins.

This paper is on the food value and the mineral contents of *Tympanotonus fuscatus* of the Cross River. Apart from the valuable wealth of nutrients and minerals these species contain, others reported about the value of its shell and suggests the possible use of the species in the production of medical powders such as baby teething supplement (Udo.2013).

Contradictory data meant to represent the food value of *T. fuscatus* have been presented by several authors. Egonmwam (1980) reported 21.04% as the crude protein value for *T. fuscatus* of the Niger Delta, Job and Ekanem (2010) gave values of crude protein for the same species caught from Itu river and Oron Creek respectively (tropical creek) to range between 40.2% and 41.58% inclusive. The values for moisture content range between 74% and 78%. FAO (2001), Opeh (2018) stated that the crude protein content of shell fishes and

most other aquatics are comparable to those of livestock which is within the range of 16.9% and 20.5%respectively with exceptions such as *Uca tangeri* (23.16%), *Egera radiata*. (34.37%) (Opeh, 2018) and *Eutropus niloticus* (25%) (Udo, 2013).

Jamabo and Chinda (2010) reported on the level of copper to be 35.61mg/kg in the flesh of *T. fuscatus* of the upper Niger River and stated that the normal standard values obtained from species and other gastropods in Bonny River were 1.20 mg/kg. Literature data on the mineral content of the species is scarce and information on its proximate food value is controversial, but reliable data on the species from the Cross estuary and its tributaries are lacking. This paper therefore seeks to add data on species inhabiting the waters of the Cross river channels and compares the values of it minerals contents to internationally accepted standards and levels of their toxicity WHO (1998). The Cross river runs through the rain forest of eastern Nigeria into the Cross river estuary from the Cameroun's receiving other waters from its tributaries.

Materials and methods

Fifty freshly caught *T. fuscatus var fuscatus* individuals were bought from fishermen at Nsidung beach, Calabar, Nigeria. Nsidung beach is located at the Southern part of Nigeria at latitude 50ºN and 50º15's .They were transported to the laboratory for study. In the laboratory, they were cleaned by scrubbing the exoskeleton thoroughly to remove all sand and other debris that were attached to it before the extraction of their flesh as recommended by AOAC (2000)

The extracted flesh /meat were oven dried at 127 ºC following the method of AOAC(2000) .The exoskeleton/shell was equally dried in slightly higher temperature of 150 ºC, one after the other in the oven. Measurement of the proximate composition of the flesh and shell for moisture, ash, crude protein, fiber, fat, and total carbohydrate followed the technique recommended by AOAC (2000). The mineral contents were determined from the solution obtained by dissolving the ash (residues left after burning in furnace) in distilled water containing a few drops of HCl. Sodium and potassium were determined with flame photometer (AOAC, 2000). Iron, manganese, calcium, copper and phosphate were measured with the Spectrophotometer at different wavelengths of 420 nm, 380 nm, 48 nm, 62 nm, respectively.

The differences in concentrations of the proximate and mineral composition between the concentrations in the shell and flesh were compared statistically with the Chi-square.

Results

Table 1 shows the proximate food value in the flesh and shell of *Tympanotonus fuscatus*. Protein and moisture were high in the flesh while energy content is similar in flesh and shell ($p>0.005$).

Table 1: Proximate composition of the flesh and Shell of *Tympanotonus fuscatus* (%)

	Protein	**Carbohydrate**	**Moisture**	**Fat**	**NFE**	**Ash**	**Crude Fibre**	**Energy (Kcal)**
Flesh	22.32	16. 42	50.02	10.00	3.57	1.22	0.84	245.17
Shell	2.63	68.41	20.50	0.37	0.64	8.10	0.01	294.00

From the results, it seems that the shell of *T. fuscatus* is more concentrated in minerals (calcium, potassium, magnesium, and phosphorus) than the flesh (Table 2). Copper is low in both flesh and shell while lead is 5.0 6 mg/g in shell and 0.40 mg/g the flesh.

Table 2: Approximate mineral contents of the flesh and shell of *Tympanotonus fuscatus* of the Cross River (mg/g)

	Na^+	**Ca^{2+}**	**K^+**	**P**	**Fe^{2+}**	**Cu^{2+}**	**Pb^{2+}**	**Cl^-**	**Mg^{2+}**	**Mn^{2+}**
Flesh	1.02	33.27	16.30	6.82	0.48	0.02	0.04	1.82	12.37	0.75
Shell	2.06	66.47	33.30	13.50	0.97	0.05	5.06	3.63	25.30	1.55

Discussion

This study revealed that *Tympanotonus fuscatus* flesh is rich in protein showing 22.32% with carbohydrate levels of 16,42% (Table 1). Energy level was high giving 245.17 Kcal. These levels are higher and comparable to that recorded for *Callinectes amnicola* (flesh) and the flesh of *Uca tangeri* (Udo &Arazu, 2011) who recorded 20.12% and 23.16% respectively. These organisms co-exist in the same environment with *T. fuscatus*. These outcomes are equivalent to that measured in the catfishes (*Heterobranchus longifilis, Clarias gariepinus* and *Chrsichthys nigrodigitatus* of the Cross River (Udo & Arazu 2012a).

Similarly, the proximate food value of the shell of these organisms is equal or similar to those recorded for other shell fishes in these environments. For example, moisture contents in *Macrobrachium vollenhovenii* is 38.40%, *M,macrobrachion* 41.105%, *Egaria radiata*, 20.47% (Udo & Arazu 2012b) is similar to what was measured for *T. fuscatus* of this study ($p>0.005$). From these observations it could be stated that most shell fishes in the Cross River seem to the have similar moisture contents.

However, the concentrations of minerals in the shell of *T. fuscatus* (Table 2) are not high when compared to those measured from *Callinectes amnicola* where iron, calcium and sodium are 171.00 mg/100gm, 564.00 mg/100gm, 260 mg/100gm respectively (Udo & Arazu, 2011; Job & Ekanem, 2010). Jamabo and Chinda (2010) reported values of 35.61 mg/kg-^{1} as the value obtained for copper in this same species inhabiting the mangrove swamp of upper Bonny River in the Niger Delta of Nigeria. This high value for copper in the Niger Delta region of Bonny in Nigeria may have something to do with the quality of the mud, that must have been polluted by oil.

The periwinkle *T. fuscatus* seem to have a stronger and more docile shell (Table 2), although not as complicated as that of *C. amnicola* judging from the calcium, sodium, and potassium concentrations of their shell (Udo and Arazu, 2012). The exoskeleton of *Macrobrachium* specie is finer and delicate than those of *T. fuscatus* (Udo & Opeh, 2013; Udo & Arazu 2012b). Both organisms are found in the same environment, their mineral contents concentrations similar.(Job and Ekanem 2010; Udo & Arazu, 2012b).

In conclusion therefore, in terms of yield of calcium in particular vis-à-vis the other minerals, the studied species would produce a higher yield of calcium for industrial extraction and is highly recommended as such. The flesh of this organism also exhibits enormous amount of proximate content as compared with other foods in the family of aquatic shell fishes.

The toxicity levels of the mineral in the organism are low compared to values given internationally for similar organisms and mineral and are therefore safe for consumption (WHO, 1998). Apart from the delicious nature of shrimp flesh, this animals compete favorably in terms of percentage of proximate protein that can be available / measured from them; it is possible for a meal we recommend that one can substitute for the other.

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