

## Evaluation of the Organoleptic Properties of *Clarias gariepinus* Smoked with Natural and Artificial Spices

Adibe, A. C., Okeke, P. A. and Arinze, O. M.

Department of Fisheries and Aquaculture, Nnamdi Azikiwe University, P.M.B. 5025, Awka Nigeria.  
[a.c.adibe@unizik.edu.ng](mailto:a.c.adibe@unizik.edu.ng)

**Abstract:** The effects of different spices on the organoleptic properties and shelf life of hygienically smoked dried *Clarias gariepinus* was evaluated with twelve (12) samples of live *Clarias gariepinus* of 1.440kg average weight. The samples were divided into three (3) portions as treatments A, B and C with four (4) replicates each. The fishes were cut into steaks of 480gm each and were assigned to the different treatments. The treatments were natural spices (*Allium sativum*, *Zingiber officinale* and *Allium cepa*), artificial seasonings (cooking cube and seasoning powder) while table salt served as control. The fishes were mixed thoroughly with the spices, allowed to stand for 30 minutes and smoked-dried in a smoking kiln. The sensory evaluation was conducted with questionnaires distributed to forty (40) evaluators of different genders. The questionnaires were structured based on a 9 point hedonic scale and the data generated were subject to descriptive and one-way analysis of variance. The results obtained revealed that the samples treated with natural spices gave the most desirable results in terms of taste, appearance, flavor and general acceptability. The results also showed that samples treated with natural spices gave longer shelf life.

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**Keywords:** Organoleptic properties; spices; smoking; shelf life

### 1. Introduction

Fish constitutes a very important component of daily diet for many people, and often provides much needed nutrients for a healthy living. Its characteristic as a cheap source of animal protein, which is now evident throughout the world, makes it an exceptional component of human diet (Iheagwara, 2013). Fish protein now takes precedence over other protein sources of plants and animal origin, and inexpensive in relation to other protein foods (Fawole *et al.*, 2007). Fish protein is indispensable to many people in developing countries, such as Nigeria, for diet supplementation, where the staple diet or food consist primarily of starchy foods (Idris *et al.*, 2010). *Clarias gariepinus*, that constantly serve as a research species of catfish is a highly nutritious fish that contain high amounts of vitamins, proteins, minerals and little or no saturated fat, and known to be low in carbohydrates (Idris *et al.*, 2010). It is an economically important freshwater fish, and enjoys wide acceptability; it is extensively cultivated in ponds (Kumolu – Johnson *et al.*, 2010). *Clarias gariepinus* is a very important freshwater fish in Nigeria as it enjoys wide acceptability in most parts of the country because of its unique taste, flavor and texture (Ayeloja *et al.*, 2011).

The preservation of fish has been an integral part of every seafaring culture (Food and Agriculture Organisation (FAO), 2011) and smoking has been used as a way of preserving and flavouring food for many thousands of years (Davies and Davies, 2009). The art of food smoking is still a practice in Alaska,

Canada, North America, Greenland, Iceland Scandinavia, Siberia Northern Russia, Northern and Eastern Europe (Barile, 2005). Ham, bacon, sausage, salami, kippers (smoked herring), smoked salmon, smoked trout are all good examples (Tawari and Abowei, 2011). This practice of smoking meat and fish outdates the art of cooking in containers, as open-fire contact (roasting) with food had been the earliest form of cooking even before the advent of earthen ware pots (FAO, 2011).

Smoking is often used to preserve and flavour meat, fish, and cheese. The reasons for fish smoking are varied, but in Nigeria, the process has proven relevant to prolonging shelf-life, enhancing flavour and increasing protein availability to people throughout the year (Kumolu–Johnson and Ndimele, 2011). In Medieval Europe, when an animal was slaughtered (often pigs) much of the meat were smoked precisely for preservation (Akinola *et al.*, 2006). The less affluent hung their meat high up on the edges or fireplace especially at night. Ashes were placed over the embers to extinguish any flames which produced an ideal Smoky environment in which to preserve their fish or game (Iheagwara, 2013). Recognised modern methods of smoking fish hygienically and technically, involves the formulation of liquid smoke that aims to provide flavour and a range of methods of drying to reduce water activity (aw) on the surface. Most drying methods use heat to change the relative humidity of the air passing over the fish (Kumolu-Johnson and Ndimele, 2011).

There are various methods used in smoking fish which have been used over the years and are described by the temperature, duration of smoking and the materials or methods employed (Kumolu – Johnson *et al.*, 2010). Though, the actual process for smoking fish will depend to a large extent on the type of kiln used and product required (FOA, 2013). These methods include cold smoking, hot smoking and smoke drying (Khanipour and Mirzakhani, 2012, Micheal, 2015, Adeyey *et al.*, 2016 and John *et al.*, 2017) and are mostly accompanied with spicing.

Spices are edible plant materials that possess anti-oxidant, antiseptic and bacteriostatic properties. They are added to foods to delay on set of deterioration, such as rancidity, and also function as seasonings to foods as well as impart flavour to the foods (Abdel *et al.*, 2009). Nigeria is rich in indigenous spices but their anti-microbial and preservative properties have not been widely exploited (Kiin–kabari *et al.*, 2011). A number of recent research works reported were basically on the effect of various spices on the final product of smoked *Clarias gariepinus*.

In this work however, focus was more on the nutritional value added by various spices, the economical implication to the processor who intends to use any common spice or a combination of two or more spices and the resultant increase or decrease in shelf life of *Clarias gariepinus*.

## 2. Material and Methods

The study was carried out in the Nnamdi Azikiwe University located in Awka the capital city of Anambra state in the Eastern region of Nigeria which lie within the coordinates 6°14' and 6.242889° 34' N latitudes, and between 7°07' and 7.118289° 06' E longitudes.

Fresh samples of *Clarias gariepinus* (average length and weight of 32cm and 1.440kg) captured from the wild (at Omanbala River in Otuocha, Anambra Local Government Area of Anambra state) and upon landing were procured from the Otuocha market early in the morning. The fish were carried to fish processing unit in the Department of Fisheries and Aquaculture of Nnamdi Azikiwe University, Awka. The fish samples were measured, weighed, cut into 480gm, washed to remove external dirt and left to drain in a plastic sieve. They were divided into three (3) portions labelled A, B and C and each replicated four times with 480gm of fish steak per replicate.

The natural spices; onion (*Allium cepa*), ginger (*Zingiber officinale*) and garlic (*Allium sativum*) were grounded into paste using a kitchen blender (Philips HR 2815). Twenty grams (20gm) of salt (NaCl) dissolved in 500ml of water, was denoted as treatment

C and served as the control. Thirty grams (30g) of the grounded natural spices each were weighed into a round bottom flask and mixed with ten grams (10g) of salt as treatment A. The artificial seasonings were cooking cube containing (493kj energy, 6g protein, 17g carbohydrate, 21994mg sodium, 63mg iron and 3687ug iodine) and seasoning powder containing (372kj energy, 10g protein, 20g carbohydrate, 32556mg sodium, 72mg iron and 4326ug iodine) as treatment C. The samples were assigned to the treatments, mixed properly and allowed to stand for 30 minutes before smoking. This was to enable ample time for the penetration of the treatments into the fish samples (Makinde and Babalola, 2011). Each batch of the treatments was smoked differently in a charcoal smoking kiln and allowed to cool.

Samples for shelf life and organoleptic tests were selected from each treatment and separately packaged in polyethylene bags, labelled according to their respective treatments A, B and C, sealed (to prevent dust, dirt and flies) and stored under a room temperature for four (4) weeks.

The organoleptic testing was conducted with questionnaires structured using the 9- point hedonic scale (David and Norman, 2003, and Wichchukit, and O'Mahony, 2014) and distributed to forty (40) evaluators of different genders. Scoring of flavor, taste, color, appearance and general acceptability of the products by evaluators was by ranking 1- like extremely, 2 – like moderately, 3 – like very much, 4 – like slightly, 5 – neither like nor dislike, 6 – dislike slightly, 7 – dislike very much, 8 – dislike moderately and 9 – dislike extremely. The experimental process was fully explained to the evaluators before allowed to participate in the organoleptic testing. They were briefed about the fish species which they would taste and the source of the fish as well as the processing method. Hence, each assessor participated in the study with full knowledge of the process. The study was also conducted within the time frame when the fish were assumed to be in the conditions acceptable to consumers to allow organoleptic testing without causing any harm to them. The data generated were subjected to statistical analysis (descriptive and one – way ANOVA) using Microsoft Office Excel 2007 and Statistical Package for Social Sciences (SPSS).

## 3. Results

Table 1 shows the distribution of sensory evaluation of the products of the smoked samples. The result shows that there is significant difference ( $p < 0.05$ ) across the various samples. It was observed that sample C has the lowest rating in flavor and taste followed by sample B and sample A., showing that sample C was lowly rated followed by sample B and sample A respectively. There is significant difference

( $p < 0.05$ ) within the samples under appearance. The result of the general acceptability also reveals that

there is significant difference among the three samples.

Table 1. Sensory evaluation of the products by the panelists

	Product A					Product B					Product C				
	Flavor	Taste	Color	Appr.	Accept.	Flavor	Taste	Color	Appr.	Accept.	Flavor	Taste	Color	Appr.	Accept.
1.	23	30	24	18	27	17	19	18	20	19	10	9	23	11	14
2.	13	6	9	8	9	11	14	18	11	9	15	14	11	11	14
3.	3	2	5	4	4	3	4	3	5	8	5	4	2	9	8
4.	0	1	2	6	0	7	3	0	4	4	8	8	4	4	4
5.	0	1	0	6	0	1	0	1	0	0	1	3	0	3	0
6.	1	0	0	0	0	1	0	0	0	0	0	2	0	2	0
7.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

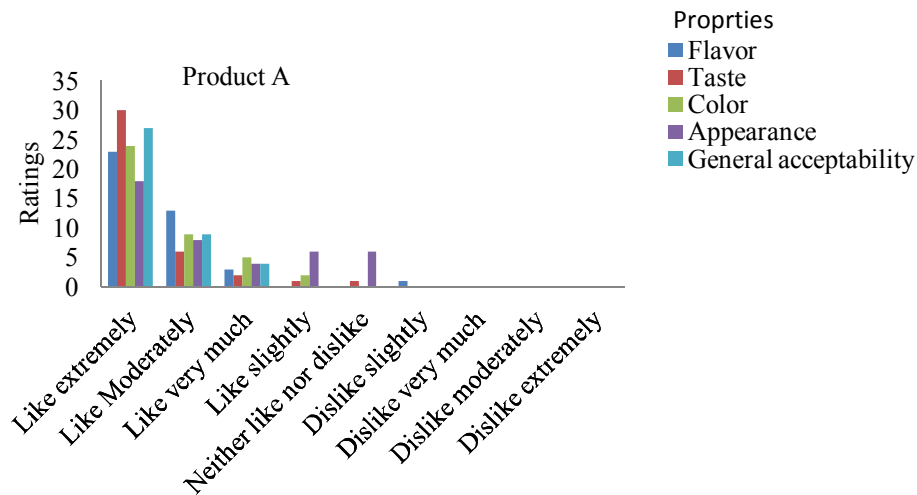


Figure 1: Rating of product A

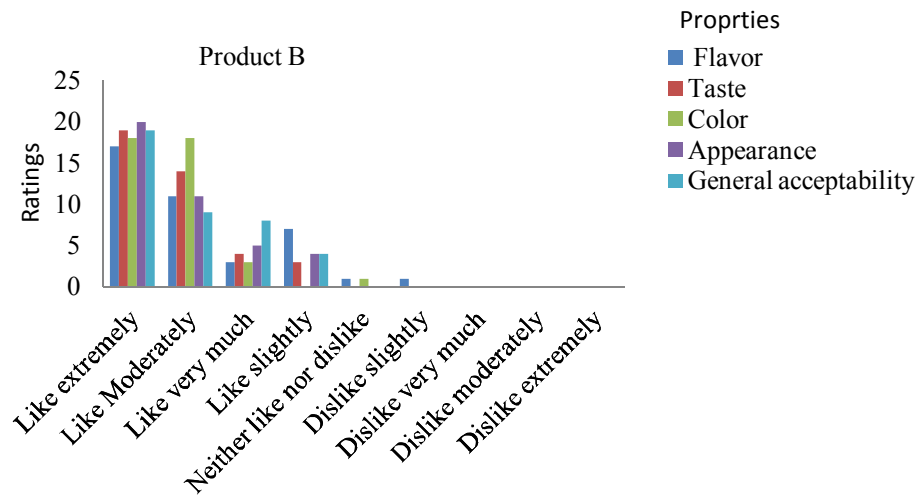


Figure 2: Rating of product B

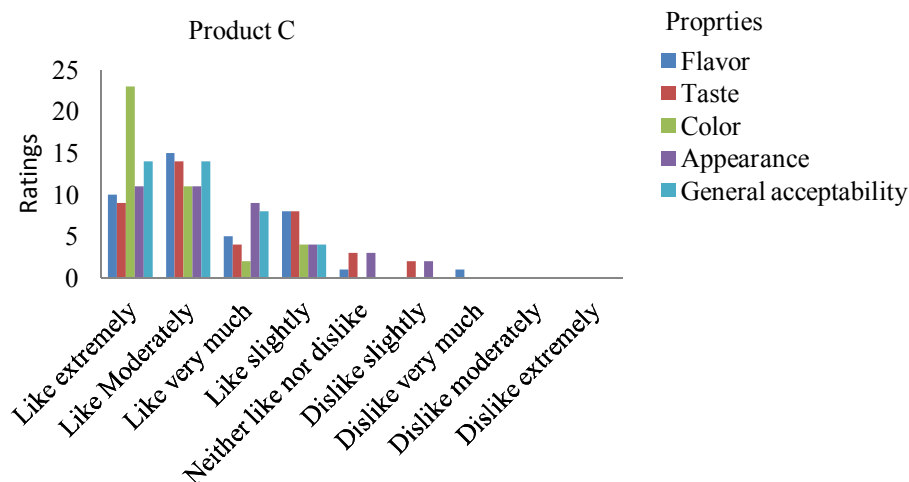


Figure 3: Rating of product C

#### 4. Discussions

The evaluators' response shows that color of the products are of less important and thus has less effect on the general preference of the evaluators except in that of sample A. Flavor and taste play a major role on the general acceptability of the products. Our study shows that natural spices have preferred results on the organoleptic properties of smoked *C. gariepinus* in terms of taste, flavor, appearance and general acceptability. This is in agreement with the reports of Taniya and Kannan (2016) and Iheagwara (2013). Sample A recorded high rating generally by the 40 panelists in all the sensory evaluation of flavor, taste and appearance while sample C had the lowest rating signifying a low acceptability by the evaluators. This may be linked to the fact that salt alone does not serve as sufficient spice in improving the organoleptic properties of smoked *C. gariepinus* (Ahmed *et al.*, 2011). The different treatments had less significant effects on the appearance of the products though with a gradual increase in the rating showing wide gap between samples A and C.

In agreement with Abdel *et al.* (2009) our study shows that the natural spices used in treating the *C. gariepinus* enhanced the flavor and delayed the onset of deterioration of the products. They are of great medicinal important and used locally (Onyeagba *et al.*, 2004). *Allium sativum* (garlic) is also known to be anti-bacterial, anti-fungal and performs as an anti-oxidative agent (Sallam *et al.*, 2004) hence the improved shelf life of the products treated with these natural spices. Since they are locally available and inexpensive (Mosarrat *et al.*, 2017 and Milda, 2015), we conclude that they should be utilized effectively in

fish preservation, preparation and for longer storage of smoked fish products.

#### Corresponding Author:

Adibe, Aloysius Chimezie  
 Department of Fisheries and Aquaculture  
 Nnamdi Azikiwe University, Awka  
 P.M.B. 5025, Awka, Anambra State Nigeria  
 Telephone: +234(0)8065751007  
 E-mail: [a.c.adibe.unizik.edu.ng](mailto:a.c.adibe.unizik.edu.ng)  
[/chimezieadibe@gmail.com](mailto:/chimezieadibe@gmail.com)

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