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Effects of Preservation methods and duration of storage on the Nutrient composition of *Clarias gariepinus* in Mubi, Adamawa State, Nigeria.

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ABSTRACT

A study on the Effects of preservation methods and duration of storage on the nutrient composition of *Clarias gariepinus* was conducted in Mubi Adamawa State. Mean concentration of Crude Protein, Fats, Moisture, Crude Fibre, Nitrogen Free Extracted, Carbohydrates and Ash with regards to different preservation methods were determined; it was observed that the different preservation methods and duration of storage have effects on the nutrient composition of fish. It was also observed that the different preservation methods (smoking, drying, and frozen) resulted in the physical and chemical change of *C. gariepinus*. Moisture and Ash in this study showed a significant effect with regards to the different preservation methods while Crude Protein, Fats, Crude Fibre, NFE and Ash showed no significant effect. Crude protein which is the most important nutrient in fish was higher (50.04± 1.82) in sun dried fish and lower (48.56± 3.72) in the smoked fish. In contrast, CHO was observed to be higher (24.62 ± 4.18) in smoked fish and lower (22.14±2.55) sun dried and frozen fish. With regards to duration of preservation of Crude Protein, Fats, Moisture, Crude Fibre, NFE, and Ash showed a significant effect, and were all high in the first week of preservation, except CHO which was high in the sixth (6^{th}) week of preservation. Many researchers have linked the availability of nutrient in fish to the method of preservation and duration of storage. This study revealed that, the longer the processor leaves a processed fish, the greater the loss in nutrient quality.

KEY WORDS: *Clarias gariepinus*, Preservation, Nutrient, Duration, Cabohydrate,

Introduction

The need for high quality protein in man's diet especially in the developing countries like Nigeria cannot be over emphasized. Fish is a good source of protein, minerals, and fats (Eyo, 2001). It is considered as the main supply of animal protein to the low and middle income groups of people (Akande and Ola, 1992, Fashina - Bombata *et al* 2005). Fish is consumed as food and is readily available in the market as fresh, smoked, dried, canned, chilled or frozen. The term preservation refers to any one of a number of techniques used to prevent fish from spoiling. Fish is a low acid food and therefore susceptible to pathogenic and enzymatic spoilage improving handling practices and processing however extended the shelf life of fish (Akande, 1996). The four most popular methods of fish preservation methods are freezing, canning, smoking and drying (Saliu, 2008). Preservation is achieved by creating condition outside or inside the fish to make it unsuitable for the optimums operation of bacteria and enzymes; preservation methods are applied with the intention of

making the fish safer and extended its shelf life (Cihazala, 1994). The most common method of fish preservation used by fish processors in Nigeria are smoking, freezing and drying. Although these methods of preservation of fish provide higher production, less waste and low production cost (Oluwaniyi and Dosun, 2008) yet those methods have been known to affect the chemical composition of the fish preserved. Several workers have linked the availability of vital nutrient in fish to the methods of preservation and duration (Osibona, 2011 and Ryder *et al.*, 1993). Many a times fish are preserved for a longer period of time using different preservation methods without considering the effect on the nutrient composition of such fish. The aim of this study therefore is to evaluate whether preservation methods and duration of storage has effect on the nutrient composition of *Clarias gariepinus.*

Materials and Methods

The study was conducted in Mubi Adamawa State Nigeria. Mubi is situated about 214km north of the state capital, Yola. It is located on latitude 11° and 8″ north of equator and longitude 11° 42″ west and 13° 34″ east. (Adebayo, 2001).

Fresh samples of *C. gariepinus* (56) were purchased from fish mongers in Mubi. Fish samples were identified taxonomically using standard reference sources (www.fishbase.org). The fish sample was transported to the Animal Science laboratory of Adamawa State University, Mubi for nutrient analysis.

The fish samples were gutted and washed with clean water as suggested by (Saliu, (2008). The fish samples were then divided into three sets and Subjected to three preservation methods.

Three preservation methods: smoking, drying, and freezing were used. The study was conducted for the period of six weeks. Each of the three sets of fish was subjected to the three preservation methods and were analysed for nutrient composition based on the preservation methods in triplicate for the period of six weeks at one-week interval as recommended by Watchman, (2000).

Crude protein, fats, moisture, crude fibre, carbohydrate and ash were the analysed using the method as described by A O A C, (2001). Crude protein was determined using kjeldahl which involved digestion, distillation and titration. The percentage crude protein was obtained using the formula:

% Protein = N x 6.25, where N =NFE, 6.

Fats were determined using Soxlet method. Percentage Fats was obtained by the formular:

% Fat = w_0-w_i/w_0, where W_0=Initial weight, W_I=Final weight

Moisture was determined using an oven drying method. Percentage moisture was obtained by the formula:

%Moisture = $w_0 - w_i/w_0 x100$, where W_0=Initial weight, W_I=Final weight

Crude fibre was determined using trichloacetic acid. Percentage crude fibre was obtained using the formula:

% CF = $w_0 - w_i$ x 100 / w_0, where W_0=Initial weight, W_I=Final weight

CHO was determined using different method as recommended by AOAC9 (2001). The percentage carbohydrate was calculated using the formula:

%CHO=100-%fibre+%fat+%crude protein

Ash was determined using an oven drying method as recommended by AOAC (2001). The percentage ash was obtained using the formula:

%Ash=weight of fish+ ash-weigh of fish+100/ Weight of feed stuff used**.**

Data obtained in this study was subjected to analysis of variance (ANOVA) and means were separated using least significant difference (LSD) as described by Steel and Torrie, (2002)

Result

Mean concentration of Crude Protein, Fats, Moisture, Crude Fibre, Nitrogen Free Extracted, Carbohydrates and Ash with regards to the different preservation methods is presented on Table 1. A significant difference ($P<0.05$) was observed in ash and moisture. The highest Ash and Moisture contents were 15.88 ± 0.49 and 8.88 ± 0.42 while the lowest contents 14.71 ± 0.17 and 5.44± 0.49 which was recorded in frozen and smoked fish respectively. A non significant difference ($P>0.05$) were observed in Crude Protein, Fats, Crude Fibre Nitrogen Free Extracted, and Carbohydrates. Highest Crude Protein content 50.04± 1.82 was recorded in sun dried fish while the lowest content 48.56± 3.72 was recorded in smoked fish. The highest Fat content 13.13± 0.37 was obtained in frozen fish while the lowest content 11.29±0.42 was obtained in smoked fish. The highest Crude Fibre 0.82±0.07 was recorded in smoked fish while the lowest content 0.70 ± 0.08 was recorded in frozen fish. Highest NFE contents 8.30±0.32 was obtained in smoked fish while the lowest content 7.96 ±0.34 was obtained in frozen fish. Highest CHO content 24.62 ± 4.18 was obtained in smoked fish while the lowest content 22.14±2.55 was obtained in sun dried fish.

Mean concentration of Crude Protein, Fats, Moisture, Crude Fibre, Nitrogen Free Extract, Carbohydrates and Ash with regards to Duration of Preservation is presented on the Table 2. The highest Crude Protein content 56 ± 0.68 highest Fat content13.92 ± 0.67, highest Crude Fibre content 0.49± 0.07, highest Nitrogen Free Extract content 9.10±0.08 and highest ash content 16.42±0.64 were obtained in the first week of Preservation. The lowest Crude Protein content 9.83 ± 0.88, lowest Moisture content 4.74 ± 0.76, lowest Crude Fibre content 0.49 ± 0.07, lowest NFE content 7.09 ± 0.07 and lowest Ash content 14.08 ± 0.08 were obtained in the last six weeks of preservation. All were significantly different ($P<0.05$) except

carbohydrates where the highest content 34.09 ± 5.65 was recorded in the 6th week while the lowest content.

Table 1: Mean nutrient composition with regards to preservation methods.

	CP	FATS	MOIST	CF	NFE	CHO	ASH
Preservation							
Smoking	48.50±3.72	11.29±0.42	5.44±0.49	0.82±0.07	8.30±0.32	24.62±4.18	14.71±0.17
sun drying	50.04± .82	11.38±1.05	6.18±0.45	0.74±0.14	7.97±0.31	22.14±2.55	14.96±0.21
Freezing	49.78±2.11	13.13±0.37	8.83±0.42	0.70±0.08	7.96±0.34	22.20±3.35	15.88±0.45

CHO = Carbohydrate, NFE = Nitrogen Free Extract, CP= Crude Protein, Crude Fibre,

Discussions

Fish has traditionally been considered as a very important component of man's diet and it is the cheapest source of animal protein and is relatively low priced when compared with other sources of animal protein (FAO, 2000) in this study, it was observed that the different preservation methods and duration of storage have effect on the nutrient composition of fish. It has also been observed that the different preservation method (smoking, drying, and frozen) result in the physical and chemical change (Kamal *et al*., 2005)). Moisture and Ash in this study have a significant effect with regards to the different preservation methods while Crude Protein, Fats, Crude Fibre, NFE and Ash have no significant effect. Crude protein which is the most important nutrient in fish was higher in sun dried fish and lower in the smoked fish. This is in line with the findings of Eyo (1998) who observed that sun dried fish possesses high quality protein when compared to smoked fish. This is also in line with the observations of Madison *et al.* (2006) who observed that smoking cause nutritive loss as a result of associated heat flow of gasses as interaction of smoke with protein occurs. In contrast, CHO was observed to be higher in smoked fish than sun dried and frozen fish. Several researchers have observed that CHO decreases with frozen and sun dried preservation (Omotosho, 1995 Kamal *et al*., 2005) with regards to duration of preservation of Crude Protein, Fats, Moisture, Crude Fibre, NFE and Ash showed a significant effect (P>0.05) and were all high in the first week of preservation, except Carbohydrate which was high in the sixth (6^{th}) week of preservation. Many researchers have linked the availability of nutrient in fish to the method of preservation and duration of storage (Hardy and Smith 1976, Botta *et al.,* 1978 and Aranillewa, *et al*., 2005). Storage time and methods are major factor implicating in the loss of nutrient in fish (whittle, 1997). James (1984 reported that the longer the processor leaves a processed fish, the greater the loss in nutrient quality as observed in this study.

Table 2: Mean nutrient composition with regards to duration of storage

Variable week	CP	FATS	MOIST	CF	CHO	NFE	ASH
1	56.86±0.06	13.92±1.06	8.79±0.67	1.17±0.17	11.64±1.04	9.10±0.11	16.42±0.64
2	54.34±1.27	13.42±0.74	8.11±0.73	0.99 ±0.05	11.64 ±1.04	8.72 0.18	15.92 ±0.44
3	51.63±1.86	12.17±0.87	7.29± 0.70	0.84± 0.10	15.38±1.43	8.29± 0.28	15.25± 0.28
4	47.74±3.15	11.92±0.92	6.42± 0.67	0.56± 0.08	20.12± 2.20	7.77± 0.43	14.92 ±0.20
5	44.69±4.18	10.67±0.86	5.58± 0.65	0.52± 0.07	25.07 ±3.71	7.49 ±0.47	14.50 ±0.13
6	41.51±5.29	9.83±0.83	4.74± 0.76	0.49± 0.07	34.09 ±5.65	7.09± 0.55	14.08 ±0.08

CHO = Carbohydrate, NFE = Nitrogen Free Extract, CP= Crude Protein, Crude Fibre,

Conclusion

Fish is a good source of concentrated nutrient when the moisture is reduced. This can be achieved through either sun drying, freezing or smoking. This study revealed that sun dried fish is the best method of preservation although it was not significant from the rest of the preservation methods. The study also revealed that fish had high nutrient during the early weeks of storage especially protein.

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