Biochemical composition of *Micromesistus poutassou* from agbalata market, Badagry Lagos West, Nigeria.

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Abstract

Fish and shellfish are widely accepted as highly nutritious and healthy foods. However, people usually think that different types of fish are of similar nutritional value and fish selection are made based on availability, freshness, flavor and other physical factors. *Micromesistus poutassou (*Blue whiting) purchased from Agbalata market, Badagry Lagos was analyzed to determine its proximate composition of its nutrients (protein, lipid, moisture, ash, carbohydrate and crude fiber), cholesterol and some of its macro and micro minerals using standard methods. Results of the mean values for moisture, protein, lipid, ash and carbohydrate were as follows: 74.99%, 18.06%, 2.61%, 1.7% and 2.39% respectively in *Micromesistus poutassou.* In addition, the major macro elements found in the fish include calcium (7.40 mg/ 100 g), sodium (6.31 mg/ 100 g), magnesium (3.70 mg/ 100 g) and potassium (3.17 mg/ 100 g), Copper (4.60 mg/ 100 g) and Iron (3.10 mg/ 100 g) were the main microelements followed by zinc (1.80 mg/ 100 g) while having a low cholesterol value of 2.61 mg/ 100 g. Results of the study show that *Micromesistus poutassou* is nutritionally high in protein with low oil content alongside varying amounts of mineral elements which are all essential for the proper health maintenance of humans.

Keywords: Micromesistus poutassou, proximate composition, mineral content, cholesterol

1. Introduction

Fish is known to be highly nutritious and an excellent source of animal protein which is consumed by a large human populace because of its availability and palatability (Foran *et al*., 2005, Sutharshiny and Sivashanthini, 2011a). Its high nutritive value is due to the presence of amino acids, fatty acid compositions and essential minerals and vitamins which support the biochemical processes of the human body (Aremu and Ekunode, 2008; Alasalvar *et al*., 2011). The consumption of fish has been linked to health benefits that include reduced risk of coronary heart disease and maintenance of good health (Arannilewa *et al*., 2005).

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Polyunsaturated fatty acids (PUFA) from fish oils have been reported to have preventive and/or curative effects for several diseases including arterial hypertension (Turkmen *et al*., 2005), cancers and inflammatory diseases (Marcholi, 2001). Minerals represent 0.2–0.3% of the total intake of all nutrients in the human diet. They are so important that without them, the remaining 99.7% of the food intake would be difficult to utilize (Nabrazyski, 2002). Some mineral elements such as calcium, sodium, potassium etc. have plenty benefits to the biological functioning of the human body whereas others such as heavy metals which are not easily biodegradable, can be toxic (Whithney and Roofes, 2008). According to the study of Adekoya and Miller (2004), fish and fish products constitute more than 60% of the total protein intake in adults especially in rural areas. Marine fishes are generally cheaper and more abundant when compared with fresh water fishes which are relatively more expensive in Nigeria. There are limited data on the nutritional composition of fish species which are commonly consumed by the low income earners in developing countries of Asia and sub-Saharan Africa (Oladipo and Bankole, 2013). *Micromesistus poutassou* popularly called *Panla,* is a popular food fish sold in Badagry market. It is an important marine fish specie caught regularly by artisanal fishermen and often bought by people because of its good quality and unique meat quality. It is readily available in fresh or smoked form in all fish markets along the coastal line in Nigeria. Thus even though it is widely eaten,its food value is not known.Knowing the nutritional of *Micromesistus poutassou* usually eaten by the people could contribute to remedying problems of malnourishment and obesity. Although fish consumption is recommended due to its nutrients, the nutritional importance of this fish specie is often neglected by consumers. Proximate biochemical analysis provides information on the nutritional value of a particular organism used as a source of food (Zafar *et al.,* 2004). Series of studies on proximate composition of different marine fishes are found in literature (Azim, 1982; Banu *et al.,* 1985; Bhuiyan, 1992; Satta, 1993; Islam and Joadder 2005; Tawfik, 2009; Sutharshiny and Sivashanthini, 2011) but much work has not been carried out on *Micromesistus poutassou*. Thus, the thrust of this study was to determine the proximate, cholesterol and mineral content of *Micromesistus poutassou* so as to understand the nutritional status of the fish.

2. Materials and Method

2.1 Description of the study Area

Agbalata market,Badagry is situated in a coastal town,southwest local government area in lagos state. Badagry is situated between Metropolitan Lagos, and the border Benin republic at Seme. Its geographical coordinates are 6° 25’ 0” North, 2° 53’ 0” East.

2.2 Sampling

Thirty fresh samples of *Micromesistus poutassou* (with weights ranging from 100–120 g) were purchased (five samples selected randomly from different fishmongers) at Agbalata market Badagry, Lagos. They were transported in an insulated ice bag to the Nigerian Institute for Oceanography and Marine Research, Victoria Island Lagos Chemistry laboratory on a 2 hour-trip for analysis.

2.3 Sample Preparation

On arrival at the laboratory, the fish samples were thoroughly washed under a flowing tap to remove any adhering contaminants and drained. They were then dissected with a knife and the intestines, guts and bones were removed. The muscle sample was then homogenized and in a mortar and pestle until a uniform mixture (homogenized) was obtained. The homogenate was stored in the refrigerator overnight before samples from the homogenate were taken for analysis.

2.4. Chemical analysis

2.4.1. Proximate analysis

Proximate analyses were carried out in triplicate determinations on the samples. Test portions of homogenized fish tissue (2 g) were dried at 103±2°C in air oven to constant weight (AOAC, 1994). The moisture [%] was calculated as weight loss. Crude protein content was calculated by converting the nitrogen content which was determined by Kjeldahl’s method. A conversion factor of 6.25 was used for the calculation of protein content (Vlieg, 1984). Lipid determination was carried out using the modified Bligh and Dyer procedure (AOAC, 1994). The ash content of the fish was determined by igniting the sample at 550°C for 5–6 h until the sample was completely free from carbon particles in a muffle furnace.Crude fiber was analyzed following the procedure of AOAC (1994).Total carbohydrate content was determined by subtracting the sum of the percentage of moisture, ash, lipid, crude protein and crude fiber from 100% i.e.

Carbohydrate = 100 - (%Moisture + %Ash + %Protein + %Lipid + %Fiber)

(Eyeson and Ankrah, 1975).

2.4.2. Mineral analysis:

(1) Sample Preparation:

10g of homogenized muscle tissue of fish sample was taken and heated up in a muffle furnace at 550°C and ashed overnight.It was then cooled to room temperature. The dried powdered (i.e residue of homogenized fish samples that had been ashed) sample was then digested with concentrated nitric acid (65%) and later perchloric acid (60%). Aliquots were then taken and used for the determination of sodium, potassium, calcium, magnesium, iron, copper, and zinc content. Sodium and potassium were determined by flame photometry (Khalil and Mannan, 1990). Iron, copper, zinc, calcium and magnesium were determined by atomic absorption spectrophotometer (AOAC, 1990).

(2) Preparation of Acid Digest

For the analysis of minerals, 1 g of powdered sample (i.e residue of homogenized fish sample that had been ashed) was taken into a 100 ml digestion flask.10 ml of concentrated nitric acid (HNO_3) was added to it and the flask was placed in the dark overnight. On the next day, 5 ml of perchloric acid was added to it. The mixture was then placed on a hot plate at 50°C for 15 minutes and then the temperature was raised slowly up to 200°C. Heating was continued till the white dense fumes of perchloric acid disappeared. After digestion, the contents were cooled and filtered through 2 Wattman filter papers (A.O.A.C 1990). Then it was transferred to a 50 ml volumetric flask and diluted with deionized water up to the mark.

(3) Cholesterol Content

Cholesterol content of the sample was estimated by the Zlatkis *et al*., (1953) method. Extracted lipid which was obtained using the Bligh and Dye Method (AOAC,1994) by employing a single-phase solubilization of the lipids using a chloroform-methanol (1:1) mixture, was treated with ferric chloride, acetic acid mixture and sulphuric acid and the color developed was observed (AOAC, 1990). After 20 minutes absorbance was read at 560 nm in a spectrophotometer.

2.5 Statistical analysis

Standard deviation and average values were calculated. The data obtained were analyzed using the SPSS 15.0 evaluation version production mode facility

3. Results and Discussion

The results of the proximate composition of *Micromesistus poutassou* are shown in Table 1. While its mineral contents are presented in Table 2.

Table 1 Percentage Proximate Composition of Nutrients In *Micromesistus poutassou*.

Nutrient	Protein	Lipid	Ash	Moisture	Carbohydrate	Crude Fiber
Mean Value	18.06 ±0.33	2.61± 0.71	1.7±0.15	74.99±0.12	2.39±0.43	0.25±0.15

Note: Each value is percentage mean ± standard error of triplicate determinations.

Table 2 Mineral and Cholesterol composition (mg/100g) of *Micromesistus poutassou* from Agbalata market, Badagry In Lagos State.

Mineral	Sodium	Calcium	Magnesium	Potassium	Iron	Zinc	Copper	Cholesterol
Quantityty (mg/100g)	6.31±0.73	7.40±0.55	3.70±0.26	3.17±1.73	3.10±0.41	1.80±0.52	4.60±0.22	2.61±0.33

Note: Each value is mean ± standard error of triplicate determinations.

3.1. Proximate Composition

3.1.1 Moisture Content

Mean percentage moisture content of *Micromesistus poutassou* was found to be 74.99% which is higher than all other constituents present in the fish. This supports the fact that water is the main component of fishes and accounts for between 70% and 80% of the weight of the fish (Tenny *et al*., 1984). Ogunlade et al (2005) reported that the moisture content of the muscle of fishes varies between 70 and 75%. The percentage mean moisture of *Micromesistus poutassou* in this study fell within this range. Moisture content of *Micromesistus poutassou* in this study is similar to those reported for fin fishes by Clement and Lovell (1994); those of some marine fishes (*Chloroscombus chrysurus* 76.52%; *Syacium micurum* 79.06%; *Sardinella aurita* 74.15% and *Pseduololithus senegalensis* 74.39% as reported by Obodai et al (2009). High moisture content of fish is a disadvantage in that it increases the fish's susceptibility to microbial spoilage,oxidative degradation of polyunsaturated fatty acids and consequently decreases in the fish quality for longer preservation time in agreement with Omolara and Omotayo (2008).

3.1.2. Protein Content*:*

Quantitatively,protein is the major component in muscle tissues of fish. The protein content tends to vary much less widely from one fish species to another (WHO/FAO, 2011). Protein content of fish is considered low if it is below 15%. In this study, edible tissue from *Micromesistus poutassou* showed good protein level (18.06%). According to Sidwel (1981), crude protein content of sea foods ranges from 8–25%, while that of finfish muscle tissues ranges from 18–22%. The crude protein content for *Micromesistus poutassou* in this study compared favorably with values reported for *Clarias gariepinus* with 18.6% by Effiong and Tofa (2006); for *Cynoglossus senegalensis* found to be 18.56% as reported by Daniel (2015) and *S.lysan* (19.47%) & *S.tol* (18.99%) as reported by Sutharshiny and Sivashanthini (2011b). The high protein content of *Micromesistus poutassou* may be attributed to the fact that it is carnivorous feeding mostly on small fishes and cephalopods (Cohen *et al*., 1990).

3.1.3. Lipid Content

The fish species (*Micromesistus poutassou)*in this study belonged to the low oil category (less than 5%). Fishes with lipid content below 5% are considered lean fishes (Stansby, 1982 & Ackman, 1989). Thus *Micromesistus poutassou* is a lean fish. Its low lipid content could be attributed to poor storage mechanism and the use of fat reserves during spawning activity (Ackman, 1989) Since the lipid content of fish are usually unsaturated and are rich on omega-3 fatty acids, the low fat content of *Micromesistus poutassou* suggests that the fish can be recommended for people with obesity.

3.1.4. Ash Content

The ash content of a food item is the inorganic residue that remains after the organic matter has been burnt off. It is a measure of the mineral content of the food item (Omotosho and Olu, 1995). The observed ash content of the fish in this study (1.7%) shows that *Micromesistus poutassou* is a good source of minerals such as calcium, potassium, zinc, iron and magnesium.

3.1.5. Carbohydrate Content

Carbohydrate occurs in very small amounts in an animal‘s body in the form of glycogen (Maynard *et al*, 1984). Hence the low value of carbohydrate (2.39%) obtained for *Micromesistus poutassou* in this study. Fishes generally have very low levels of carbohydrate since glycogen does not contribute to the reserves in the fish body tissue (USDA, 2010). Carbohydrate content of *Micromesistus poutassou* in this study was found to be lower than those reported by Adeniyi *et al.,* 2012 which were 3.85% (*Clarias gariepius*), 8.86% (*Malapterurus electricus*) and 6.85% (*Tilapia guineensis*).

3.2. Mineral Composition

Micromesistus poutassou contained appreciable quantities of minerals which are extremely important since they act as cofactors in various metabolic reactions in biological systems. The extent of the concentration of these metals in a fish, can suggest to the extent to which the fish picks up particulate matter from the surrounding water and sediment while feeding, as bottom feeder are known to concentrate more metals than the surface feeder (Okoye, 1989). It was found to contain relatively higher concentration of calcium (7.40 mg/ 100g) which functions as a constituent of bones and teeth, regulation of nerve and muscle function. Comparison of the calcium content in *Micromesistus poutassou* in this study with other results from literature on other marine species, show that mackerel and some other catfishes exhibit higher calcium levels in the range of 13.20 mg/100 g and 12.87 mg/100 g (USDA, 2010). Udo and Arazu (2011) reported lower calcium values of 2.80 mg/100 g, 2.08 mg/100 g and 2.11 mg/100 g for *Scomber scombrus, Trachurus trachurus and Sardine pilchard* respectively. Sodium (6.31 mg/100 g) found as the second highest concentration of mineral in *Micromesistus poutassou* is the principal cation in extracellular fluids. It regulates plasma volume and acid-base balance, involved in the maintenance of osmotic pressure of body fluids.The third highest occurring mineral in the fish is magnesium, which is an active component of several enzyme systems. It is also a constituent of bones, teeth, enzyme cofactor, (kinases etc.) (Murray *et al*., 2000). Potassium (3.17 mg/100 g) as the least of the macro mineral element found in *Micromesistus poutassou* is very important for its involvement in vital physiological functions such the osmotic and acid-base balances and both intra and extracellular concentrations related to the Na/K pump system (Mahan and Escott-Stump, 2002). Amidst the micro minerals, the highest concentration in M*icromesistus poutassou* ,was that of copper (4.60 mg/ 100 g) followed by iron (3.10 mg/100 g) and subsequently zinc (1.80 mg/ 100 g).Copper plays an important role in metabolic functions such as the mobilization of iron for hemoglobin synthesis besides being a cofactor of enzymes such as cytochrome C-oxidase, superoxide dismutase and monoamine-oxidase (Franco, 1995). Iron functions with hemoglobin in the transport of oxygen. In cellular respiration, it functions as an essential component of enzymes involved in biological oxidation such as cytochromes c, c_1, a_1, etc (Malhotra, 1998). The value recorded for iron in the fish muscle may be due to its availability in the water and the feeds it consumes. This value reported for M*icromesistus poutassou* is similar to the iron concentration in *Scomber scombus* (3.16 mg/100 g) as reported by Ogundiran et al, (2013); Dahunsi *et al*., 2012). Zinc acts as a co-factor for many enzymes and partakes in diverse metabolic processes such as cellular growth and multiplication, and the

functioning of macrophages and lymphocytes. (Maret, 2001). The presence of these minerals in this fish enriches its nutritional value even more.

3.3. Cholesterol Composition

The cholesterol content of *Micromesistus poutassou* was found to be 2.61 mg/ 100 g. Cholesterol, a sterol and also a lipid molecule, is biosynthesized by all animal cells since it is an essential structural component of animal cell membranes, that is required for the maintenance of both membrane structural integrity and fluidity. It also serves as a precursor for the biosynthesis of steroid hormones, bile acids and vitamin D (Hanukoglu, 1992). De Kooning (2005) has estimated that one fifth of the total cholesterol of fish passes into oil and four fifths in the muscle. In the liver, cholesterol is converted to bile salts, which solubilize fats in the digestive tract and aids in the intestinal absorption of fat molecules as well as the fat soluble vitamins A, D, E and K. Celik (2008) found the amount of cholesterol in *Oncorhynchus mykiss* to be 35.04 mg/ 100 g while Imre and Saglik (1998) reported the cholesterol content for some saltwater fishes to range from 40.3–75.3 mg /100 g. Robert and Macus (1990) also found the cholesterol content in some marine fish samples to be within a range 30–60 mg/100 g. The cholesterol value of *Micromesistus poutassou* in this study was found to lower than the above mentioned. This could be attributed to the fact that it is a lean fish. Cholesterol content in fish is influenced by several factors amongst which is the polyunsaturated fatty acid (PUFA) content. According to Kinsella (1986), an increase in the PUFA content will be followed by a decrease in the cholesterol level. In general, fish lipids contain cholesterol level least down to a level of 140 mg/100 g (Javitt, 1994). The results obtained in this study coincides with the above statement.

4. Conclusion

Nutritional information regarding proximate composition, mineral and cholesterol contents of *Micromesistus poutassou* from Agbalata market, Badagry Lagos was investigated in this research work. The study revealed that the muscle of *Micromesistus poutassou* was characterized by relatively high moisture, good protein level, low lipid content and good mineral elements. In perspective of nutritional value of the fish, the results of the study revealed that *Micromesistus poutassou* is a good healthy food that is rich in essential nutrients required for the maintenance of human health.

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