



## PROXIMATE COMPOSITION OF FRESH, COLD AND HOT SMOKED BLUE WHITING (*MICROMESISTIUS POUTASSOU*, RISSO 1827)

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### ABSTRACT

Fish is an important source of animal protein in the human diet. The proximate composition of foods includes moisture, ash, lipid, protein and carbohydrate contents. The study was carried out to determine the proximate composition of fresh, cold and hot smoked Blue whiting (*Micromesistius poutassou*, Risso 1827). Frozen 15 kg of *Micromesistius poutassou* (Blue whiting) was purchased and divided into 3 parts of 5 kg each to determine the fresh, hot and cold smoked (Proximate composition (moisture, protein, lipid, ash and carbohydrate) of the fish. Proximate analysis was carried out for fresh fish samples. The other parts were smoked in the NIOMR smoking kiln before proximate analysis of the fish were determined. Hot and cold smoked process of the fish were carried out for 7 hours at 80°C and 3 hours at 30°C respectively. The mean value results for ash, moisture, lipid, protein and carbohydrate for fresh fish were 3.33±0.58%, 76.34±0.9%, 2.81±0.37%, 17.23±0.62 % and 0.29±0.26% respectively while the mean value results for hot smoked fish were 4.2±1.15%, 15.66±0.21 %, 23.67±0.59 %, 56.45±1.01 % and 0.29±0.03 % respectively and cold smoked fish were 4.21±0.71 %, 68.26±0.21 %, 4.32±0.44 %, 20.76±0.34 % and 2.55±0.27 % respectively. The results of this study showed that ash, fat, and protein content increased after smoking and moisture content decreased after smoking. It also showed that *Micromesistius poutassou* belong to low fat group and it is high in protein content.

**Keywords:** cold smoking, Fresh *Micromesistius poutassou*, hot smoking, proximate composition.

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### INTRODUCTION

Fish is the cheapest source of animal protein [1]. It is one of the most important available sources of animal protein in the tropics and has been widely accepted as a good source of protein and other elements. It has a relatively 10% calories content hence its role in nutrition is recognized for the maintenance of healthy body [2, 3]. In Nigeria, fish and fish products constitute more than 60% of the total protein intake in adults [4]. They are widely accepted and a much-cherished delicacy that cuts across socio-economic, age, religious and educational barriers [5]. Interest in fish consumption has increased over the years, due to its health benefits it imparts and being a rich source of omega 3 fatty acids that reduces cholesterol levels and the incidence of heart disease and pre-term birth [6]. It is better digested than beef or other types of protein [7]. Fish and fish products constitute about 50% of the animal protein consumed in Nigeria [8] with a population of 209 million people [8].

*Micromesistius poutassou* (Blue whiting) popularly called Panla in Nigeria is among the fishes imported to Nigeria from Netherlands, Ireland, Germany, Norway, Russia, Chile, Iceland, Poland, Mauritania and Japan [9]. According to Food and Agriculture Organization [10], *Micromesistius poutassou* is a low oil fish with the fat content range 1.9- 3.0%. The water content is about 79-80% and the protein is 19-20%. Also, Kolade [11] stated that the fish belongs to high protein category. Fishes with lipid content (2-4%) are low fat [12], hence, *M. poutassou* (Panla) is considered as a low-fat fish. It's a common smoked fish found in Lagos and other regions of

Nigeria. *Micromesistius poutassou* (Panla) is a cheap and nutritious fish that can be bought fresh or smoked.

Preservation of food through smoking is a well-known method and is widely used in fish processing in the world. It is one of the oldest methods that has been used to process and preserve food [13]. The two types of smoking methods are hot and cold smoking. Fish smoking helps in slowing down fish deterioration thereby giving the commodity a longer shelf-life [14]. This study was carried out to determine the proximate composition of fresh, hot and cold smoked *Micromesistius poutassou* (Blue Whiting).

### MATERIALS AND METHODS

#### Sample collection

Fifteen kilogrammes (15 kg) of *Micromesistius poutassou* (Blue whiting) was purchased from Ofa ventures cold room at Bariga market, Lagos, Nigeria. The fish was transported immediately to the fish processing unit of the University of Lagos. The weight and length of fish ranges from 82.5 g to 191.2 g and 18 cm to 25 cm respectively.

#### Processing of fish

The fish were gutted and washed with tap water and placed in a plastic basin. The fish were divided into 3 parts of 5 kg each. Proximate analysis was carried out for fresh fish samples. The other part was smoked in the university of Lagos NIOMR smoking kiln before proximate analysis of the fish were determined. Hot and cold smoking of the fishes were carried out for 7 hours at 80°C and 3 hours at 30°C respectively.

### Proximate composition

After bringing the samples to uniform size by grinding and mixing, they were analyzed for moisture, protein, lipid, ash, and carbohydrate by the methods of AOAC [15] and conducted in Graduate Laboratory of chemistry department/Post graduate laboratory of the department of Marine Science, Faculty of Science, University of Lagos. The proximate analysis of the samples was carried out in triplicates.

The protein content of the fish was determined by micro-kjeldahl method. Moisture was determined by oven drying method. Samples were dried in an oven at 100-105°C for 24 hrs until a constant weight was obtained. Ash content was determined by placing the sample in muffle furnace at 550°C for 2-4 hours until fully ashed which was indicated by the appearance of grey white ash. Fat content was determined by using the Soxhlet extraction method. Carbohydrate content was determined by the addition of protein, ash, fat and moisture and subtracted from 100%.

### Statistical analysis

Data were analysed using SPSS 25.0 software. Treatment means were compared using Analysis of Variance and Duncan Multiple Range Test.

### RESULT

The proximate composition of Fresh, hot and cold smoked *Micromesistius poutassou* is shown in Table 1. Fresh fish contains 3.33±0.58 % of ash, 76.34±0.9% of moisture, 2.81±0.37 % of fat, 17.23±0.62% of protein and 0.29±0.26% carbohydrate, hot smoked *Micromesistius poutassou* fish contains 4.2±1.15% ash, 15.66±0.21% moisture, 23.65±0.59% lipid, 56.45±1.01% protein and 0.29±0.03% carbohydrate and cold smoked *Micromesistius poutassou* fish contains 4.21±0.21% ash, 68.26±0.21% moisture, 4.32±0.44% lipid, 20.76±0.34% protein and 2.55±0.27% carbohydrate. In Table 2, significant difference ( $p < 0.5$ ) in weight and water loss of hot and cold smoked *Micromesistius poutassou* was shown in relation to processing time after smoking.

### DISCUSSION

Ash is a measure of mineral content in food, fish inclusive [16]. The ash content of fresh fish in this study is 3.33%. This study is in agreement with Ergeton *et al.*; Kolade [17, 11] which states that the ash content of fresh *Micromesistius poutassou* is within the range of 3-4% and 1.9-3.3% respectively. The ash content of fresh fish is 3.33% while the ash contents of hot and cold smoked fish are 4.2% and 4.21 respectively. There was no significant difference ( $p > 0.05$ ) between the ash content of hot and cold smoked *Micromesistius poutassou*. The increase in the percentage ash content after smoking is due to the removal of major portion of the moisture inside the

fish tissue during smoking process [18]. This study is in agreement with Umar *et al.* [19], who reported an increase in ash content of smoked *Clarias gariepinus* and *Oreochromis niloticus* after smoking in the study of nutritive value of fresh and smoked fish (*Clarias gariepinus* and *Oreochromis niloticus*) from Dadinkowa dam Gombe. Also, Masud and Subhash [20], recorded increase in ash content of smoked fish samples when compared with that of fresh fish in the study of the effect of salt and smoke on quality and shelf life of salt-smoke-dried Batashi (*Neotropius atherinoides*) kept at different storage condition. Moisture content of fresh *Micromesistius poutassou* in this study is 76.34%. The result in this study agreed with the result reported by Jahan *et al.* [18] in the study of three Marine Pelagic fish, that *Micromesistius poutassou* moisture content range is 76 - 80%. Mahmud *et al.* [13] also recorded high moisture content in range of 71.44-80.48%, in the study of the proximate and major mineral composition of 23 medium sized marine fin fishes. Talab and Ghanem [21], recorded 76.52% moisture in grey mullet fish. Ondo-Azii *et al.* [22], reported moisture content of between 74.36-78.50% in the study of proximate composition and microbial study of five marine fishes consumed in Garbon. Masud *et al.* [23], also recorded high moisture content of 76.06% in *Mystus tengara* fish. The result is not in agreement with Kolade [11] which stated that moisture content of *Micromesistius poutassou* range is 79-80%. Ahmed *et al.* [24], recorded a lower water content of 69.45% in *Hydrocynus spp* and 67.23% in *Schilbe spp*. Abbas & Khogalie [25, 12] also recorded a lower moisture content 70.9% in *Hydrocynus sp* and 74.99% in *Micromesistius poutassou* respectively. After hot and cold smoking, the water content of *micromesistius poutassou* decreased from 76.34% to 15.66% and 68.26% respectively. There was significant difference ( $p < 0.05$ ) in moisture content of fresh, hot and cold smoked *Micromesistius poutassou*. This is attributed to the removal of water during smoking due to application of heat which reduces water activity in fish tissue [26]. Also, the weight of fish reduces in relation to smoking time, due to the smoking process, there was significant difference ( $p < 0.05$ ) in loss in weight between hot and cold smoked *Micromesistius poutassou* (Table 2). According to Maria *et al.* [27], the weight loss is due to dehydration during smoking. The protein content of fresh *Micromesistius poutassou* in Table 1 is 17.23%. The fish was found to be high in protein. This proved that the fish belong to the group of fish that are termed as high protein. This study coincides with the report of Masud *et al.* [23] who reported that protein content of five marine fish species is in range 16.05-20.78%. Also, in agreement with Kolade, Jahan *et al.* [11, 18] who recorded 16-18% protein content. It is not in agreement with Palani Kumar *et al.* [12] who reported protein content of 18.06% in *micromesistius poutassou* in the study carried on biochemical composition of

*Micromesistius poutassou* from Alagbata market, Badagry. Also, not in agreement with Abbas & Khogalie [25] who reported 19.5% protein in *hydrocynus sp.* After smoking, there were significant difference ( $P < 0.05$ ) in fresh, cold and hot smoked *Micromesistius poutassou*. This agrees with the findings of Adeyeye *et al.* [28], who reported the mean protein contents of fresh silver catfish, spotted tilapia, Bonga shad, Nigerian tongue sole, and Guinea barracuda samples were 15.70%, 17.85%, 15.18%, 17.96% and 17.89% and their smoked samples were 54.80 %, 59.35 %, 56.18 %, 57.11 % and 58.63 % respectively. Oyedokun [29], also reported an increase in protein content of *C. gariepinus*, *O. niloticus* and *M. rume* after smoking. This finding is also in agreement with the report of [30], who reported that protein content of fish increases with smoking in the study on the nutritional composition of *Clarias gariepinus* obtained from NIOMR smoking furnace. The increase in protein content may be due to loss of moisture resulting in aggregation in the proteins [31, 32]. Generally, fishes are grouped into four categories according to their fat contents; lean fish (less than 2%), low fat (2-4%), medium fat (4-8%) and high fat [13]. The fat content of fresh *Micromesistius poutassou* in this study is 2.81%. The result shows that the fish belongs to low fat/ low oil category (2-4%). The result is in agreement with Jahan *et al.* [18] which states that fat content of *Micromesistius poutassou* range 2-4% in their study of proximate composition of three marine pelagic fish: blue whiting (*Micromesistius poutassou*), boar fish (*Capros aper*) and Atlantic herring (*Clupea harengus*). Also, in agreement with Kolade [11] which reported fat content of 1.9-3.0% in *Micromesistius poutassou*. The result tallies with Palani Kumar *et al.* [12] which states that the fish belongs to low fat category (<5%) in the study of biochemical composition of *Micromesistius poutassou* from Alagbata market in Badagry Lagos West, Nigeria. After cold and hot smoking, there was an increase in fat content from 2.81% for fresh fish to 4.32% and 23.67% for cold and hot smoked fish respectively. This could result from the evaporation of moisture during the smoking process. The result in this study is in agreement with Oyedokun [29], recorded mean fat contents of fresh silver catfish, spotted tilapia, Bonga shad, Nigerian tongue sole, and Guinea barracuda samples were 8.38%, 5.79%, 7.81%, 6.89% and 4.62% and their smoked samples were 19.32%, 13.39%, 18.09%, 12.83% and 14.16% respectively. Also in agreement with the result of Aiyelaja and Akinrotimi [33] in the study of evaluation of Smoking Process on Proximate Composition of Some Marine Fish Species observed increase in fat content of *Ethmalosa fimbriata*, *Pseudotolithus elongatus*, *Mugil cephalus* and *Lutjanus goreensis* from  $9.10 \pm 0.35\%$  to  $10.05 \pm 0.02\%$ ,  $5.15 \pm 0.01\%$  to  $14.20 \pm 0.03\%$ ,  $3.15 \pm 0.02\%$  to  $11.53 \pm 0.04\%$  and  $3.27 \pm 0.01$  to  $35.13 \pm 0.05\%$  respectively. The result agrees with the

work of Bouriga *et al.* [34] who recorded an increase in the fat content of *Clarias gariepinus* from 14.28% for fresh fish to 21.20% when smoked. The carbohydrate content in this study is 0.29% in fresh and hot smoked fish. This agrees with Food and Agricultural Organisation [10] which reported that the carbohydrate content in fish is usually low, <0.5. The result in this study does not agree and was found to be lower than those reported by Olagbemide, and Ayelaja *et al.* [35, 36].

## CONCLUSION

The result of this study revealed that smoking process changes the proximate composition of the fish after smoking. The findings indicated increase in protein, ash, and lipid contents and decrease in moisture content after smoking. It also showed that the fish is high in protein and belongs to low fat category of fishes.

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**Table 1:** Result of Proximate composition of Fresh, Hot and Cold smoked *Micromesistius poutassou*.

Nutrient	Fresh Fish (Mean Value)	Hot smoked fish (Mean Value)	Cold smoked fish (Mean Value)
Ash	3.33±0.58	4.2±1.15*	4.21±0.21*
Moisture	76.34±0.9*	15.66±0.02	68.26±0.21*
Fat	2.81±0.37	23.67±0.59*	4.32±0.44
Protein	17.23±0.62	56.45±1.01*	20.76±0.34
Carbohydrate	0.29±0.26	0.29±0.03	2.55±0.27*

Values represent mean ± standard deviation in (%)

\*Represents significant value.

**Table 2:** Weight changes during smoking process of hot and cold smoked *Micromesistius poutassou*

<b>Parameters</b>	<b>Hot smoked</b>	<b>Cold smoked</b>
<b>Initial Weight (kg)</b>	5	5
<b>Weight when smoked (kg)</b>	1.3	3.75
<b>Water Loss (kg)</b>	3.7	1.25
<b>% Water Loss</b>	74	25
<b>Processing Time (hrs)</b>	7	3