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Full Length Research Paper

Assessment of nutrients and sensory qualities of brine pre-treated catfish smoked with two different woods

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Comparative evaluation of brine pre-treated catfish, C*larias gariepinus* smoked with the smoke of woods such as *Anthonata mycrophylla* and *Dialium guinensis* were studied. Thirty catfishes weighing 475 ± 50 g were harvested, killed, eviscerated and rinsed thoroughly under tap water and were divided into 3 batches of ten fishes and were immersed in 10% brine solution for 30 min. Each batch was smoked for 4 h with woods' smoke of *A. mycrophylla*, *D. guinensis* and gas oven, respectively. The oven dried sample served as control. The smoked catfish were allowed to cool at room temperature and samples were taken from each batch, respectively for proximate composition analysis. Nevertheless, the remaining smoked fish products were labeled/coded and subjected to sensory evaluation by trained test panel on ten point hedonic scale. Results of the sensory evaluation obtained reveal that there was no significant difference (P > 0.05) among the sensory parameters except the flavour; however, the proximate analyses revealed that fish samples smoked with woods had higher scores for ash than oven dried fish (P < 0.05). Nevertheless, the crude fat (25.46%) of oven dried sample is higher than those recorded for samples smoked with woods (P < 0.05). These results show that these woods could be suitable for fish smoking without negative effects on nutrients and sensory qualities for consumer acceptability.

Key words: Assessment, nutrients, sensory qualities, catfish, wood smoke.

INTRODUCTION

Fish constitutes a very vital component of the diet for many people by providing nutrients that are often absent in cereal based diets (Clucas and Sutchitte, 1981). However, fish has been reported to provide between 30 and 80% of the total animal protein intake of the coastal people of Nigeria. It is rich in protein with amino-acid composition which compared favourably with eggs, milk and meat in the nutritional value of its protein (Olomu, 1995).

The effect of different processing and preservation methods on nutritional compositions of different species of fish, such as *Citharinus citharus* (Effiong and Fakunle, 2009), *Oreochromis niloticus* (Abolagba and Melle, 2008; Egbal et al., 2010), Mullet, *Mugil cephalus* (Ghelichpour and Shabanpour, 2011) have been studied. Nevertheless, processing and preservation methods such as canning and freezing are technologies that are not conventional in artisanal sub-sector, basically due to cost and non-availability of equipment and storage system (Eyabi-Eyabi, 1998).

The methods commonly used are traditional techniques, such as salting, sun drying and smoking, which have been increasing fish availability to Nigerians, especially those living at the coastal states. This study was designed to evaluate and compare the nutritional and organoleptic qualities of brine pre-treated catfishes smoked using the smoke of woods such as *Anthonata mycrophylla* and *Dialium guinensis.*

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Table 1. Weight characteristics of catfish smoked with *A. mycrophylla* wood smoke.

Live weight of fish	Dressed weight	Weight after smoking	Total weight loss	Percentage weight loss
500	400	200	300	60.00
450	400	150	300	66.7

Average weight loss (%) = 63.34.

Table 2. Weight characteristics of catfish smoked with *D. guinensis* wood smoke.

Live weight of fish	Dressed weight	Weight after smoking	Total weight loss	Percentage weight loss
500	400	210	290	58.00
450	400	158	292	64.89

Average weight loss (%) = 61.44.

Table 3. Weight characteristics of catfish smoked with gas oven.

Live weight of fish	Dressed weight	Weight after smoking	Total weight loss	Percentage weight loss
500	400	180	270	54.00
450	400	140	260	57.78

Average weight loss (%) = 55.89.

MATERIALS AND METHODS

Sample preparation

The test fish were harvested from fish pond at Federal Polytechnic, Nekede, Owerri, Imo State, Nigeria. Thirty freshly caught catfish (*Clarias gariepinus*) weighing between 450 and 500 g were killed, eviscerated and washed thoroughly under tap water to remove blood and slime. They were randomly grouped into three batches with ten fish and their dressed weight were taken accordingly. Each group was immersed in 10% brine solution for 30 min, thereafter, the fishes were transferred into a basket, covered with a Muslin cloth to prevent flies and dust contamination.

Brine preparation

Brine solution (10%) was prepared by dissolving 5 kg of common salt (NaCl) in 45 kg of distilled water and was agitated by shaking vigorously for about 5 min, according to Oguntokun (2000).

Smoking process

The catfish were smoked using traditional steel kiln (drum) whose fuel composed *A. mycrophylla* and *D. guinensis*, each weighing about 14.0 kg. Smoking lasted for 4 h accompanied with turning over of the fish at intervals to prevent charring and obtain uniformly smoked products. The fishes were covered with cartons to retain heat and prevent dust and flies contamination. At the end of the smoking exercise, smoked samples were removed from the kiln and allowed to cool at room temperature.

Chemical analysis

Moisture, protein, ash, and fat contents were determined according to standard method (AOAC, 2000).

Organoleptic assessment

Smoked products were submitted to ten trained test panel from Food Technology Department of the College to evaluate the sensory qualities such as texture, taste, aroma, and colour. These parameters were assessed on a ten points hedonic scale (9 = excellent; 8 = very good; 6 = good; 4 = fair; 2 = poor; and 0 = bad) according to Afolabi et al. (1984). Panelists filed in a single line to assess the smoked products were requested to mask their mouth with water after tasting each sample to avoid bias in judgement/evaluation.

Statistical analyses

Data collected were subjected to one-way analysis of variance (ANOVA), where significant difference occurred; means were separated by least significant difference (LSD) according to Steel and Torie (1980).

RESULTS AND DISCUSSION

The result of the weight characteristics of *Clarias gariepinus* smoked with *Anthonatha macrophylla* wood is presented in Table 1. While Tables 2 and 3 presented the weight characteristics of African catfish smoked with *D. guinensis* wood or gas oven, respectively. The average moisture loss (63.34% or 61.44%) from the smoked catfish are similar to the value of less than 65.00% recommended by Cardinal et al. (2001). The proximate composition of the smoked fish on dry matter basis is presented in Table 4. Highest crude protein (68.17%) was recorded from sample A, while samples B and C

Table 4. Proximate composition of catfish smoked with different woods smoke (% DM)

Parameter	Fish sample		
	A	B	C
Crude protein	68.17[a]	68.07[a]	66.62[a]
Crude fat	20.19[a]	21.19[a]	25.46[b]
Ash	5.40[a]	4.94[a]	2.34[b]
Moisture	4.98[a]	4.11[a]	4.46[a]
Nitrogen free extract	1.27[a]	1.84[a]	1.13[a]

[a,b]Means not followed by the same superscript letter are significantly different (P < 0.05) within row. A = salted catfish smoked with *A. mycrophylla*; B = salted catfish smoked with *D. guinensis*; C = salted catfish smoked with gas oven. NFE = Nitrogen free extract (Carbohydrate).

Table 5. Organoleptic assessment of catfish smoked with different woods smoke.

Parameter	Fish sample		
	A	B	C
Texture	6.3[a]	6.5[a]	6.4[a]
Colour	6.8[a]	6.4[a]	6.3[a]
Flavour	7.8[a]	7.9[a]	6.3[b]
Taste	8.1[a]	7.9[a]	6.8[a]

[a,b]Means not followed by the same superscript letter are significantly different (P < 0.05) within row. A = salted catfish smoked with *A. mycrophylla*; B = salted catfish smoked with *D. guinensis*; C = salted catfish smoked with gas oven.

have values of 68.07 and 66.62%, respectively. There was no significant difference (P > 0.05) within the treatments. These values were similar to value of 68.40% reported by Olayemi et al. (2011), but slightly higher than 64.07% value recorded by Ime-Ibanga and Fakunle (2008). However, the crude lipid values were 20.19, 21.19, and 25.46% for samples A, B, and C, respectively.

The oven dried sample has the highest crude fat content (P < 0.05) of 25.46%. The lower values recorded from the samples smoked with woods smoke may be attributed to dripping of fat during smoking exercise (Ima-Ibanga and Fakunle, 2008; Ogbonna and Ibrahim, 2009).

The ash content was the lowest in the sample smoked in oven (Table 4). The higher value from samples smoked with woods smoke could perhaps be influenced by the tar/smoke deposited on the fish. Result of the organoleptic assessment of the brine pre-treated catfish smoked with different energy sources is shown in Table 5.

The fish sample smoked with *D. guinensis* has the highest ranking of 6.5 in terms of texture, while fish smoked with *A. mycrophylla* showed the highest value of 6.8 for colour of the smoked product. There was no significant difference (P > 0.05) in terms of colour and texture among the treatments.

Nevertheless, the mean scores of 7.8, 7.9, and 6.3 reported for flavour of the smoked sample A, B, and C showed that catfish smoked with woods had a better aroma/flavour when compared with oven dried sample "C" and there was a significant difference (P < 0.05) between flavour of fish samples smoked with woods smoke and those smoked in gas-oven. The preference for flavour of smoked samples in woods smoke may be attributed to the chemical compound in hard wood characterized with deposition of phenolic compounds, carbonyls, and syringic acid which adds to flavour (Eyo, 2001; Ekeocha et al., 2010).

Conclusion

This comparative study has shown that smoked fish products smoked using *D. guinensis* and *A. mycrophylla* when compared favourably with oven dried samples nutritionally had better acceptance in terms of taste and flavour. Nevertheless, the technology of kiln smoking is easily adopted by rural fish mongers with ready availability of cheap fuel (woods) around, so, this study reveals that the smoke of woods, *D. guinensis* and *A. mycrophylla* are recommended for fish smoking.

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