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PRELIMINARY STUDY ON THE ANTIOXIDATIVE AND ANTIMICROBIAL EFFECTS OF FRESH GARLIC (*Allium sativum*) ON THE SHELF LIFE OF HOT SMOKED CATFISH (*Clarias gariepinus*)

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ABSTRACT

The effects of fresh garlic (*Allium sativum*) at concentrations of 0 g/kg (control), 10 g/kg, 30 g/kg and 50 g/kg of fish on lipid oxidation and microbial growth of hot smoked catfish *Clarias gariepinus* during a 28 day storage period at ambient temperature of 20-26^oC was examined. The samples were subjected to chemical and microbial analyses during the storage period. The results of analyses suggest that fresh garlic possesses antioxidant and antimicrobial properties, which can extend the shelf life of *Clarias gariepinus*.

Keywords: Thiobarbituric acid, rancidity, total coliform counts, peroxide value.

INTRODUCTION

Fish is a major source of animal protein in Nigeria. It is readily available in most market as fresh, smoked, sun-dried, canned, chilled or frozen. Its muscle contain four basic nutrients in varying proportions; water 70-80%, protein 16-25%, lipid 1-5% and vitamins (Clucas, 1982). Only a negligible proportion of fresh fish caught in lakes and rivers in Nigeria is sold fresh. Great portion is preserved by smoking and sundry (Ikem and Blandary, 2001). Heat generated as a

result of smoking removes water, inhibits bacterial growth, retard enzymatic action, imparts aroma, taste and colour on processed fish but its quality can deteriorate during storage due to lipid oxidation and microbial growth. While lipid oxidation is responsible for reduction in nutrient quality as well as changes in flavours (Kumolu-Johnson and Ndimele, 2001); microbial contamination could precipitates public health concern and economic loss in terms of fish spoilage. Thus suitable natural agent possessing both antioxidative and antimicrobial properties may be useful to compliment smoking technique for maintaining fish qualities.

Gallic, *Allium sativum* is one of the mostly used natural ingredients to enhance flavour in food. It has a wide spectrum of actions which include antibacterial, antifungal and antioxidative as well as beneficial effects on the cardiovascular and immune system of human (Sallam *et al*, 2004). Thus, this research is aimed at studying the effectiveness of fresh garlic at different concentrations on the qualities and shelf life of hot smoked *Clarias gariepinus*.

MATERIALS AND METHOD

A total of 50 African catfish, *Clarias gariepinus*, of average weight of 100g were obtained from Lagos State University Hatchery, Lagos Nigeria. The samples were stunned with salt and eviscerated. Fresh garlic, *Allium sativum* was purchased from a local market in Oke-Odo, Lagos. The fresh garlic outer coats were removed, cloves peeled and crushed finely with a kitchen blender.

The fish samples were cleaned and dipped in 15% brine solution for 10 minutes,

drained and divided into four batches labeled A, B, C and D. Fish samples in batch A (control) were not treated with garlic. The fish samples in batches B, C and D were treated with the garlic paste at 10g/kg, 30g/kg and 50g/kg of fish. Then, the fish were smoked with tropical hardwood at 80-85°C for 6 hours. The smoked samples were cooled, packaged in labeled plastic buckets and stored at ambient temperature of 20-26°C for 28 days. Samples were subjected to chemical and microbiological analyses.

Chemical analysis

Thiobarbituric acid reactive substance (TBA-Rs) determination

The oxidative stability of smoked catfish was measured by thiobarbituric acid-reactive substance (TBA-RS) according to (AOAC, 1995).

Peroxide value

The oxidative stability of smoked catfish was also measured using titrimetric determination of the amount of peroxide and hydro peroxide group (the initial product of lipid oxidation).

Microbiological analysis

The total coliform counts were determined according to the method of Fawole and Oso (1995).

Statistical analysis

Statistical analysis was performed using SPSS v. 17.0 for windows. Analysis of variance (ANOVA) was used and statistical significance was set at $p < 0.05$. Fisher's least significant difference (LSD) was used to separate differences in treatment of means.

RESULTS AND DISCUSSION

The oxidative stability of the smoked catfish samples *Claris gariepinus* measured using thiobarbituric acid (TBA) reaction and peroxide value during the 28 day storage period as showed in Figures 1 and 2 revealed an increase in (TBA) and peroxide values with time but samples

with higher concentration of fresh garlic treatment had lower figures in comparison to untreated samples. The weekly microbiological analysis (Table 1) reveal that treated samples (A, B and C) had lower microbial growth than the untreated sample {control (A)}.

The statistical analysis of the thiobarbituric acid value (TBA) and peroxide value in Table 1 showed that there was significant difference ($p < 0.05$) in the lipid oxidation between the untreated samples and treated samples which is in agreement with the study by Ikeme and Bhandary (2001) and Sallam *et al* (2004) in which ginger and garlic pastes were effective in retarding the development of oxidative rancidity in mackerel, *Scomber scombrus*, and in chicken sausage respectively. They also reported that the effectiveness of spices as an antioxidant is directly related to their concentration. However, the microbial growth among the treatment did not show any significant difference ($p > 0.05$) but there was a noticeable trend; the treatment with the highest microbial growth was the control (A), which was not treated with garlic while the treatment with the highest concentration of garlic (50g of garlic/kg of fish) had the least microbial growth.

CONCLUSION

This study has shown that garlic (*Allium sativum*) has some antioxidative and antimicrobial properties, which can retard the growth of micro-organisms and thus, extend the shelf life of fish like *Clarias gariepinus*. However, the insignificance ($p > 0.05$) of microbial growth among the treatments suggests that the storage period of the experiment should be extended for a clearer result since there was a trend.

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Table 1: Mean Thiobarbituric Acid (TBA) value, peroxide values and microbial growth during the 28 days storage period

Treatments	TBA	PEROXIDE	MICROBIAL COUNTS
A	4.32 ± 0.39 ^a	12.31 ± 2.06 ^a	12.03 ± 0.56 ^a
B	3.62 ± 0.31 ^{ab}	11.35 ± 1.86 ^b	11.58 ± 0.51 ^a
C	3.06 ± 0.26 ^{ba}	7.78 ± 1.49 ^{bc}	11.24 ± 0.41 ^a
D	3.09 ± 0.18 ^{ba}	6.91 ± 1.08 ^{bc}	11.15 ± 0.43 ^a

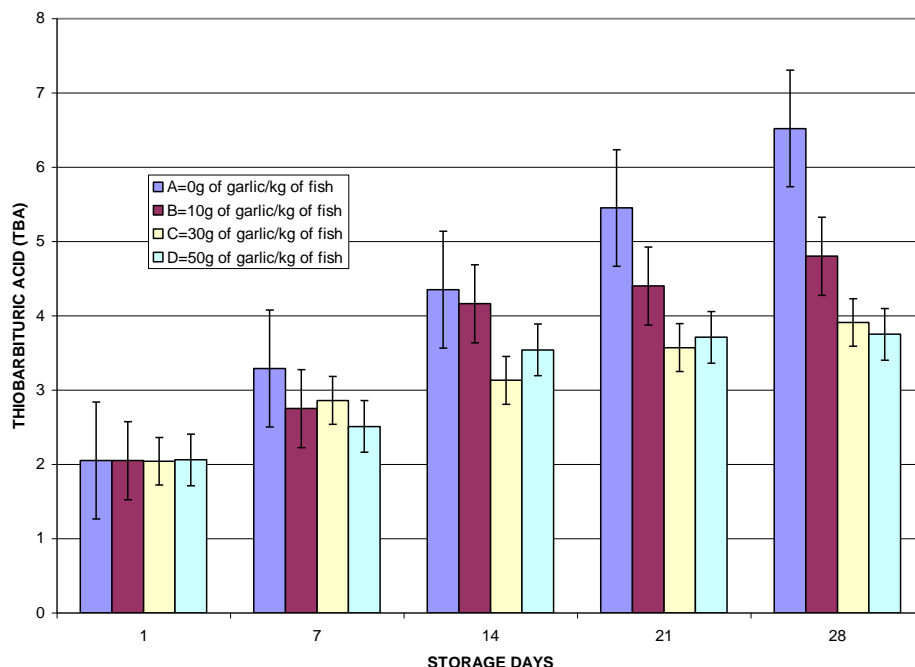


Fig.1: Thiobarbituric acid (TBA) value during the 28 days storage period

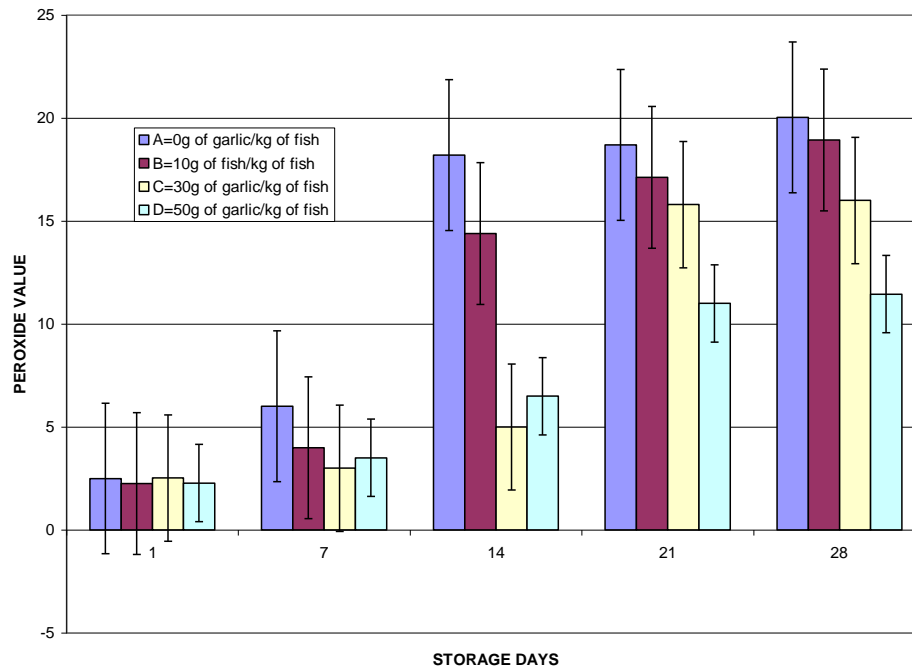


Fig. 2: Peroxide value during the 28 days storage period