



Comparative Proximate Analysis of Fried and Roasted Tilapia (*Oreochromis Niloticus*) Fish

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Abstract

The aim of this study was to determine the proximate composition of fried and roasted Tilapia fish (*Oreochromis niloticus*). The Parameters determined in the proximate composition includes protein, fat, ash, moisture and carbohydrate content using standard procedures de. The average moisture content for *O. niloticus* was found to be within the range of 29.55 to 45.16%. The ash content of both fried and roasted fish sampled ranged from 15.76 to 17.98% with no significant difference ($P < 0.05$) between the ash content of fried and roasted tilapia fish. The protein contents ranged from 18.23 to 19.32% for both fried and roasted samples with no significant difference ($p < 0.05$) between the two samples but the fat content showed significant difference ($p < 0.05$) between the fried and roasted samples with value range of 16.29 to 31.43%. The carbohydrate content of fried and roasted Tilapia fish revealed a range of 3.93 to 5.01% respectively there is no significant difference between carbohydrate content of fried and roasted tilapia fish. This study showed that fried tilapia fish is more nutritious. This indicate that frying is the best method of processing tilapia

Keywords: Comparative, Proximate composition, Tilapia, *Oreochromis niloticus*.



INTRODUCTION

The global consumption of fish and derived fish products has greatly increased during recent decades, due to a number of distinct factors (Wim *et al.*, 2007). Foremost among these factors is the growing knowledge that fish constitute an important and healthy part of the human diet, mainly owing to the presence of ω -3 polyunsaturated fatty acids (PUFA), which play an essential role in human health (Ruxton *et al.*, 2004), also to the presence of vitamins, minerals and proteins with a high biological value. Consequently, it is a well-known fact that fish represent a high-quality nutritional source (Sidhu, 2003). Fish demand is also increasing as a result of the increasing world population, higher living standards and the good overall image of fish among consumers (Cahu *et al.*, 2004). Fishes are rich source of protein commonly consumed as an alternative source of protein due to the higher cost of meat and other sources of animal protein (Omolara and Omotayo, 2009). Tilapia which belongs to the family *Cichlidae* have been important source of food for man at least since recorded history began (Fryer and Iles, 1972). The Nile tilapia, *Oreochromis niloticus* is an important fish in the ecology of tropical and sub-tropical region including Nigeria. It is the most popular species of the bony fish in Africa (Abdel-Hamid *et al.*, 2000; Offem *et al.*, 2007). Tilapias represent an important freshwater species of fish for aquaculture in different regions of the world.

They are characterized by fast growth, adaptability to a wide range of environmental variables, disease resistant and high flesh quality. They have the ability to reproduce under varying culture conditions and readily able to convert food low in plant protein to high quality flesh (El-Sayed, 2006). Since fish is not normally consumed raw, various processing methods are employed in preparing them for consumption and some of these processes include boiling, frying, roasting, smoking, which could have varying effects on their nutrient contents, texture and flavour (Eriksson, 1987). Several factors influence the nutritional content of food during processing. Heat and flow of gases cause drying of food item. This decreases water content thereby causing the changes associated with dehydration such as increasing the protein and fat content of the food (Morris *et al.*, 2004). Fishes are rich source of protein commonly consumed as an alternative source of protein due to the higher cost of meat and other sources of animal protein (Omolara and Omotayo, 2009). Since fish is not normally consumed raw, various processing methods are employed in preparing them for consumption and some of these processes include boiling, frying, roasting and smoking which could have varying effects on their nutrients contents, texture and flavour (Eriksson, 1989). Heating process (boiling, roasting and frying) is applied to enhance flavor and the taste of food and inactivate pathogenic microorganisms (Bognar, 1998). Ali (2014) recorded increased of dry matter, protein and ash content in boiled and roasted fish fillets. The study was carried out to determine the comparative proximate composition (moisture, ash, protein, fat, and carbohydrate) of fried and roasted tilapia (*Oreochromis niloticus*).

MATERIALS AND METHODS

Sample Collection and Processing

Fresh tilapia fish were collected from Yankura commercial market and transported inside polythene bags. The samples length weight were determine using meter rule and weighting balance and then washed with clean water, after which small amount of salt was added to the fish which is the normal method of preparation of fish (Bassey *et al.*, 2014). Three (3) of the samples were deep-fry in oil for



about 5 minutes which contained 750 ml of vegetable oil and was heated to a temperature of 170°C and until the fish turned brown. To achieve uniform cooking, the samples were occasionally turned by means of spatula (Bassey *et al.*, 2014). Another three (3) samples were rapped with foil paper and then roasted using charcoal for one hour thirty minutes until fully roasted Bassey *et al.* (2014). The samples were then transported to food and science technology (FST) Laboratory, Kano State University of Science and Technology (KUST Wudil) All samples were foiled and transportation to the laboratory. The samples were crushed in the laboratory using mortar and pestle and were placed separately in a white polythene bag and labelled for further analysis.

Determination of Proximate Composition

All the analyses were carried out in triplicates using the recommended methods of the Association of Official Analytical Chemists (AOAC, 2006). Moisture was determined using Oven-drying/Evaporation method (AOAC, 2006). Three grams of the sample was dried at 105°C for 2 hrs to a constant weight in an air-circulatory oven (Universalwärmeschrank, UNB 100). Loss in weight was taken as a measure of moisture content of the sample, and calculated as percentage of the sample weight. Ash was determined using Incineration (Combustion) method (AOAC, 2006). Three grams of the dried sample was incinerated at 550°C for 4 hrs in a muffle furnace until ash was obtained. The non-combustible residue represented the ash and was calculated as percentage of the weight taken. Crude protein was estimated by a process as described in the Official Methods of Analysis (No.2.057) of AOAC (2006). Crude fat was determined by the gravimetric semi- continuous solvent extraction method (AOAC, 2006). Total carbohydrate was obtained by the difference method as described by Onyeike and Omubo-Dede (2002). That is total carbohydrate (%) = 100 - (%Moisture + % Ash + %crude protein + %crude fat).

Data Analysis

Data were entered into Microsoft Excel and analysed using SPSS for Windows version 15.0 software. Treatment means were compared using one way Analysis of Variance (ANOVA) at 5% level of significance reported as mean standard errors (\pm SE). Significantly different treatment means were separated using Duncan's multiple range test (DMR).

RESULT

Total Length and Body Weight of *Oreochromis niloticus*

The average length of the sampled fish ranged from 30.37 to 31.64cm while average weight of the fish ranged from 513.0 to 523.88g (Table 1). Table 2 shows the proximate analysis of the fried and roasted tilapia (*Oreochromis niloticus*). Moisture content of fried tilapia was significantly ($p < 0.05$) lower with value of (29.55 ± 4.08) compared to that of roasted tilapia (45.16 ± 1.73). No significant differences ($p > 0.05$) between the fried and roasted fish in ash content (15.76 ± 2.02 and 17.98 ± 3.96) respectively. Similarly, the mean value of protein content of fried tilapia is higher (19.32 ± 1.26) compared to that of roasted (18.23 ± 2.28). The crude fat content of fried fish was significantly ($p < 0.05$) higher with value of (31.43 ± 0.20) compared to that of roasted with value of (16.29 ± 5.51). And lastly, the carbohydrate



mean value content of roasted and fried fish showed no significant differences ($p>0.05$) with values of $(5.01 \pm 4.55$ and $3.93 \pm 2.41)$ respectively.

Table 1: Total length and body weight of *O. niloticus*

Variables	<i>Oreochromis niloticus</i>	
	Male	Female
Length (cm)	31.64 \pm 2.09	30.37 \pm 1.63
Weight (g)	523.88 \pm 64.40	513.0 \pm 16.13

Table 2: Proximate composition of fried and roasted Tilapia (*O. niloticus*) in percentages (%)

PROXIMATE COMPOSITION					
Heat treatment	Moisture%	Ash %	Protein %	Fat %	Carbohydrate %
Fried	29.55 \pm 4.08 ^a	15.76 \pm 2.02 ^a	19.32 \pm 1.26 ^a	31.43 \pm 0.20 ^a	5.01 \pm 4.55 ^a
Roasted	45.16 \pm 1.73 ^b	17.98 \pm 3.96 ^a	18.23 \pm 2.28 ^a	16.29 \pm 5.51 ^b	3.93 \pm 2.41 ^a

Mean value of triplicate determination \pm Standard deviation. Values not accompanied by the same superscript across the column are significantly different at $P<0.05$

DISCUSSION

The fish's chemical composition can be affected by many factors including species, environmental condition, fish size, level of protein in the diet, and feeding rate (Ogata and shearer, 2000). The size of the sampled fish is within the range reported by Olapade *et al.* (2016)

The moisture content of fried was significantly low with value of (29.55 ± 4.08) compared to roasted (45.16 ± 1.73) . This may be due to the evaporation of water by the high heat of oil. The low amount of moisture in the fried fish than the roasted fish might have contributed to high protein content in the fried fish. This is in accordance with the findings of Gokoglu *et al.* (2004) and was in contrast with work of Afolabi *et al.* (1984) who reported 80.01- 81.11% moisture in Tilapia fish. The decrease in the moisture content in fried fish was also described as the change that makes the protein and fat contents increase significantly in fish fillet (Garcia-Arias *et al.*, 2003).

Ash content of roasted tilapia is higher with (17.98 ± 3.96) values compared to that of fried tilapia (15.76 ± 2.02) . This may be due to the increase minerals in roasted fish than the fried fish (Toppe *et al.*, 2006). The direct contact with oil in high temperature might contribute in extraction of minerals from the fried tilapia. Also similar result was reported by Aberoumand and Nejad, (2015) on fried fish and also Bulla *et al.* (2011) reported similar result on roasted fish. This finding disagrees with Olapade *et al.* (2016) who reported an ash content range of 1.24 – 1.48% in *O. niloticus* and that of hybrid Tilapia to be 1.30 – 1.42%. Abinbola (2010) also reported 1.30% and 1.06% for *Tilapia guineensis* and *Tilapia melanotheron* respectively.

The high protein recorded in the fried fish might be due to the less time taken in frying compared to the roasting, it may also be due to direct heat which the roasted encounter than the fried fish. This high protein in fried was also reported by (Aberoumand and Nejad, 2015) and also (Kocatepe *et al.*, 2011) reported that fried and microwave-cooked fish had significantly higher protein than raw fish.



Musaiger and D'souza (2008) reported similar trend on the effects of cooking method on proximate composition of fish and shrimp. This study was in contrast to El Hawarry (2012) who obtained 11.32% and 9.8% in fresh *O. niloticus* and hybrid (*O. niloticus* and *aureus*)

The fat content in fried fish was also significantly higher (31.43 ± 0.20) than that of roasted (16.29 ± 5.51). The high fat content of fried may be due to oil absorption during the frying process. Fat increase might be due to the oil penetration into the fish after water is partially lost by evaporation (Saguy and Dana, 2003). Similar result has been reported for African catfish fried in sunflower oil (Rosa *et al.*, 2007). The finding in this research disagrees with result of Olapade (2016) who reported a fat content value range of 0.55 – 0.64% of Nile Tilapia fish. It is also in contrast with the finding of Garduno-lugo *et al.* (2003) who reported lipid content in red *O. niloticus* to be 0.33%.

Carbohydrates have generally been ignored, as they appear in a small percentage of bodyweight, in the form of glycogen (Weatherley and Gill, 1987). Similarly Shearer, (1994) reported that carbohydrate content is relatively small in fish. Salihu (2013) also reported carbohydrates content of fresh and smoked Tilapia fish to be 3.67 and 2.57%. However, the little difference observed between fried and roasted tilapia this study may be due to the fact that the level of carbohydrate decrease with increase in direct contact with heat. Chukwu and Shaba, (2009) also reported a similar result on carbohydrate content.

CONCLUSION

The result indicated significant differences in moisture and fat content between fried and roasted tilapia fish. No significant difference in Ash, protein and carbohydrate between roasted and fried fish, however fried fish showed higher level of crude protein content compared to roasted fish. This indicates that the fried tilapia is more nutritious in term of protein supplement.



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