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RESEARCH ARTICLE

THE EFFECT OF PRESERVATION METHODS ON THE CHEMICAL AND MINERAL ELEMENT COMPOSITION OF TWO FISH SPECIES OBTAINED FROM ABA, NIGERIA

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ABSTRACT

The mineral elements and proximate (protein, crude fat, crude ash, moisture and total carbohydrate) composition of *Clarias gariepinus* (Cat fish) and *Oreochromis niloticus* (Tilapia) preserved by traditional methods (smoking, frying and steaming) were investigated by standard methods described by the Association of Official Analytical Chemist (AOAC). The mean protein, fat, fiber, ash, moisture and carbohydrate composition in g/100g for fresh Tilapia were found to be 21.54, 3.50, 0.43, 1.30, 61.00, 10.53, and for cat fish – 19.53 , 1.00, 1.30, 1.74, 76.40, 1.33 respectively. The fresh fish samples were preserved by smoking, frying and steaming, and the result of the proximate and mineral element analysis of the preserved samples showed that the nutrient contents were affected to varying degrees by the different preservation methods.

INTRODUCTION

Fish is an aquatic organism that has been used as food for generations now. It is one of the most important sources of animal protein available in the tropics and has been widely accepted as a good source of protein and other elements for the maintenance of healthy body (Andrew, 2001). It is also a source of revenue for many. It is harvested and eaten in various forms because of its rich protein and nutrient values. Fish constitutes 30% to 80% of the total protein intake of the coastal people of West Africa (Abolagba and Melle, 2008). Raw (or Fresh) fish has to be stored and kept for days or even months before being transported to where they are needed. Fish is a highly perishable food and to avoid deterioration different methods have been employed for its preservation. In Nigeria, fish is most often preserved by the traditional methods of steaming, frying and drying (sun or smoke) in homes and for commercial purposes. Preservation of food has been reported to affect the nutrient quality of food (Harris, 1988). Nutrients are the building blocks of the human body, and they enter into the cells, regulate their functions and furnish the energy for their work (Severi *et al*., 1997). The important aspect of preservation is to maintain or create additional nutritional value, texture and flavor (Fawole *et al*., 2007). This research work therefore seeks to evaluate the effect of processing methods (smoking, frying and steaming) on the nutrient quality of two species of fish (Cat Fish and Tilapia) commonly consumed in Aba metropolis, Nigeria.

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MATERIALS AND METHODS

Sample collection and pretreatment

Fresh Catfish and Tilapia samples of the same weight were bought from two different fish farmers in Aba metropolis, and used for the analysis. Catfish and tilapia were chosen because they are readily available, affordable and commonly consumed. Each of the samples was gutted, washed thoroughly with clean water and drained. The washed samples were each divided into four portions; a portion was analyzed immediately, and the remaining three portions were salted and left to stand for about 10 minutes. Then the three portions were subjected to deep frying in vegetable oil, smoking with firewood, and steaming in hot water respectively. The fried and smoked fish samples were packaged and stored for a week prior to analysis, while the steamed sample was refrigerated for some days before analysis.

Method of Analysis

The crude protein, crude fat, moisture, total carbohydrate and crude fiber, ash and mineral elements (Na, K, Ca, Mg and Fe) were determined using standard methods as described by AOAC (1996). The crude protein (N X 6.25) content was determined using the micro-Kjeldahl method. The moisture content was obtained by drying the sample in an oven at 105^{o}C until a constant weight was obtained. Ash contents were determined after combustion in a muffle furnace at 550^{o}C, total fat was estimated by soxhlet extraction method using normal

hexane. And the carbohydrate content was obtained by difference method.

RESULTS AND DISCUSSION

The Results showed that *Clarias gariepinus* (Cat fish) and *Orechronis niloticus* (Tilapia) both contained fat, protein, carbohydrates, ash, moisture and and the mineral elements Iron, magnesium, Calcium, Sodium and Potassium in varying proportions. Table 1 and 2 shows the mean proximate composition of Tilapia and Catfish and the effects of preservation methods on fish samples. The fresh Tilapia and Catfish have higher moisture and protein value than the preserved samples. The moisture content was lower in fresh Catfish (61g/100g) than in fresh tilapia (76.4g/100g). Fresh tilapia had higher protein, carbohydrate, fat, and ash contents than Catfish. Catfish (1.30) was richer in crude fiber than tilapia (0.43). The results in Tables 1 and 2, 3, 4 indicates that preservation methods affects the proximate and mineral element composition of both fish samples. The result showed that the protein and moisture contents in the two fish samples decreased after preservation. The decrease was in the order: smoked > steamed > fried.

Table 1. Effect of preservation methods on the proximate content of tilapia fish (g/100g)

METHOD	PROTEIN		CARBOHYDRATE		MOISTURE		FAT		ASH		CRUDE FIBRE	
	Content	% Change	Content	% Change	Content	% Change	Content	% Change	Content	% Change	Content	% Change
Fresh	21.54		12.66		61.00		3.50		1.80		0.43	
Smoked	8.27	--13.27	31,43	18.77	50.00	-11.00	9.00	5.50	1.30	-0.50	0.87	0.44
Fried	10.42	-31.6	21.07	8.41	55.40	-5.60	10.50	7.00	2.61	0.81	0.43	±0
Steamed	9.02	-12.52	23.81	11.15	59.20	-1.80	8.00	4.50	1.74	-0.06	1.30	0.87

Table 2. Effect of preservation methods on the proximate content of cat fish (g/100g)

METHOD	PROTEIN		CARBOHYDRATE		MOISTURE		FAT		ASH		CRUDE FIBRE	
	Content	% Change	Content	% Change	Content	% Change	Content	% Change	Content	% Change	Content	% Change
Fresh	19.53		1.33		76.40		1.00		1.74		1.30	
Smoked	4.55	-14.98	37.18	+35.85	49.60	-26.80	6.50	5.50	2.17	0.43	1.73	0.43
Fried	7.60	-11.93	26.07	+27.74	56.60	-19.80	7.50	6.50	2.17	0.43	1.30	±0
Steamed	6.13	-13.40	18.30	+16.97	67.40	-9.00	6.00	5.00	2.17	0.43	0.43	-0.87

Table 3. Effect of preservation on mineral element composition of tilapia fish

METHOD	SODIUM		POTASSIUM		CALCIUM		MAGNESIUM		IRON	
	Content	% Change	Content	% Change	Content	% Change	Content	% Change	Content	% Change
Fresh	153.00		243.00		2.89		1.79		0.074	
Smoked	123.00	-30.00	230.00	-13.00	2.24	-0.65	1.70	-0.09	0.052	-0.022
Fried	117.00	-36	122.00	-121	1.92	-0.970	0.02	-0.87	ND	±0.00
Steamed	131.00	-22	238	-5.00	3.13	0.24	2.04	0.25	0.016	-0.013

Table 4. Effect of preservation on mineral element composition of cat fish

METHOD	SODIUM		POTASSIUM		CALCIUM		MAGNESIUM		IRON	
	Content	% Change	Content	% Change	Content	% Change	Content	% Change	Content	% Change
Fresh	242.00		290.00		3.28		1.85		0.045	
Smoked	231.00	-11.00	269.00	-21.00	1.20	-2.08	1.75	-0.10	0.036	0.009
Fried	120.00	-122	153.00	-137	1.84	-1.44	0.78	-1.07	0.032	0.013
Steamed	238.00	-04.00	275.00	-15.00	3.37	0.09	2.00	0.15	0.042	0.003

The carbohydrate, fat and ash content of all the preserved samples were higher than that in the fresh samples. This shows the three preservation methods lead to increase in the carbohydrate, fat and ash contents of fish. The vital nutrients of fish have been reported to depend largely on the method of preservation or storage (Ojewola, 2003 and Akhter *et al*., 2009). Aberoumand (2011, Greenfield and Kosulwat (1999) and Kubow (1992) reported that the reactions of water/oil with food items particularly at high temperatures during processing affects some nutrients in the food item as well as causes alteration in the structure of the oil and denaturing of the food nutrients. The increased fat content is attributed to the concentration of the nutrients after evaporation of the moisture content. And the fried sample contained higher fat values than the others this is due to the absorption of oil used in the frying of the fishes. In this study, smoking, frying and steaming reduced the protein and moisture contents in both samples. Several other researchers have also observed this decreases (Akhter *et al*., 2009; Arannilewa *et al*., 2005; Omotosho, 1995 and Aberoumand, 2013). Smoking increases the shelf-life of fish as a result of the combined effect of dehydration, anti microbial and anti-oxidant activities of several smoke constituents mainly formaldehyde, carboxylic acids and phenols (Doe 1998, Olopade *et al*., 2011). Fishes are consumed as a major source of protein, it is therefore important that its value is not compromised during processing. This study shows that all the preservation method reduced the protein contents of the fishes. Smoking resulted in a greater decrease of the protein contents of Catfish (from 21.54% to 8.27%) and tilapia (from 19.53% to 4.55%). Fresh Catfish had higher protein content than tilapia. The decreased protein contents is attributed to the denaturing of the protein due to high temperatures (Greenfield and Kosulwal, 1991; Aberoumand 2011,and Aberoumand 2013) similar studies have reported decreased protein and moisture contents. Smoking affects the nutritional value of fish mainly by reducing the biological availability of protein (Stround (1998) and Olopade *et al*., 2011). The increase in ash content after preservation might be due to loss of humidity as opined by Salan *et al* (2006). Similar increases in ash content after preservation has been reported by Olopade *et al* (2011).

Olapade *et al.* (2011) reported higher crude protein after smoking of Clarias gariepinus. The result of the present study is contrary to reports by Olopade *et al.* (2011) of increased protein content after smoking in both samples. The crude fiber contents were low. Catfish contained higher amount of crude fiber than Tilapia. The two species of fish contained all the mineral elements analyzed. Tables 3 and 4 show the mineral elements composition and the effect of the different preservation methods on them. The result indicates that the fish samples can serve as sources of mineral elements required by the body for proper function of the body cells, and that fish is a good source of the mineral elements sodium, potassium and calcium. The sodium and potassium contents of both fish samples are greatly reduced by frying (Table 3 and 4)

Conclusion

The two species of fish contains nutrients and mineral elements that are essential for proper body function. But these nutrients are affected by the methods employed in their processing and preservation. It is therefore pertinent that fish samples are not over processed before being consumed.

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