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Microbiological Quality of Traditional Smoked Catfish (*Clarias gariepinus)* In Selected Local Government Areas of Kebbi State, Nigeria

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ABSTRACT

This study was aimed at assessing the effect of traditional smoking methods on fish Quality from three selected local government in Kebbi state. 2kg of samples we're collected from three locations namely Jega, Yauri and Argungu local government. The samples were stored in an air tight bag for 6 weeks after which they were taken to the laboratory for proximate analysis and microbial analysis. The mean moisture content ranged from 8.50 - 9.00, crude protein ranged from 47.16 - 48.32, fibre content ranged from 1.50 - 2.00. The sensory evaluation revealed that color, odor and taste of samples from Yauri and Argungu were the most preferred. Six (6) microorganisms were identified; aggregate lowest means microbial count was 59.67x105 CFU/g for Yauri and highest count was 69.47 x 105 CFU/g for Jega. The results analyzed revealed that they were not significant.

INTRODUCTION

Fish and fishery products are an important food component for a large part of the world's population, with an average consumption level of 20.1 kg per capita (FAO, 2016). In developing countries, fish is a relatively cheap and accessible protein source, suitable for complementing high carbohydrate-based diets of West African population (Adeyeye *et al.,* 2015; Ikutegbe and Sikoki, 2014). Fish is one of the best sources of proteins, vitamins and minerals and are essential nutrients required for supplementing both infant and adult diets (Abdullahi et al., 2001).

In Nigeria, it has also been noticed that fish is eaten fresh, preserved or processed (smoked) and form a much-cherished delicacy that cuts across socio-economic, age, religious and educational barriers (Adebayo-Tayo et al., 2008). Among muscle food, fish is the most perishable and loses freshness after death due to autolytic and microbial spoilage (Dehghani, *et al.,* 2018; Matak,*et al.,* 2015). In tropical regions, conservation of fresh fish remains a problem because of the lack of adequate infrastructures, and environmental and climatic conditions that contribute to its spoilage within few hours (Anihouvi, *et al.,* 2012). To prevent fish spoilage and reduce postcapture losses, various preservation methods including frying, fermentation, drying, salting, and smoking are used (Adeyeye et al., 2015; Ikutegbe and Sikoki, 2014). Smoking consists in submitting fish to direct or indirect action of smoke during the incomplete combustion of certain trees used as fuel. Smoking of foodstuffs improves food organoleptic characteristics, induces water loss, and reduces the microbial load, thanks to heat and the presence of aromatic and bactericidal substances (Chakroborty & Chakraborty, 2017; Yusuf et al., 2015).

Fish and fish products are involved in 10-20% of foodborne diseases (Pilet & Leroi, 2011), and the presence of pathogenic bacteria such as Staphylococcus aureus, Salmonella spp., pathotypes of Escherichia coli, and Listeria monocytogenes has been reported in SF (Adeyeye et al., 2015; Ayeloja, *et al.*, 2018; Ineyougha, Orutugu, and Izah, 2015; Likongwe, *et al.,* 2018; Nunoo and Kombat, 2013). Another concern is the contamination by fungi. In this respect, various studies have reported the occurrence of aflatoxigenic fungi in SDF (Ayeloja et al., 2018; Babalola, *et al.,* 2018; Job, *et al.,* 2016). Therefore, it is necessary to identify microbiological quality of smoked dried fish. This study was aimed at assessing the effect of traditional smoking methods on fish quality.

MATERIALS AND METHODS

Sampling procedures and storage

A total of 30 (thirty) smoked- dried catfish (*Clarias gariepinus*) each were collected from three different local government in Kebbi state. They include Yauri, Argungu and Jega local government, Kebbi state, Nigeria. The fish samples were taken to the Molecular Laboratory at Faculty of Science Kebbi State University of Science and Technology, Aliero, Kebbi state for bacteriological analysis. The samples were preserved in air tight polythene bags for 6 weeks. Proximate and bacteriological analysis was conducted on the stored samples after 6 weeks.

Physical characteristics

Characteristics such as colour, odour, and texture of the traditionally smoked dried fish were examined using organoleptic / sensory test. The entire test was done in triplicate and the mean values were taken.

Sensory Evaluation

Ten test panels were selected for sensory evaluation. Every week samples were brought out in a clean plate for assessment of taste and observations were recorded. Table was generated using Hedonic scales.1= Bitter, 2 - slightly salty, 3 - salty, 4 - good

Proximate Analysis

The proximate compositions were determined using standard method described by AOAC (2000). Each analysis was carried out in triplicate.

Bacteriological Test

The bacteriological test was done in triplicates using standard plate count. 1g of the fish products for each of the three samples were diluted into (nine) 9mls of distilled water in sterilized universal tube (A.O.A.C., 2000).

Data analysis

The data obtained were subjected to descriptive statistics using SPSS version 20. One way analysis of variance (ANOVA). Means were separated using Duncan multiple range test ($P< 0.05$).

RESULTS AND DISCUSSION

The proximate composition of fish samples from the three locations after 6 weeks storage is presented in Table 1. Samples from Yauri and Argungu had the least moisture content (8.50) and were not significantly different ($P >0.05$), while samples from Jega had the highest value (9.0). This could be as a result of the different fish smoking methods and the amount of moisture lost during sun drying. Ali *et al* (2011) reported similar results that percentage moisture content in smoked dried fish was least compared to sun dried fish and had longer shelf life and keeping quality. The percentage of crude protein ranged between 47.16 to 48.32 with Jega having the highest crude protein content. The process of smoking reduces the percentage crude protein of fish (Ime – *Ibanga et al.* 2008).

Table 1: Proximate composition of smoked dried *Clarias gariepinus* samples

Location	Moisture%	Protein%	Fibre%	Lipid%	Ash%	Carbohydrate%
Jega samples	9.00±0.06[a]	48.32±0.34[a]	2.00±0.06[a]	10.50±0.23[a]	7.00±0.06[a]	22.85±0.60[b]
Yauri samples	8.50±0.23[a]	47.16±1.53[a]	2.00±0.06[a]	10.00±0.12[a]	6.00±0.06[c]	26.34±0.56[a]
Argungu samples	8.50±0.17[a]	47.20±1.20[a]	1.50±0.00[b]	11.00±0.58[a]	6.50±0.06[b]	24.64±0.58[a]

Means with the same letters were not significantly different (p>0.05)

Table 3 showed that all fishes from the three sources have both fungi and bacteria and 6 microorganisms were identified. Thus, the relatively high humidity and high temperature of about 30^{o}C might have favoured or provided optimum growth environment for the bacteria and fungi. Also the unacceptable direct contact with hands of purchasers and hawkers could have contributed significantly to the prevalence of different microbes. The count of bacteria and fungi as represented in table 4 and 5 are within the class B of the microbiological quality category of ready- to –eat foods. Yauri and Argungu had the lowest count of 2.60 x 10^5 cfu/g while Jega had the highest fungi count of 2.83 x 10^5cfu/g. The study showed that Yauri has least bacteria count of 116.70 x 10^5 cfu/g and Jega had the highest count of 136.70 x 10^5 cfu/g. these rate of bacteria load was as a result of different smoking methods (Eyo, 2001).

Table 3: Microbial types on smoked dried fish from three different locations

Location	Identified fungus isolated	Identified bacterial isolated
Jega	*Aspergillus spp*.	*Streptococcus spp.*
Yauri	*Aspergillus spp.*	*Bacillus spp.*
Argungu	*Mucor spp.*	*klebsiella*

The mean values of bacteria and fungi count of smoked dried fish from three different sources is presented in Table 4. The highest bacteria colony was in Jega and highest fungi were in Yauri Local Government.

Table 4: Bacteria and fungi count on smoked dried fish from three different locations.

Location	No of bacteria colonies (10^5)	(CFU X No of fungi colonies 10^5)	CFU X Mean (CFU X 10^5)
Jega	136.67±12.01	2.23±0.40	69.45
Yauri	120.00±5.78	2.63±0.43	61.32
Argungu	119.67±11.83	2.60±0.38	61.14

The aggregate lower mean of microbial count was 59.67 x 10^5 cfu/g for Yauri while the highest count of 69.47 x 10^5 cfu/g was for Jega. There is no significant differences (P>0.05) between all means of the various sources of the smoked dried fish.

Table 5: Mean microbial count (cfu x 10^5)

Microbes	Jega	Yauri	Argungu
Bacteria	136. 70[a]	116.70[a]	119.60[a]
Fungi	2.83[a]	2.60[a]	2.60[a]
Mean	69.47	59.67	61.10

Means with the same letters are not significantly different (P>0.05)

CONCLUSION

From the results obtained, it showed that the presence of pathogens on smoked dried fish is an indication that the hygiene and safety of such fish is low. Therefore the study recommends the use of mechanized smoking system that would dehydrate the fish to prevent contamination due moisture content and caution should be exercised on the consumption of processed fish stored on open shelf for five weeks and above.

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