



## Bacteriological status and proximate composition of croaker (*Pseudotolithus elongatus*) from retail outlets in Makoko environs in Lagos State, Nigeria

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### ABSTRACT

Fish is a food with excellent nutritional value due to its high protein content but it could also be responsible for ill health. The microorganisms present in fish could be from the natural micro flora or those introduced through fecal contamination or during processing, storage and distribution. This study assessed the bacteriological status and the proximate composition of croaker bought from retail outlets in Makoko environs in Lagos state. Fresh and smoked croaker were collected and analyzed for bacterial pathogens using standard microbiological procedures. The bacterial load ranged between 4.37 and 5.00 (Log<sub>10</sub> cfu/g). The mean proximate composition of fresh croaker was 21.43% crude protein, 75.52% moisture, 1.28% ash and 0.25% lipid while smoked croaker contains 39.22% crude protein, 51.89% moisture, 1.28% ash and 1.48% lipid. All pathogens tested for were present in fresh croaker. However, *Salmonella* spp. was not isolated from smoked croaker. It can be inferred from this study that there is a need to improve on the hygiene and sanitary conditions in this market to ensure that fish sold is safe for human consumption.

**Keywords:** *Pseudotolithus elongatus*, Bacterial load, Contamination, Sanitary conditions, Makoko

### INTRODUCTION

The increasing urban population in African countries calls for attention on food safety and quality. In Nigeria, fish is one of the most consumed food product. There has been an increase in awareness on the nutritional and health benefits of the consumption of fish in the last two decades (Din *et al.*, 2004). The consumption of fish is recommended due to its good digestibility and high content of polyunsaturated fatty acids (Oluwaniyi and Dosunmu, 2009). Fish is a food of excellent nutritional value. It is made up of lipid, moisture, and protein and this constitutes the nutritional value, functional aspects and sensory characteristics of the flesh (Adejonwo, 2016). Fish provides high quality protein rich in essential amino acids and a lot of minerals which includes phosphorus, magnesium, iron, zinc and iodine in marine fish.

Depending on their lipid content, fish are classified as lean, semi fatty or fatty. Fish oils in fatty fish such as salmon, tuna, mackerel and sardine are the richest source of polyunsaturated fatty acids such as eicosa-pentaenoic acid and docosahexaenoic acid. Fish is also a good source of vitamin B and in fatty species, vitamins A and D. It also has non protein nitrogen fraction that plays a vital role in fish quality (Arino *et al.*, 2013). In order to meet the required food regulations and commercial specifications, the measurement of proximate profiles such as protein, moisture, ash and lipids are very important (Watermann, 2000; Tawfik, 2009; Surtharshiny and Sivashanthini, 2011; Ondo-Azi *et al.*, 2013). However, attention should be given to all these interests as their impact can be decreased by bacterial activities. Also, the proximate

composition of fish helps in estimating the quality of the raw material for its maximum use (Mridha *et al.*, 2005; Adejonwo, 2016). In addition, the knowledge of proximate composition of fish species from water bodies in Nigeria is limited. Despite the fact that these important fish species are in high demand, data on proximate analysis is scanty.

The species of genus *Pseudotolithus* (family: Sciaenidae) (croakers) constitute an abundant and commercially important fish in Benin near shore waters (Sossoukpe, 2011; Sossoukpe *et al.*, 2013; Nunoo *et al.*, 2013) and indeed throughout the Atlantic coast of West Africa (Nunoo *et al.*, 2013). In Nigeria, various fish species are found in water bodies and these fish species serve as food and are of great importance to the country economically. Important fish species like the croakers, catfishes, tilapias, threadfins account for about 90% of Nigeria's fishery (FDF, 2004; Osibona, 2011). The preservation of fish is a major concern because it is highly perishable, especially when the species are found in the tropical regions. However, in urban centers, freezing is a method of preservation mostly used but the supply of electricity cannot be fully guaranteed. The production and release of toxins from bacteria infected fish is referred to as food borne intoxication or disease (Odu and Imaku, 2013). Fish product, thus, requires very good processing and handling practices in preserving its functional components and nutrients (Abolagba and Igbinevo, 2010). The hypothesis states that the microorganisms found in infected fish could cause ill health when inadequate processing practices are not applied. Since fish can be contaminated in various ways with microorganisms, this study was therefore carried out to determine the bacteriological status as well as the proximate composition of *Pseudotolithus elongatus* (croaker) bought from Makoko market in Lagos.

## MATERIALS AND METHODS

### Sample collection

In this study, twenty (20) fresh and twenty (20) smoked samples of *P. elongatus* were bought from Makoko fish market. This market has a close proximity to Lagos Lagoon in Yaba Local Government area of Lagos State, Nigeria. Its geographical coordinates are 6° 29' 46" North and 3° 23' 16" East. The specimens of *P. elongatus* were collected in separate sterile polythene bags, labeled and taken to

the Microbiology laboratory at the Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos for microbiological studies. The fresh samples were put into a cooler box containing ice packs. The samples were bought on a quarterly basis for a period of twelve months.

### Proximate composition analysis

Using the oven drying method, the moisture content of the samples was determined. This is done by drying a known weight of the fillet at 105 °C until a constant weight was attained (AOAC, 1994). The determination of the ash content was carried out by incineration of the dried sample obtained from the determination of moisture in a muffle furnace at 525 °C for 24 hrs. The protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method (6.25 x N) (AOAC, 1994). The lipid was extracted using a modified method of Bligh and Dyer as described by AOAC (1994). All the experiments were made in triplicate and the result were expressed on mean value given.

### Microbiological analysis

The bacteriological status of croaker (*Pseudotolithus elongatus*) was determined by using standard microbiological procedures. Forty samples of croaker (20 smoked and 20 fresh) were bought from Makoko market. About 5 g of each fish sample was crushed into small pieces in a sterile mortar. This was then homogenized in a beaker containing 45 ml of sterile distilled water giving a 1:10 dilution. Microbiological load determination was carried out using standard decimal dilutions. The media used for the bacteriological analysis were Nutrient agar (NA) for total bacterial count, Mannitol salt agar (MSA) for *Staphylococcus aureus* and Salmonella Shigella agar (SSA) for *Salmonella*. All samples were inoculated on different agar plates separately, labeled and incubated at 37 °C for 24 hours for evidence of growth. Pure cultures of the isolates were Gram stained, while the cell morphology were observed under the microscope.

### Statistical analysis

The data collected was subjected to SPSS version 16.0. Mean differences were determined using Duncan's Multiple Range test. A significant difference of  $P < 0.05$  was established.

## RESULTS

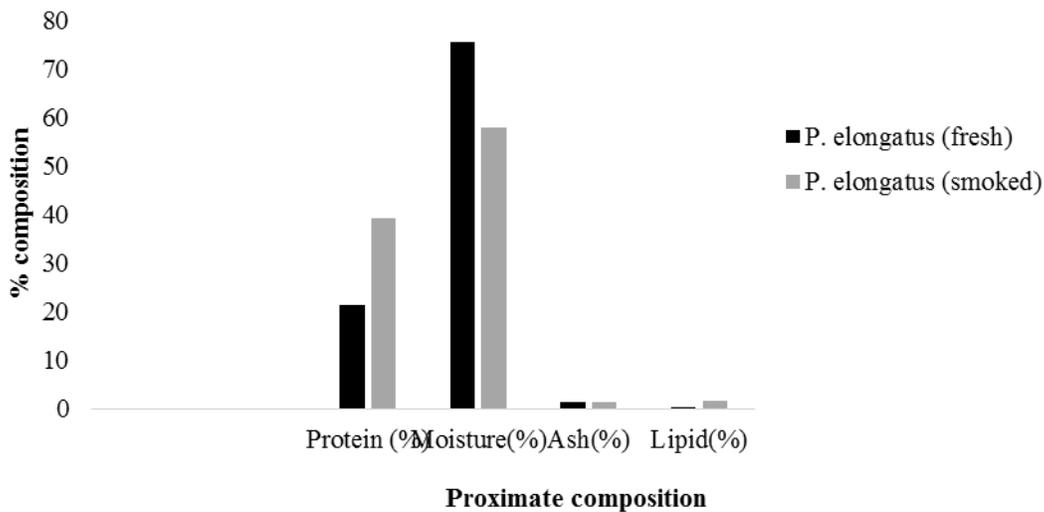
### Proximate composition

The mean quarterly proximate compositions of *Pseudotolithus elongatus* (croaker) for both fresh and smoked is shown in fig. 1. The protein content of fresh croaker was 21.43%, moisture, 75.52%, ash, 1.28% and lipid, 0.25% while smoked croaker contains 39.22% protein, 57.89% moisture, 1.28% ash and 1.48% lipid.

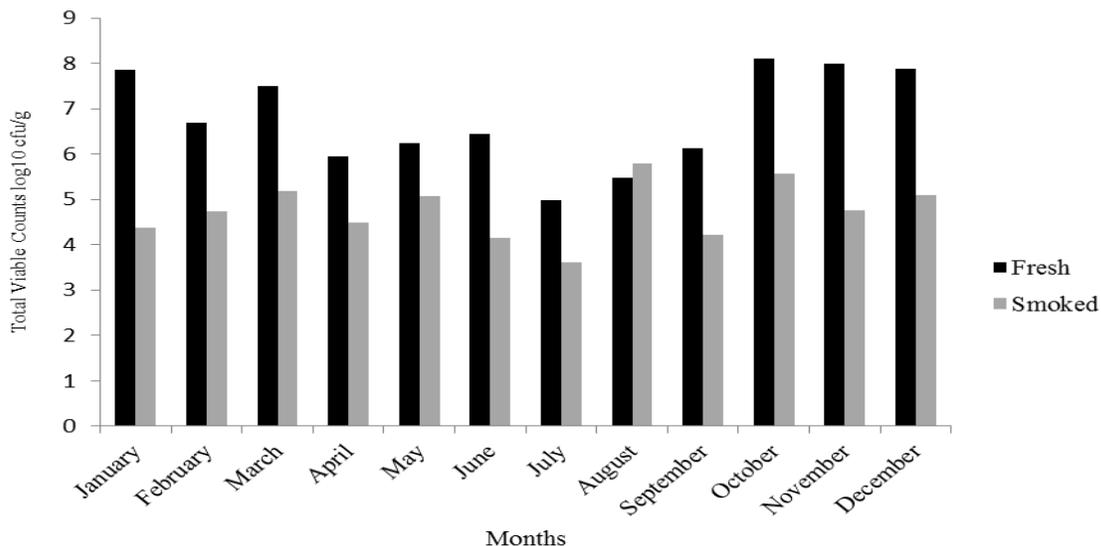
### Microbiological analyses

The bacterial load of *P. elongatus* is shown in figure 2. It reveals that the mean total viable count of fresh *P. elongatus* ranged from 4.98 - 8.11  $\log_{10}$  cfu/g while that of smoked *P. elongatus*

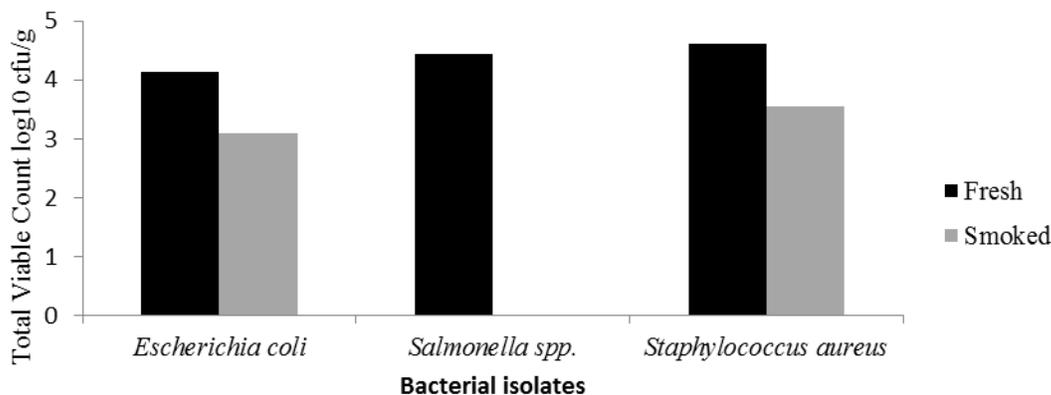
ranged from 3.98 -5.79  $\log_{10}$  cfu/g. Organisms of the family Enterobacteriaceae was also found in both smoked and fresh *P. elongatus*. The mean value of the microbial isolates found in both fresh and smoked *P. elongatus* is presented in figure 3. The mean TVC value of *Escherichia coli* ranged from 3.52 – 4.76  $\log_{10}$  cfu/g, 2.99 – 3.18  $\log_{10}$  cfu/g in fresh and smoked *P. elongatus* respectively. It was quite different in the case of *Salmonella* spp. because this organism was only found in fresh *P. elongatus* with a range of 4.21 – 4.65  $\log_{10}$  cfu/g. It was not detected in smoked *P. elongatus*. *Staphylococcus aureus* showed a high range of 4.45 – 4.77  $\log_{10}$  cfu/g and 3.22 – 3.85  $\log_{10}$  cfu/g in fresh and smoked fish respectively.



**Figure 1:** Proximate composition of fresh and smoked *P. elongatus* in Makoko environs in Lagos state.



**Figure 2:** Total Viable Count of Fresh and Smoked *P. elongatus* from Makoko environs in Lagos State



**Figure 3:** Microbial Load of *P. elongatus* from Makoko environs in Lagos State

## DISCUSSION

Basically, fish is made up of moisture (66-81%), protein (16-21%), lipids (0.2-25%) and ash (1.2-1.5%) (FAO, 1999 and Adejonwo, 2016). In this study, *P. elongatus* contained high level of protein in both fresh and smoked *P. elongatus*. This is similar to the findings of Osibona (2011) who reported that *Pseudotolithus* species have high protein content. The high percentage of protein content of this fish species is a good source of animal protein and this can be used in treating protein deficiency conditions. The high level of protein content may be attributed to the proteinous content of what they feed upon as they feed mostly on molluscs, algae, diatoms and crustaceans (Osibona, 2011).

However, the result for lipid determination was low. This is quite similar to the findings of Njinkove *et al.* (2016) who reported lipid determination as 0.36% in fresh *P. elongatus*. The variation in lipid content shows that this fish species belongs to the low oil category and this could be due to the fact that *Pseudotolithus* species does not store lipid in the muscle. Basically, fish can be categorized into four groups according to their fat content: lean fish (<2%), low fat (2-4%), medium fat (4-8%) and high fat (>8%) (Ackman, 1989). Hence, *P. elongatus* can be considered as lean fish.

Ash is equally an important component because it is a measure of the mineral content. In this study, the ash content of *P. elongatus* shows that it is a good source of minerals such as magnesium, iron, potassium, calcium and zinc. In this study, the ash content of *P. elongatus* is 1.28% for both fresh and smoked. This is quite different from the findings of Abraham-Olukayode *et al.* (2013) who re-

ported the ash content of *P. elongatus* to be 1.50%.

One major component of fish is moisture. This study recorded high levels of moisture in both fresh and smoked *P. elongatus*. Ackman (1989) reported that the moisture content of fish is between 70-80% of the total weight. Njinkove *et al.* (2016) also reported that fresh *P. elongatus* contained 78.24% of moisture which is quite different from the findings of this study. The moisture content is within acceptable limits. Ondo-Azi *et al.* (2013) also reported high moisture content in *Pseudotolithus* species.

According to the International Commission on Microbiological Specification for Food (ICMSF), the maximum recommended bacterial count for good quality product is 5.7 log<sub>10</sub> cfu/g (ICMSF, 1986). The bacterial load for smoked croaker and some fresh croaker samples obtained from Makoko market were within the acceptable limit. Ola and Oladipo (2004) also had a bacterial load of 3.72 log<sub>10</sub> cfu/g from fresh croaker that fell within the specified range; but Ibrahim *et al.* (2014) had a higher bacterial load of 6.26 log<sub>10</sub> cfu/g from fresh catfish.

*Salmonella spp.* were isolated from fresh fish in this study and this is in agreement with Ibrahim *et al.* (2014), who reported the presence of *Salmonella spp.* in fresh catfish. *Salmonella spp.* was absent in smoked fish in this study. This is supported by Olayemi *et al.* (2012), who also did not isolate *Salmonella spp.* from smoked fish. *Salmonella* is one of the most important food-borne pathogens, being responsible for about half the reported cases and outbreaks of food borne diseases in US (Butt *et al.*, 2004). There are several instances of rejection of shrimp from South East Asia due to contamination with *Salmonella*. It is generally

believed that like *Escherichia coli* and *Salmonella* are not present in the natural aquatic environment but are derived as a result of sewage contamination. However, unlike *E. coli*, *Salmonella* is associated with a number of non-human hosts e.g. reptiles (Winfield and Groisman, 2003).

According to Adeyeye *et al.* (2015), the occurrence of *S. aureus* from fresh spotted tilapia fish was within a range of 2.79 – 2.94 log<sub>10</sub> cfu/g while that of smoked bonga shad fish from different processing centers was within a range of 3.21- 3.94 log<sub>10</sub> cfu/g. The results from this study revealed that *Staphylococcus aureus* was present in all the samples. The presence of *S. aureus* was attributed to the contamination of fish samples by man (Eze *et al.*, 2011). *S. aureus* in fish has also been isolated by other researchers (Okonko *et al.*, 2008; Abolagba *et al.*, 2011; Ibrahim *et al.*, 2014). *S. aureus* is an indicator of hygiene and sanitary conditions, the presence of this organism indicates the unhygienic condition during processing, storage and distribution (Tavakoli *et al.*, 2012).

## CONCLUSION

This study has provided basic scientific and detailed knowledge of the proximate composition of *P. elongatus*. This study also revealed that *P. elongatus* has high levels of protein and moisture content. On the overall *P. elongatus* is of great benefit to man because of its high nutritional components. The organisms isolated in this study are of public health significance and their presence suggests that foodborne illness could arise if these fishes are consumed in the undercooked state. Thus, it is recommended that hygienic and sanitary practices in Makoko market be improved upon in order to have relatively safe products for consumption.

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