http://fepi-spas.com/spasjournal **ISSN: 2714-2532** Article

Sensory Assessment of Fish Types Prepared by Moist Cooking Methods for Sale in Restaurants in Ilaro, Nigeria

Nwokorie E.C.[1]✉, KWUSI N.R.[2]

[1]*Department of Hospitality Management, The Federal Polytechnic Ilaro, Nigeria.*

[2]*Department of Hospitality Management Technology, Federal Polytechnic Nekede, Nigeria.*

(✉edwin.nwokorie@federalpolyilaro.edu.ng)

Abstract

This study determined the suitable fish that could be subjected to moist methods of cooking for serving meals in restaurants. This study employed the use of primary method (sensory assessment) and secondary method (published materials) for data collection. A population of 27 individuals was randomly selected, in which a sample size of 25 was determined using Taro Yamane formula. The sensory assessment score sheets were administered to the panelists to evaluate the sensory attributes of the samples produced, for overall acceptability, which were thereafter analyzed using analysis of variance (ANOVA) with the aid of SPSS Version 20.0. Results revealed that there was no significant difference between the samples with the moist cooking methods used, while overall acceptability is in favour of *Trachurus trachurus*. The study recommends the need to cook the prescribed fishes with low heat not only to preserve fish nutrients but to optimize taste and appearance to influence patronage.

Keywords: Cooking methods, culinary tourism, fish dishes, food production, restaurants

INTRODUCTION

The rising demand by customers for an alternative source of animal protein, other than beef, pork, and poultry; is of great concern to restaurant operators in most Nigerian cities. A major influential factor for the demand is hinged on the culture and religion of diners, which drives the choice of food products and what they consume. In fact, most religions consider the consumption of some species of animal abominable; hence, cannot be part of their diet. Specifically, Nwokorie (2015) reported that Muslims and some Christians and traditionalists abhorred the consumption of pork as part of their diet. While this religious belief does not eliminate the availability of pork in local restaurants, the general acceptability of the product by diners affects the profit margin of restaurants where these products are sold.

Similarly, as a result of nutritional and health conditions of most adult diners, either existing or anticipated, dietary concerns of many diners have taken a paradigm shift toward alternative animal protein sources for consumption. As a result, fish is fast becoming a major consideration as an alternative source of animal protein for customer consumption in restaurant establishments.

Fish is a good source of animal protein and minerals (Tidwell & Allan, 2001) and is widely consumed in many parts of the world because of its rich content in protein. Fish protein is considered of high quality because of its low saturated fat, richness in essential amino acids and content of Omega 3 and Omega 6 fatty acid known to promote healthy living (Zhang et al., 2020). However, like many other protein food commodities, fish needs careful handling mainly because of its easy spoilage attribute after capture due to the high tropical temperature. High tropical temperature accelerates the activities of bacteria, enzymes and chemical oxidation of fat in the fish (Eyo, 2013). A large quantity of fishes harvested in Nigeria was wasted through poor handling (Adeyeye, 2016), and resulted in a consistent scarcity of the products. These losses are minimized by the application of proper handling, processing and preservation techniques (Bate & Bendall, 2010).

Fish consumption is increasing on a global scale. The Food and Agriculture Organization, FAO (2017), as well as Gupta et al. (2015), wrote that fish provided 20% of animal protein intake of about 2.6 billion people globally and at least 50% of animal protein intake for more than 400 million in Asia and Africa. In developing countries, it provides up to 13% of animal protein intake (Obiero et al., 2019). Fish is also available and affordable in most developing countries, though adequate preservation is still a major challenge (Panchavarnam, Basu, Manisha, Warner & Venugopal, 2003; Joardder & Hasan-Masud, 2019).

The evident quick spoilage of fish has been noted in research as a problem requiring attention, which has affected demand for fish. Kumar, Singh and Danish (2013) wrote that "Susceptibility of fish to rapid spoilage has been attributed to its intrinsic characteristics and possibility of microbial contamination from various sources." However, preparation methods of fish are a major way of encouraging demand and consumption (Sigh et al., 2018).

In the Nigerian situation, varieties of fishes abound in the market, but it can be argued that sale and consumption of fish is novel in the local restaurant industry. However, fish quality, type and preparation/cooking methods which determine product output and acceptability are factors that influence demand, customer loyalty and subsequent return on investment. Different methods of fish preparation come with different drawbacks. The dry method of cooking fish causes browning and hardness to the outer layer of the fish. The dry method also introduces bacterial or dust from the surrounding to the fish due to its exposure to air, and can affect fish aroma and taste. Comparably, the moist method reduces the risk of contamination and reserves the nutrient in the liquid.

The major objective of this study is to conduct a sensory assessment of selected fish types subjected to moist methods of cooking for sale in local restaurants in Ilaro, Nigeria. Specific objectives are to:

i. determine the best fish product to be subjected to moist methods of cooking
ii. examine the effect of the moist methods of cooking on the selected fish products
iii. determine the overall acceptability of the fish products using sensory evaluation

Different methods can be used in cooking fish for different guests in the restaurant. For most local restaurants, general acceptability of dishes is a common consideration while preparing meals. The major reason, as observed by Nwokorie and Ezeibe (2017), is because most local restaurant owners and managers consider overall customer preferences as opposed to individual customer preference. However, in selecting the appropriate fish-cooking method, it is imperative to consider important factors that would influence customer patronage for a given food commodity (including fish foods). These factors include, but are not limited to the price of the commodity, appearance of the product, health condition of the consumer, year-round availability, the effect of the cooking method on product output and nutritional retention (Hughner & Maher, 2006; Melovic, Cirovic, Dudic, Vulic & Gregus, 2020; Nwokorie, 2017; Nwokorie & Ezeibe, 2017).

Fish is usually treated by various processes before consumption. Frying, baking and roasting are most basic and familiar operation of cooking at home and in food service. Bognar (1998) found that the different cooking techniques, (pan frying, deep frying, steaming, poaching and microwave cooking) enhance flavour and taste, inactivate pathogenic microorganisms and increase the shelf life. During cooking, chemical and physical reactions occur, which improves the nutritional value of food (Zhang, Wang, Wang & Zhang, 2014). Similarly, cooking can cause undesirable modifications in the structure, appearance and taste of food (Spencer, 1973). Therefore, the outcome is determinant upon the cooking method adopted for a given food commodity.

Three methods of cooking are practiced: the dry heat-cooking method, moist heat-cooking method and fry heat-cooking method. These cooking methods have their advantages and disadvantages. Although, each cooking method can be chosen as a result of the given situation or what culinary advantage a restaurant establishment intends to achieve. Specifically, for business-oriented fish cooking, the moist method of cooking has the

following advantages (Chumngoen, Chen & Tan, 2018; Gök, Uzun, Tomar, Çağlar & Çağlar, 2019):

a. Achieving uniformity
b. Simplified method not requiring special skills or equipment
c. Less chances of burning and scorching
d. Retaining flavour
e. Better food texture as it becomes light and fluffy
f. Saving time and wasting less fuel
g. Minimizing loss of nutrient and flavour
h. Easy digestibility, as no fat is added
i. Less cooking time compared to other methods

Several moist cooking methods apply to fish cooking. Particular methods can be advised for particular fishes to ensure that the fish value and nutrient are completely retained. The moist method of cooking is introduced to reduce the browning or hardness that occurs in dry method.

Moist-heat cooking methods use liquid for cooking – water, stock or steam. One major advantage of steam is that it transfers more heat at the same temperature. As a result, the food cooks faster and fewer nutrients are lost. The cooking temperature can vary from 70 – 120° C (158 – 212° F). These methods are, particularly, suitable for preparing pasta, rice, pulses and vegetables (Cover, Bannister & Kehlenbrink, 2006; Holmes, Woodburn & Davis, 2009). The methods referenced below, though not exhaustive, are the more common techniques.

Poaching Method – a type of moist-heat cooking technique that involves cooking by submerging food in a liquid, such as water, milk, stock or wine. Poaching is differentiated from other "moist heat" cooking methods, such as simmering and boiling, in that it uses a relatively low temperature, approximately 71–82°C (Katz, Solomon & William, 2012). Chumngoen et al., (2018) and Gök et al., (2019) observed that this temperature range made it particularly suitable for delicate foods such as egg, poultry, fish and fruits, which easily fall apart or dry out using other cooking methods. Poaching is considered a healthy method of cooking because it does not use fat to cook or flavour the food (Gök et al., 2019).

Boiling Method – a moist-heat cooking method in which water is allowed to boil to a heat of 100°C and more. The fish would be entirely immersed in water to enable heat distribute evenly and attain a full boil. Though, it depends on the kind of food being cooked, some products can be allowed to boil from cold to hot temperatures, while others can be added as soon as the water simmers. Care, however, should be taken not to overcook the fish to avoid toughness because boiling makes quick cooking of fish (Karimian-Khosroshahi, Hosseini, Rezaei, Khaksar & Mahmoudzadeh, 2016). One major benefit of boiling in moist heat is the ability to retain the natural flavour of the fish, maintaining its fresh taste and tampering less with the nutritional qualities (American Heart Association, 2009; Castro-González, Maafs-Rodríguez & Pérez-Gil Romo, 2015; Karimian-Khosroshahi et al., 2016)

Steaming Method – water is allowed to boil continuously and allowed to vaporize as steam. In most cases, cooking is done either by setting the fish on a steam pot, metal or wooden carrier, for the purpose. Steaming preserves fish flavour (Castro-González et al., 2015), delicate flesh and nutrients, including omega-3 fatty acids (Stancheva, Merdzhanova, Galunska & Dobreva, 2014), and takes a relatively less time to prepare as fish quickly turns opaque when it is done (Liam,, Zakaria, Gunny & Ishak, 2014). Moreover, steaming removes added fat and eliminates cyanotoxins (bacterial toxins) in fish by up to 26% within two minutes of the steaming compared to boiling method (Castro-González et al., 2015; Liam et al., 2014; Stancheva et al., 2014; Xu et al., 2016).

In summary, it is important to understand the essence of comparison for the three cooking methods. While considering the ease in preparation that suffices for trainee chefs in the restaurant, quickness in preparation of meals to avert customer aggression during service failures (Nwokorie & Ezeibe, 2016) is also a point of reference. Nevertheless, acceptability of the product by customers is of paramount importance to the restaurant manager to ensure the marketability of product post-production using any cooking method under consideration.

MATERIALS AND METHOD

The study explored both quantitative and qualitative approaches. The primary source of data includes the use of sensory assessment sheets, which were presented to a panel of analysts for completion during sensory evaluation. Secondary data were sourced from existing literature appropriately. A sample size of 25 persons was drawn from a randomly selected population of 27 residents of Ilaro Area of Ogun State, Nigeria. The sample size was determined using the Taro Yamane formula for sample size calculation as observed in Nwokorie and Adiukwu (2020), and Nwokorie and Igbojekwe (2019).

Data for the study were retrieved from the taste panelists using the sensory assessment scorecard prepared in a nine-point hedonic scale to evaluate organoleptic attributes of the fish products including appearance, colour, taste, aroma and overall acceptability. Consequently, data were analyzed using One-way Analysis of Variance (ANOVA) with the aid of Statistical Package for Social Sciences (SPSS) version 20.0 to determine significance difference in the treatment means and the least significant difference (LSD) analysis ($p<0.05$) to separate means.

Appropriate cooking utensils were employed in the preparation of the fish products at the Demonstration Kitchen of Hospitality Management, The Federal Polytechnic Ilaro. Three fish species were selected for the study as a result of their entire season availability in the local market. They were purchased at Sayedero Market in Ilaro. The selected fishes are

i. Kote or Horse mackerel – *Trachurus trachurus*
ii. Titus or Atlantic mackerel – *Scomber scombrus*
iii. Doctor or Nibble fish – *Garra rufa*

Five pieces (each) of the fishes were washed in clean potable running water and cut into four equal sizes after having the head and tail parts discarded. Six seasoning cubes (*Maggi*) were used with salt, pepper and onions. The combined spices (seasoning, onion, salt, and pepper) were added onto the fish before applying the appropriate cooking methods: poaching, boiling, and steaming.

RESULTS

The following samples (fishes) and moist cooking methods were adopted for the study;

Samples: *A= Kote*
B= Titus
C= Doctor
Method: *X= Poaching*
Y= Boiling
Z= Steaming

Table 1: Descriptive statistics on the samples using the three moist methods of cooking

Sample	n	Taste		Colour		Flavour		Aroma		Appearance		Overall Acceptability	
		$\bar{x}$	±	$\bar{x}$	±	$\bar{x}$	±	$\bar{x}$	±	$\bar{x}$	±	$\bar{x}$	±
AX	25	7.76	1.128	7.64	1.150	7.60	1.107	7.60	1.154	7.72	.812	8.16	.986
AY	25	7.92	1.320	7.96	.934	7.52	1.013	7.52	1.122	7.60	.916	7.84	1.027
AZ	25	7.44	1.083	7.48	1.045	7.56	1.121	7.56	.960	7.76	.791	8.04	1.059
BX	25	7.60	1.190	7.52	.918	7.24	1.157	7.24	1.200	7.68	1.290	7.80	.866
BY	25	7.76	.925	7.80	1.080	7.56	.832	7.56	1.083	7.88	1.066	8.12	.881
BZ	25	7.48	1.159	7.76	.925	7.84	1.157	7.84	.746	7.92	.812	7.76	.969
CX	25	7.28	1.173	7.56	1.003	7.44	1.224	7.44	1.003	7.44	.916	7.76	1.090
CY	25	7.16	1.795	7.40	1.154	7.16	1.354	7.16	1.067	7.28	.791	7.40	1.443
CZ	25	7.48	1.417	7.20	1.384	7.32	1.224	7.32	1.435	7.00	1.290	7.68	1.314
Total	225	7.54	1.263	7.59	1.078	7.47	1.149	7.47	1.098	7.58	1.066	7.84	1.090

Codes: n = Sample size; $\bar{x}$ = Mean; ± = Standard Deviation.

Table 1 shows descriptive statistics of the different moist methods. The mean response of AX, AY, BX, and BY was approximately 8 with standard deviation of ±1.128, ±1.320, ±1.190, ±0.925 to imply that on average, the analyzed fishes with their moist method taking 'taste' into consideration were 'liked very much' by the respondents while the mean of AZ, BZ, CX, CY

and CZ was approximately 7 and were found to be 'liked moderately.' Mean response on 'colour' also indicates that AX, AY, AZ, BX, BY, BZ, and CX were 'liked very much' (6.08 ±1.778; 6.36 ±2.018) while CX and CZ were 'liked moderately.' The flavour of the fishes subjected to three moist methods of cooking were also analyzed. Samples (AX, AY, AZ, BY and BZ) were found with approximate mean of 8, which tends to be 'liked very much' while the BX, CX, CY, and CZ samples were 'liked moderately' with an approximate mean of 7. The aroma has the same result with flavour AX, AY, AZ, BY and BZ. The mean is approximately 8 and the samples are 'liked very much' while the BX, CX, CY, and CZ were 'liked moderately' with an approximate mean of 7. Mean response of the appearance reveals that AX, AY, AZ, BX, BY, and BZ have mean scores of 8 (approximately) while sample 'C' was found to have the approximate mean of 7, which sensed to be 'liked moderately.' Overall acceptability scores depict that the samples subjected to the moist cooking methods were found to be 'liked very much' except CZ that was found to be 'liked moderately.'

Table 2: ANOVA result of significant difference between the samples subjected to moist method of cooking

		Sum of Squares	df	Mean Square	F	Sig.
Taste	Between Groups	11.849	8	1.481	.925	.497
	Within Groups	346.000	216	1.602		
	Total	357.849	224			
Colour	Between Groups	10.462	8	1.308	1.130	.344
	Within Groups	249.920	216	1.157		
	Total	260.382	224			
Flavour	Between Groups	14.800	8	1.850	1.421	.189
	Within Groups	281.200	216	1.302		
	Total	296.000	224			
Aroma	Between Groups	8.622	8	1.078	.890	.525
	Within Groups	261.440	216	1.210		
	Total	270.062	224			
Appearance	Between Groups	17.840	8	2.230	2.035	.044
	Within Groups	236.720	216	1.096		
	Total	254.560	224			
Overall Acceptability	Between Groups	11.360	8	1.420	1.203	.298
	Within Groups	254.880	216	1.180		
	Total	266.240	224			

Table 2 shows the significant difference in ANOVA results of the samples subjected to moist methods. The groups on the ANOVA table indicate the source of variation of the considered samples in the study. The F-value of 0.925 and Sig. of 0.497 show that there is no significant mean difference in the type of fish subjected to moist method taking 'taste' into consideration. Based on colour test of significance, the result of F-statistics is 1.130 with Sig. 0.344, which indicate that there is no significant mean difference in the type of fish subjected to moist methods since the p-value is greater than 0.05. For the flavour, the F-statistics is 1.421 and p-value 0.189, greater than (alpha) 0.05, shows that there is no significant mean difference in the type of fish subjected to moist method. Aroma shows an output (F-statistics) of 0.890 and Sig. value 0.525. This indicates that there is no significant mean difference in the types of fish subjected to moist method. In terms of appearance, the results revealed a significant mean difference in the fishes subjected to moist methods since the F-statistics is 2.035 and Sig. is 0.044 which is less than 0.05 level of significant. The overall acceptability of F-statistics is 1.180 with the significance of 0.298. This implies that there is no significant difference in the type of fish subjected to moist cooking methods. Least Significance Difference (LSD) method of post-hoc test was adopted to check the behaviour of the samples

subjected to moist methods based on sensory attributes (Figure 1).

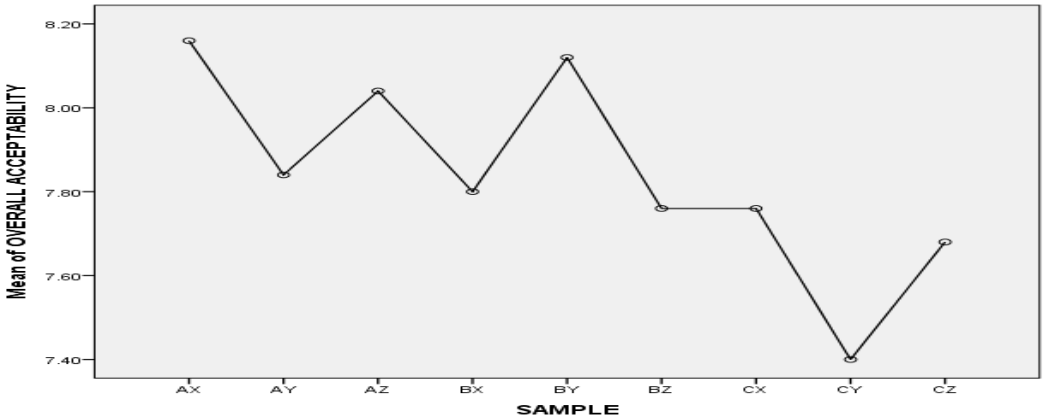

Figure 1. *Overall acceptability of fish samples based on sensory attributes*

Table 3: ANOVA result of significant difference for sample 'A' subjected to the moist methods of cooking

		Sum of Squares	df	Mean Square	F	Sig.
Taste	Between Groups	2.987	2	1.493	1.069	.349
	Within Groups	100.560	72	1.397		
	Total	103.547	74			
Colour	Between Groups	2.987	2	1.493	1.362	.263
	Within Groups	78.960	72	1.097		
	Total	81.947	74			
Flavour	Between Groups	1.307	2	.653	.558	.575
	Within Groups	84.240	72	1.170		
	Total	85.547	74			
Aroma	Between Groups	.080	2	.040	.034	.966
	Within Groups	84.400	72	1.172		
	Total	84.480	74			
Appearance	Between Groups	.347	2	.173	.133	.875
	Within Groups	93.600	72	1.300		
	Total	93.947	74			
Overall Acceptability	Between Groups	1.307	2	.653	.622	.540
	Within Groups	75.680	72	1.051		
	Total	76.987	74			

Table 3 tests the significant difference in sample 'A' subjected to the three moist cooking methods. The groups of the ANOVA indicate the source of variation of the samples. The F-value of 1.069 and Sig. value of 0.349 shows that there is no significant mean difference in the type of fish subjected to moist method taking 'taste' into consideration. Based on colour test of significance, the result of F-statistics is 1.362 with Sig. value of 0.267 indicating that there is no significant mean difference in the fish subjected to moist cooking methods since the p-value is greater than 0.05. For the flavour component, the F-statistics is 0.558 and Sig. value of 0.575 shows that there is no significant mean difference in the samples. Result for aroma revealed F-statistics of 0.034 and Sig. value of 0.966, showing no significant mean difference in the type of fish subjected to a moist cooking method. In terms of the appearance, the results revealed no significant mean difference in the samples, since the F-statistics is 0.133 and Sig. value is 0.875. The overall acceptability has F-statistics value of 0.622 with the Sig. value of 0.540. This implies that there is no significant difference in the type of fish based on the method applied

Table 4: ANOVA result of significant difference for sample 'B' subjected to the moist methods of cooking

		Sum of Squares	df	Mean Square	F	Sig.
Taste	Between Groups	.987	2	.493	.409	.666
	Within Groups	86.800	72	1.206		
	Total	87.787	74			
Colour	Between Groups	1.147	2	.573	.600	.552
	Within Groups	68.800	72	.956		
	Total	69.947	74			
Flavour	Between Groups	2.587	2	1.293	1.150	.322
	Within Groups	80.960	72	1.124		
	Total	83.547	74			
Aroma	Between Groups	4.507	2	2.253	2.132	.126
	Within Groups	76.080	72	1.057		
	Total	80.587	74			
Appearance	Between Groups	.827	2	.413	.438	.647
	Within Groups	67.920	72	.943		
	Total	68.747	74			
Overall Acceptability	Between Groups	1.947	2	.973	1.184	.312
	Within Groups	59.200	72	.822		
	Total	61.147	74			

Table 4 tests the significant difference of sample 'B' subjected to moist cooking methods. The groups of the ANOVA indicate expected variation of the samples. The F-value of 0.409 and Sig. value of 0.666 show no significant mean difference in the samples based on the taste. Result for colour shows that F-statistics is 0.600 with Sig. value of 0.552 which indicates no significant mean difference in the samples. F-statistics for flavour is 1.150 while Sig. value is 0.322. This shows no significant mean difference in the fish subjected to moist cooking methods. Aroma result with F-statistics of 2.132 and Sig. value of 0.126 shows there is no significant mean difference in the samples. Result for appearance revealed no significant mean difference in the samples since the F-statistics is 0.438 and Sig. value is 0.647. F-statistics and Sig. value for overall acceptability are 1.184 and 0.312 revealing no significant difference in the samples.

Table 5: ANOVA result of significant difference for sample 'C' subjected to the moist methods of cooking

		Sum of Squares	df	Mean Square	F	Sig.
Taste	Between Groups	1.307	2	.653	.297	.744
	Within Groups	158.640	72	2.203		
	Total	159.947	74			
Colour	Between Groups	1.627	2	.813	.573	.566
	Within Groups	102.160	72	1.419		
	Total	103.787	74			
Flavour	Between Groups	2.667	2	1.333	.828	.441
	Within Groups	116.000	72	1.611		
	Total	118.667	74			
Aroma	Between Groups	.987	2	.493	.352	.705
	Within Groups	100.960	72	1.402		
	Total	101.947	74			
Appearance	Between Groups	2.480	2	1.240	1.187	.311
	Within Groups	75.200	72	1.044		
	Total	77.680	74			
Overall Acceptability	Between Groups	1.787	2	.893	.536	.587
	Within Groups	120.000	72	1.667		

Total	121.787	74

Table 5 tests the significant difference of sample 'C' with the three moist cooking methods. The groups of the ANOVA indicate expected variations of the considered samples. The F-value of 0.297 and Sig. value of 0.744 show there is no significant mean difference in the taste of the fish subjected to moist cooking method. Result for colour of the samples revealed that F-statistics is 0.573 with Sig. value of 0.566 which indicates that there is no significant mean difference in the samples. For flavour, the F-statistics of 0.828 and Sig. value of 0.441 show no significant mean difference in the samples subjected to moist cooking method. Aroma gives an output of F-statistics of 0.352 and Sig. value of 0.705 to show no significant mean difference in the type of fish subjected to moist method. In terms of the appearance, the result shows there is no significant mean difference in the samples with an F-statistics of 1.187 and Sig. value of 0.311. The F-value and Sig. value of overall acceptability are 0.536 and 0.587, to show there is no significant difference in the samples.

CONCLUSION

Sensory assessment conducted showed no significant difference in all the three types of fishes subjected to the three moist cooking methods. Result of mean scores for all samples of the corresponding methods fell between 7 and 8, which were rated between 'like moderately' and 'like very much' based on the Hedonic scale used.

The study concludes, therefore, that the three fish samples (*Trachurus trachurus*, *Scomber scombrus* and *Garra rufa*) are acceptable for sale in local restaurants, judging from the ease of preparation of fish samples using any prescribed moist cooking method, which makes for its general acceptability.

The fish can be purchased from the local market and they are available throughout the year. The level of tolerance to heat makes good presentation of the products, which also creates an opportunity for optimum sale.

In terms of appearance, *Trachurus trachurus* performed better than the other samples during sensory assessment. Though the difference between the fishes was not significant, using the three moist cooking methods, overall acceptability rate of the three samples shows a high possibility of patronage of the products in the local restaurant industry. However, acceptability rate for *Trachurus trachurus* is higher than that of *Scomber scombrus* and *Garra rufa* as evidenced by the mean scores and standard deviation.

The heat regulation is important while cooking fish using poaching and steaming methods to preserve nutrients. The *Poissonnier* (Fish Chef) should understand the need to cook the prescribed fish with low heat not only to preserve fish nutrients but to optimize taste and appearance.

Careless food handling can lead to contamination. Food handlers should ensure proper handling of fish during preparation to reduce the risk of contamination. Additionally, it is advisable to cover the fish when cooking with moist methods to reduce the risk of contamination.

For the advantage of fighting obesity, local restaurants should embrace cooking fish with moist methods, especially to assist food choices of obese customers. To this end, local restaurants should find a means of educating customers on the benefits of consuming fish cooked with moist methods. Therefore, customer orientation is important; hence, restaurants should inculcate the same into their marketing strategy.

The *Poissonnier* should endeavour to minimize cooking time for fish while using moist methods, especially for boiling method, to regulate cholesterol oxidation. Care should also be taken in the event of turning while cooking to enhance the stability and avoid shredding of the fish.

The *Poissonnier* should also ensure consistency in the prescribed methods of moist cooking for fishes. Excess use of additives should be avoided in order not to tamper with taste and aroma in different portions. As additives affect customer acceptability when inconsistency is perceived either for appearance, taste or aroma at purchase intervals and portions.

REFERENCES

Adeyeye, S.A.O. (2016). Traditional fish processing in Nigeria: a critical review. *Nutrition and Food Science*, *46*(3), 321-335.

American Heart Association. (2009). How fish is cooked affects heart-health benefits of omega-3 fatty acids. *ScienceDaily*. Retrieved from www.sciencedaily.com/releases/2009/11/091117161004.htm

Bate, E.C., & Bendall, J.R. (2010). Changes in fish muscle after death. *British Medical Bulletin*, (12), 2305.

Bognar, A. (1998). Comparative study of frying to other cooking techniques influence on the nutritive value. *Grasas y Aceites*, *49*, (3-4), 250-260.

Castro-González, I., Maafs-Rodríguez, A. G., & Pérez-Gil Romo, F. (2015). Effect of six different cooking techniques in the nutritional composition of two fish species previously selected as optimal for renal patient's diet. *Journal of Food Science and Technology*, *52*(7), 4196–4205.

Chumngoen, W., Chen, C. F., & Tan, F. J. (2018). Effects of moist- and dry-heat cooking on the meat quality, microstructure and sensory characteristics of native chicken meat. *Animal Science Journal*, *89*(1), 193–201.

Cover, S., Bannister, J.A., & Kehlenbrink, E. (2006). Effect of four conditions of cooking on the eating quality of two cuts of beef. *Journal of Food Science*, *22*(6), 635-647.

Cristelle, T.T., Macaire, W.H., Serge, N.H., François, T., Fani, M., Michel, L., & Binay, N. (2018). Effects of boiled fish *(Silurus glanis, Heterotis niloticus, Cyprinus carpio and Oreochromis niloticus)* ingestion on the growth of young male and female wistar albino rats. *Journal of Nutrition and Food Sciences*, *8*, 1-10.

Eyo, E.E. (2013). Fish processing and utilization. Paper Presented at the National Workshop on Fish Processing, Preservation, Marketing and Utilization, New Bussa, pp.4-5.

FAO. (2017). Global fish economy. *GLOBEFISH Highlight*, *2*, 11-12. Retrieved from http://www.fao.org/3/a-i7332e.pdf

Gök, V., Uzun, T., Tomar, O., Çağlar, M.Y., & Çağlar, A. (2019). The effect of cooking methods on some quality characteristics of *gluteus medius. Food Science and Technology*, *39*(4), 999-1004.

Gupta, V., Gandotra, R., Koul, M., Gupta, S., & Parihar, D. S. (2015). Quality evaluation and shelf life assessment of raw and value added fish product (fish cutlet) of Wallago attu during frozen storage conditions (212 8C). *International Journal of Fisheries and Aquatic Studies*, 2, 5.

Holmes, Z.A., Woodburn, M., & Davis, E.A. (2009). Heat transfer and temperature of foods during processing. *Critical Reviews in Food Science and Nutrition*, *14*(3), 231-294.

Hughner, S.H., & Maher, J.K. (2006). Factors that Influence Parental Food Purchases for Children: Implications for Dietary Health. *Journal of Marketing Management*, *22*(9-10), 929-954.

Joardder, M.U.H., & Hasan-Masud, M. (2019). *Food Preservation in Developing Countries: Challenges and Solutions*. AG, Switzerland: Springer.

Karimian-Khosroshahi, N., Hosseini, H., Rezaei, M., Khaksar, R., & Mahmoudzadeh, M. (2016). Effect of different cooking methods on minerals, vitamins, and nutritional quality indices of Rainbow Trout *(Oncorhynchus mykiss)*, *International Journal of Food Properties*, *19*(11), 2471-2480.

Katz, H., Solomon, W., & William, W. (2012). Encyclopedia of food and culture. New York: Scribner.

Kumar, A., Singh, P., & Danish, M. (2013). Changes in proximate, biochemical and microbiological characteristics of dried Labeo gonius fillets during storage at room temperature. *African Journal of Biotechnology*, *12*(20), 2997-3005.

Liam, K., Zakaria, Z., Gunny, A.A.N., & Ishak, M.A.M. (2014). Effect of steaming process on new formulation and physical properties of earthworm-based fish pellets for African Catfish *(Clarias gariepinus). Pakistan Journal of Biological Sciences*, 17: 1064-1068.

Melovic, B., Cirovic, D., Dudic, B., Vulic, T.B., & Gregus, M. (2020). The analysis of marketing factors influencing consumers' preferences and acceptance of organic food products: Recommendations for the optimization of the offer in a developing market. *Foods*, *9*, 259.

Nwokorie, E.C. (2015). Food tourism in local economic development and national branding

in Nigeria. *HATMAN Journal of Hospitality and Tourism, 5*(1), 20-26.

Nwokorie, E.C. (2017). Acceptability of roast *Dioscorea rotundata* with fortified *Gongronema latifolium* sauce for consumption in Nigeria restaurants. *International Journal of Innovative Research and Advanced Studies, 4*(1), 27-33.

Nwokorie, E.C., & Ezeibe, N. (2016). Service failure as a causative of customer aggression on hospitality industry employees. *Basic Research Journal of Business Management and Accounts, 5*(2), 12-18.

Nwokorie, E.C., & Ezeibe, N. (2017). Consumer acceptability of bread produced from alternatives to wheat flour for sale in hotels and restaurants. *International Journal of Science and Research, 6*(4), 1463-1467.

Nwokorie, E.C. & Igbojekwe, P. (2019). Security challenges for the hotel industry: Implications for selected hotels in Owerri, Nigeria. *Academica Turistica – Tourism and Innovation Journal*, *12*(2), 193-205. https://doi.org/10.26493/2335-4194.12.193-205

Nwokorie, E.C. & Adiukwu, K.I. (2020). Hospitality and tourism entrepreneurship: Administrative barriers in Imo State, Nigeria. *International Scientific Journal – TURIZAM*, *24*(1), 13-32. https://doi.org/10.5937/turizam24-22955

Obiero, K., Meulenbroek, P., Drexler, Dagne, A., Akoll, P., Odong, R., Kaunda-Arara, B., & Waidbacher, H. (2019). The contribution of fish to food and nutrition security in Eastern Africa: Emerging trends and future outlooks. *Sustainability*, *11*, 1636.

Panchavarnam, S., Basu,S., Manisha, K., Warner, S.B., & Venugopal, V. (2003). Preparation and use of freshwater fish, rohu (Labeo rohita) protein dispersion in shelf-life extension of the fish steaks. *LWT - Food Science and Technology*, *36*(4), 433-439.

Sigh, S., Roos, N., Sok, D., Borg, B., Chamnan, C., Laillou, A., & Wieringa, F. T. (2018). Development and acceptability of locally made fish-based, ready-to-use products for the prevention and treatment of malnutrition in Cambodia. *Food and Nutrition Bulletin*, *39*(3), 420–434.

Spencer, M. (1973). Chemical changes during cooking, processing and storage of food. *Nutrition & Food Science*, *73*(2), 11-14.

Stancheva, M., Merdzhanova, A., Galunska, B., & Dobreva, A.D. (2014). The effect of steaming process on fat soluble vitamins' content and fatty acid profile in Bluefish and Rainbow Trout fillets. *Animals Review*, *1*(1), 1-10.

Tidwell, J. H., & Allan, G. L. (2001). Fish as food: aquaculture's contribution. Ecological and economic impacts and contributions of fish farming and capture fisheries. *EMBO reports*, *2*(11), 958–963. https://doi.org/10.1093/embo-reports/kve236

Xu, Y., Chen, Y., Cao, Y., Huang, W., Zhang, S., Xia, W., & Jiang, Q. (2016). Effect of steam cooking on textural properties and taste compounds of Shrimp (*Metapenaeusensis*). *Food Science and Technology Research*, *22*, 75-81.

Zhang, X., Ning, X., He, X., Sun, X., Yu, X., Cheng, Y., Yu, R., & Wu, Y. (2020) Fatty acid composition analyses of commercially important fish species from the Pearl River Estuary, China. *PLoS ONE*, *15*(1), 1-16.

Zhang, Y., Wang, X., Wang, W., & Zhang, J. (2014). Effect of boiling and frying on nutritional value and *in vitro* digestibility of rabbit meat. *African Journal of Food Science*, *8*(2), 92-103.