MICROBIAL ASSESSMENT OF GARLIC ON THE SAFETY AND SHELF LIFE OF SMOKED TILAPIA FISH (*Oreochromis niloticus*)

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Abstract

Fish has been playing an important role in addressing nutritional and livelihood security of people in the developing countries. This work was carried out to assess the microbial assessment of garlic on the safety and shelf life of smoked tilapia fish (oreochromis niloticus). The microbial load counts (TVC, TCC and TFC cfu/g) and isolated microorganism were evaluated on smoked tilapia fish preserved for 0, 2, 4, 6 and 8 weeks with 5g of salt, garlic (natural preservatives) and untreated sample. Highest Bacteria Count (TVC) of 3.5×10^5 was recorded in salt sample at the 8 weeks of storage and highest fungi count (TFC) of 5.5×10^6 was recorded in untreated sample at week 2 of storage while highest coliform count (TCC) of 4.2×10^5 is recorded in untreated samples at week 2 of storage and the microorganism isolated from the samples showed that the highest number of microorganism species was recorded in untreated sample with 8 species of microbes while the least was in garlic with 3 species of microbes. Statistical analysis shows a significant difference in the number of colonies formed between the groups at ($p < 0.05$). The preservative samples used in this work, reduced the microbial load, discourage quick spoilage, and encourage longer shelf-life of smoked tilapia fish.

Key words: Smoked fish, microbial load, garlic and salt.

Introduction

Fish is a highly nutritious food and it is particularly valued for its protein which is of high quality compared to those of meat and egg (Ojutiku et al., 2009). Fish provides 20% of animal protein intake to about 2.6 billion people globally and at least 50% of animal protein intake for over 400 million in Asia and Africa. But, in developed countries, it provides only 13% of animal protein intake (FAO, 2008). Dried fish is a major component of harvested fisheries in many countries including Nigeria. About 25 to 30% of the world fish catch is consumed in the dried, salted, smoked form or combination of these processes (Aliya et al., 2012). In Nigeria, there is an increase in the consumption of smoked fishes among the people. And some people testified that they do not eat foods that are preserved unnaturally due to health risk. Some chemical preservatives like table salt, brining, addition of sodium sorbate are commonly used for smoking of fish in which they may have adverse effect on human health but herbal preservatives have no effect and add to the flavor and seasoning for some foods and they also act as antimicrobial agents by killing microbes that present in the food. Herbal preservatives also called natural preservatives are used in preserving food naturally. Some of these herbal preservatives consist of proteins, eugenol, gallic-acid, folate, tannis, vitamin B, vtamin C, vitamin E, vitamin K, choline and triterpene. Preservatives are substances, are either natural or synthetic that helps keep foods fresh looking and tasting longer and prevent them from deteriorating and rotting too quickly (Wikipedia, 2010). Garlic, Latin name Allium Sativum belongs to the onion family Alliaceae including shallots and leek, Garlic has been used throughout recorded history for both medicinal and culinary purposes (Wikipedia, 2010).

Materials and Methods

Study Area: The study was carried out at Oyo state college of Agriculture and Technology which is located in Igboora, within $7^0.5$ North and $3^0.30$ east of the equator with an average annual rainfall of 1278mm and average annual temperature 27^0c (Sanusi 2011).

Sample collection: Thirty kilogramme (30 kg) of fresh tilapia (*Oreochromis niloticus*) were purchased from Oyan dam in Ogun State of Nigeria. The samples were taken to the Department of Science Laboratory Technology of the Oyo State College of Agriculture and Technology, Igboora where the experiment was carried out. The natural Preservative (garlic) was bought at Towobowo local market in igboora, Oyo State.

Processing of natural preservatives: The garlic was milled to fine powder with the aid of a

Binatone blender (Model BLG+10), sieved and weighed, then poured inside an air-tight container until ready for use. The samples were subjected to treatments where group 1, was not treated (control) and group 2 was mixed with 5g of garlic or salt. Smoking was done at fish farm processing unit of Oyo State College of Agriculture and Technology Igboora, according to the methods described by Omojowo and Ibitoye (2005).

Microbiological Analysis: The samples were subjected to analysis after two, four, six and eight weeks of storage at a room temperature on total viable count (TVC), total coliform count (TCC) and fungi count according to the methods described by Olusegun and Jacob, 2013.

Statistical Analysis: The data generated from these investigations were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. And they were subjected to one way analysis of variance (ANOVA) and test for significance were carried out using Duncans multiple range tests.

Results and Discussion

The results of the statistical analysis carried out on microbial plate counts of freshly and smoked fish samples are given in Table 1 and the microorganisms isolated from each samples are presented in

Table 2. Microbial load of smoked tilapia fish treated with group 1 and 2

WEEK 0	TVC (Cfu/g)	TFC (Cfu/g)	TCC (Cfu/g)
Untreated	7.5×10^3	9.5×10^3	5.5×10^3
Salt	9.0×10^3	6.1×10^3	3.1×10^4
Garlic	5.0×10^3	5.0×10^3	NG
WEEK 2			
Untreated	2.5×10^4	5.5×10^6	4.2×10^5
Salt	NG	5.1×10^4	3.9×10^4
Garlic	NG	5.4×10^4	NG
WEEK 4			
Untreated	2.9×10^4	SPLT	SPLT
Salt	NG	1.4×10^5	NG
Garlic	3.9×10^4	5.9×10^4	NG
WEEK 6			
Untreated	SPLT	SPLT	SPLT
Salt	7.5×10^4	3.5×10^5	NG
Garlic	NG	5.3×10^4	NG
WEEK 8			
Untreated	SPLT	SPLT	SPLT
Salt	3.5×10^5	NG	NG
Garlic	NG	NG	NG

KEY: NG=No growth, TVC=Total viable count, TFC=Total fungi count, TCC=Total coliform count, SPLT= Spoilt

Table 2: Microorganisms isolated from freshly smoked tilapia fish samples

Fish sample	Microorganism (bacteria and fungi species)
Untreated	*Bacillus cereus, Klebssiella spp, Bacillus Subtilis, Proteus mirabilis, 4 bacteria + 4 fungi species Nigrospora spp, Aspergillus spp, Aspergillus flavus, penicillium spp*
Salt	*Bacillus cereus, Klebssiella spp, 2 bacteria + 2 fungi species Nigrospora spp, Aspergillus spp*
Garlic	*Bacillus cereus, Bacillus spp, 2 bacteria + 1 fungi species Penicillum spp*

Microbial Load Counts of the Samples

As shown in Table 1, the numbers of microbial colonies formed by each sample was obtained. The microbial load varied significantly ($P < 0.05$) among the three samples (untreated/control, salt and garlic). TVC at fresh state of the samples, the salt sample recorded higher value of (9.0×10^3), followed by untreated sample of (7.5×10^3) and the least value recorded in garlic sample of (5.0×10^3). In the second week, the TVC recorded higher value of (2.5×10^4) in untreated sample and the least value recorded in garlic sample of (2.4×10^3) while salt sample recorded (zero/no growth). In the fourth week, the TVC recorded higher value of (3.9×10^4) and (2.9×10^4) in garlic and untreated

sample while salt sample recorded (zero/no growth). In the sixth week, the TVC recorded higher value of (7.5×10^4) in salt sample and garlic sample recorded (zero/no growth) while untreated sample got spoilt at the end of the sixth week of storage and count could not be made again. In the eighth week, the TVC recorded higher value of (3.5×10^5) in salt sample while (zero/no growth) was recorded in garlic sample and no record was recorded in untreated sample. The bacterial load (TVC) count results for all the samples used for this study are below the maximum bacteria count of 5×10^5 cfu for good fish product according to the International Commission on Microbiology Safety for Food and it was shown that bacteria species were presented in all the samples (table 2). The results obtained were similar to those observed by Olusegun and Jacob 2013.

The TFC at fresh state of the samples recorded higher value of (9.5×10^3) in untreated sample, followed by salt and garlic sample of (6.1×10^3)and(5.0×10^3) respectively. In the second week, the TFC recorded higher value of (5.5×10^6) in untreated sample, followed by salt, and garlic sample of (5.7×10^4) and (5.4×10^4) respectively. In the fourth week, the TFC recorded higher value of (1.4×10^5) in salted sample, followed by garlic sample of (5.9×10^4) while untreated sample got spoilt at the week four of storage and the count could not be made again. In the sixth week, the TFC recorded higher value of (5.3×10^5) in garlic sample, followed by salt sample of (3.5×10^5) while no record was recorded in untreated sample. In the eighth week, zero/no growth was recorded in salt and garlic while no record was recorded in untreated sample. It shows that fungi species were presented in all the samples (table 2). The results obtained were similar to those observed by Adebayo-Tayo *et al.*2008 and Fafioye, *et al.* 2002.

The TCC at fresh state of the samples recorded higher value of (3.1×10^4) in salt sample and the least value of (5.5×10^3) in untreated sample, while (zero/no growth) was recorded in garlic sample. In the second week, the TCC recorded higher value of (4.2×10^5) in untreated sample and (3.9×10^4) was recorded in salt sample while garlic sample recorded (zero/no growth). In fourth week, salt and garlic samples recorded (zero/no growth) and untreated sample got spoilt at the week four of storage and count could not be made again. In sixth week, salt and garlic samples recorded (zero/no growth) and untreated sample, count could not be made again. In eighth week, all the samples recorded (zero/no growth) except untreated sample which have been spoilt at week four of storage. The increased in (TCC) of some fresh fish samples which later generally dropped significantly ($P < 0.05$) at the end of 8 weeks may be due to presence of water. The results were similar to those observed by Olusegun and Jacob 2013.

Conclusion and recommendation

Results of this study are significant because most of these natural preservatives are medicinal which have no effect and add to the flavor and seasoning for some foods and they also act as antimicrobial agents by killing microbes that present in the food. Salt may have little effects on human health and some patients are advised by their medical doctor to be mindful of their salt intake. This work shows that some natural preservatives can serve as substitute for salt in food preservation; it may be due to the effects of the preservatives effects which slow down autolysis of smoked fish samples and consequently slow down the protein break down. With the results of this work, it is recommended that garlic as a natural preservatives used in this work can serve as replacement for salt.

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