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*Research Paper*

# Nutritive value and organoleptic attributes of Xylopia Aethiopica pre-treated smoke cured Clarias Gariepinus (Burchell, 1822)

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The aim of this work is to investigate the nutritive and sensory values of steam extracted Xylopia aethiopica pre-treated smoke cured Clarias gariepinus. Fish were pre-treated with steam extracts of the spice at concentrations of 0.00%, 5.00%, 7.5% and 10.00% before smoke curing. These were subjected to analysis to obtain the proximate composition in order to ascertain the crude protein, ash, lipids, and Nitrogen free extract. Ten trained test panelist evaluated the sensory qualities of Taste, Aroma, Appearance and General Acceptability. The results of the proximate composition of X. aethiopica (dosage range of 0.00 % - 10.00%) pre – treated fish are: crude protein (65.98 + 0.54% - 67.00+ 0.29%), Ether extract (12.73 + 0.00% - 14.03 + 0.80%) and Ash (5.54 + 0.00 % - 6.33 + 0.00%), showing significant difference ($P<0.05$) linear increase with increasing spice dosage. Except in appearance were significant differences($P<0.05$) existed between the control and treated samples, the sensory evaluation revealed that products pre -treated with steam extracted X. aethiopica retained consumer acceptability in all attributes measured ($P>0.05$). Increasing concentration of the spice reduced the aesthetics of the product. This spice can be used to prevent insect infestation and in the process improve product acceptability.

**Keywords:** Clarias gariepinus, Dermestes maculatus, Xylopia aethiopica, Nutritive value, Organoleptic attributes, Spice pre-treatment and Smoke-curing.

## INTRODUCTION

Fish is acknowledged as a major protein source in Nigeria (Agbabiaka, 2010a). Nutritionally, fish is the cheapest and direct source of protein and micronutrients for several millions of Africans (Bene and Heck, 2002). In Artisanal and Industrial fisheries, any harvest that cannot be consumed upon catch must be subjected to handling and processing in order to preserve and extend the shelf life with the positive consequence of converting it to a true trade commodity and commercial item. For the single reason of making this excellent protein source available on the shelf, a concerted effort has been exerted materially and humanly to attain this noble objective. In storage, however, this huge investment can be thwarted by the polyphagous fish pest (Cloud and Collinson, 1996) of even forensic significance (Richardson and Craft, 2001), Dermestes maculatus Degeer.

Freshwater fish makes up about 69.6% of the fish consumed in Nigeria while 60% of such comes from catfish culture (Fish network, 2009). Clarias gariepinus is the most cherished fresh fish culture in Nigeria with good flavour and high feed conversion (Garibaldi, 1996).

In an attempt to protect smoke-cured fish from damage due to Dermestes maculatus, the product has been exposed to a variety of measures using expensive synthetic compounds that have been found to be deleterious to mankind (Boeke et al., 2001) and have

also added taint (Proctor 1960) to the product. This development has forced researchers to seek ecologically friendly methods of controlling this pest of dry fish. Several workers have since started to evaluate (Okorie et al., 1990; Amusan and Okorie, 2002; Akinwumi, 2010; Akinwumi and Fesobi, 2010) plant-based spices and materials for the control of D. Maculatus. Xylopia aethiopica (Uda) belong to the plant family Annonaceae (Rehm and Espig, 1991; Asawalam, 2006). Xylopia aethiopica is an important evergreen, a medicinal plant widely distributed in West Africa. The concoctions prepared from its morphological parts are used in traditional medicine for the treatment of skin infections, candidiasis, cough, fever dysentery and stomach ache (Okigbo et al., 2005), mosquito repellence (Adewoyin et al., 2006) and has termite antifeedant (Lajide et al., 1995) properties.

The influence of Xylopia aethiopica on the nutrient and sensory aspects of the product to which it has been applied must be evaluated if its' use in controlling D. maculatus is to be worthwhile. The aim of this work is to investigate the nutritive and sensory values of steam extracted; Xylopia aethiopica pre-treated smoke cured Clarias gariepinus.

## MATERIALS AND METHODS

### Purchase and processing fish samples

Dried fruits of Xylopia aethiopica were purchased from a herbal store in Eke Ukwu Owerri Market, South Eastern Nigeria. The dry fruits were pulverised using Q-link grinder (model: QBL-15L40, China). The ground spice was stored in an air tight bottle and kept to a condition in the laboratory at ambient temperature. 37 pieces of catfish (Clarias gariepinus) with an initial mean weight 270.30 g/ fish were obtained from the Fish Ponds of the Department of Fisheries and Marine Technology of the Polytechnic. These were sacrificed, degutted, sectioned and weighed on a mini digital pocket balance (capacity: 500 g. make: China). Sections of the raw fish were spiced with Xylopia aethiopica at the rate of 2 g spice/40 g, 3 g spice/40 g, and 4 g spice/40 g wet fish, respectively to make up concentrations of 5%, 7.50% and 10% spice pre-treatment treatments. Each treatment was steamed in cooking pot until fish were cooked using its natural moisture. The spiced and steamed fish were then smoke cured at low flame generated from Ugba wood (Pentaclethera macrophyla) in a local mud smoking kiln for 4 h at a temperature range of 90°C – 110°C.The pre-treated samples were wrapped with polythene bags after cooling and left in the laboratory under ambient conditions prior to proximate and sensory evaluations. Fish used for control experiments were not pre-treated with spice but subjected to proximate analysis using the standards of (AOAC, 2000).

### Proximate analysis

The steamed, spice pre-treated, smoke cured, uninfected fish and control samples were sent for proximate analyses to ascertain the crude protein, ash, lipids, and Nitrogen free extract contents using standard methods (AOAC, 2000).

### Sensory evaluation

The steamed spiced smoked fish were submitted to ten trained test panelist from the Polytechnic to evaluate the sensory qualities of Taste, Aroma, Appearance and General Acceptability. These parameters were assessed on a Seven (7) Point's Hedonic Scale using the modified criteria of Eyo, (2001). Tests were in triplicates for each treatment.

### Statistical analysis

Data obtained were subjected Analysis of Variance. Where a significant difference was detected, means were separated using multiple range tests as outlined by Obi (1990).

## RESULTS AND DISCUSSION

The nutrient assay of C. gariepinus pre-treated with varying doses of steam extracted X. aethiopica prior to smoke curing (Table 1) proved that the protein content improved ($P<0.05$) (control = 64.90%) as the concentration of X. aethiopica increased (10.00% XA=67.00%). Agbabiaka et al. (2016) reported a linear increase in crude protein content of spice pre-treated Moonfish. Akinwumi and Fesobi, (2010) reported improved crude protein value of catfish pre-treated with both powder and extract of some spices. The components of spice biochemistry could have influenced the nutrient profile of pre-treated fish. This is supported by the proximate composition of X. aethiopica which is given as follows: crude protein (7.9 + 0.03%), Ether extract (33.70 + 0.3%) and Ash (9.5 + 0.1%) (Bouba et al.,2012). In the same manner, Linear significant ($P<0.05$) increases in proximate composition of steam extracted X. aethiopica pre-treated fish were observed with Ether Extract, Ash and the Soluble Carbohydrates. Ash content is indicative of the mineral profile of fish and the increase noted with steam extracted pre-treatment of fish with X. aethiopica is an improvement on product quality. Clucas and Ward, (1996) noted that minerals especially calcium content in a fish product is an indication of the quality of the product.

The ranges of the moisture content of the treated and untreated samples are 10.10 + 0.00% - 12.99 + 0.12%.

**Table 1.**Proximate compositions of *Clarias gariepinus* pre-treated with varying doses of steam mediated *X. aethiopica* before smoke curing.

| Proximate Composition | Fish pre-treated 0% (control) | Fish Pre-treated 5.0 % X.A. | Fish pre-treated 7.3% X.A. | Fish pre-treated 10.0% X.A. |
|---|---|---|---|---|
| Moisture | 10.10±0.00$^{b}$ | 12.99±0.12$^{a}$ | 12.50±0.10$^{a}$ | 12.21±0.00$^{a}$ |
| Protein | 67.00±0.29$^{b}$ | 65.98±0.54$^{a}$ | 66.50±0.25$^{a}$ | 66.80±0.55$^{a}$ |
| Fat | 14.03+0.80$^{b}$ | 12. 73+ 0.00$^{a}$ | 12.77+0.00$^{a}$ | 12.90+0.00$^{a}$ |
| Ash | 06.33+0.00$^{b}$ | 05.54+0.00$^{a}$ | 0 5.67+0.00$^{a}$ | 05.79+0.00$^{a}$ |
| NFE | 03.20+0.57$^{bc}$ | 01.95+1.17$^{a}$ | 02.00+0.19$^{ab}$ | 02.10+0.23$^{ab}$ |

Footnotes: values are means ± standard errors. Letters a, b and c: For all proximate composition data, values with the same letter are not significantly different (P>0.05) while values with different letters are significantly different (P<0.05) in each row.

**Table 2.** Sensory evaluation of *Clarias gariepinus* treated with different doses of *Xylopia aethiopica*.

| Parameter | Dosage(%) | | | |
|---|---|---|---|---|
| | 0.00% | 5.00% | 7.30% | 10.00% |
| Taste | 7.00±0.00a | 6.80±0.29$^{a}$ | 6.60±0.34$^{a}$ | 6.40±0.45$^{a}$ |
| Appearance | 7.00±0.00a | 5.50±0.17$^{b}$ | 4.80±0.53$^{b}$ | 4.00±0.45$^{c}$ |
| Aroma | 7.00±0.00a | 6.60±0.30$^{a}$ | 6.80±0.47$^{a}$ | 6.20±0.36$^{a}$ |
| Mouth feel | 7.00±0.00a | 6.90±0.18$^{a}$ | 6.30±0.40$^{a}$ | 6.60±040$^{a}$ |
| General Acceptability | 7.00±0.00a | 6.70±0.25$^{a}$ | 6.50±0.30$^{a}$ | 6.40±0.33$^{a}$ |

Footnotes**:** values are means ± standard errors. Letters a, b and c: For all sensory parameters, values with the same letter are not significantly different (P>0.05) while values with different letters are significantly different (P<0.05) in the rows.

This range of moisture is in conformity with the reported range for a shelf life of three to nine months in proper storage given that mould growth is possible above 12% moisture (Jallow, 1995). Moisture content values of 10%-12% and 10.74%-12.11% (Extracts) have been reported for P. guineense pre-treated sample (Omafuvbe and Kolawole, 2004; Akinwumi and Fesobi, 2010). IKeme 1990 noted that the proximate composition of traditionally smoked fish is dependent on the degree of dryness and quantitatively they are related to the moisture content. Moisture content is a measure of available water and water activity (AW) in cured products and therefore serves as the basic parameter for the technical description of cured products with respect to assessing their stability to microbial invasion, enzymatic activity, hydrolytic reactions, rancidity development and with certain limitations, providing useful information to insect infestation (Ikeme, 1990; Eyo 2001). The range of moisture content obtained in the steam extracted, X. aethiopica pre-treatment of C. gariepinus prior to smoke curing, qualifies it for use in the protection of smoke-cured fish against Dermestes maculatus Degeer. Results the of sensory analyses of spice pre-treated smoke cured C. gariepinus and control experiments on the 10 man, 7 points, Hedonic scale on the parameters; Taste, Appearance, Aroma, Mouthfeel and General Acceptability are summarised in (Table 2). Except in appearance were significant differences(P<0.05) existed between the control and treated samples, the sensory evaluation revealed that products pre -treated with steam extracted X. aethiopica retained consumer acceptability in all attributes measured (p>0.05). Increasing concentration of the spice reduced the aesthetics of the product. Other plant product produced similar results when they were used to treat C. gariepinus prior to smoke curing (Onu and Baba, 2003 and Akinwumi et al., 2007) Though evidence exists for alteration of sensory attributes in the use of plant-based insecticides in cured fish protection, Okorie et al. (1990) proved that modification of the botanical can eliminate the problem. The aesthetic reduction can, therefore, be eliminated through the use of extracts. Agbabiaka et al. (2016) reported that moon fish treated with black pepper and ginger water extracts retained consumer acceptance. The general acceptability in all the sensory parameters indicated that the spices might have inherent chemical compounds responsible for the pleasant colour, taste and flavour/aroma in smoke cured products (Bhandary, 1993; Amadi, 2003).

## Conclusion

It is, therefore, safe to conclude that Fish can be spiced prior to smoking with X. aethiopica to prevent D. maculatus infestation without altering consumer acceptability from the nutritive and sensory points of view. Use of extracts can further improve product quality.

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