



**SHORT COMMUNICATION**

**SENSORY EVALUATION AND FATTY ACID PROFILE OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*) REARED UNDER DIFFERENT CULTURE FACILITIES**

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**Abstract**

This research was conducted to evaluate the sensory evaluation and fatty acid profile of *Oreochromis niloticus* (mean weight 127±2.03g) reared under three different culture facilities (plastic, sandcrete tanks and earthen ponds), at the Teaching and Research Farm of the Department of Fisheries and Aquaculture Technology, the Federal University of Technology, Akure, Ondo State, Nigeria. This study was carried out to find out if habitat could influence the nutrient composition of the fish. Standard procedures were used in the analysis of tissue nutrient. Fatty acid profiles of *O. niloticus* were determined using Gas chromatography-mass spectrometry (GC-MS) method. There was significant difference ( $p < 0.05$ ) in sensory evaluation of *O. niloticus* reared in plastic, sandcrete tanks and earthen ponds. The percentage of saturated and unsaturated fatty acids was higher (50.08%, 21.22%) in earthen pond cultured of *O. niloticus* than the plastic and sandcrete tanks. The results suggest raising *O. niloticus* in pond possess-nutritional advantages and produce fish with a better fatty acid profile, for the well-being of consumer.

**Keywords:** Sensory assessment, Fatty acids and *Oreochromis niloticus*.

**Introduction**

Fisheries products are recommended for human consumption because they reduce the risk of cardiovascular diseases in human beings (Kang and Leaf, 1996). Fish are an essential constituent of human diet and the benefit of this adequate matter is highly linked to the quality of their lipid content, a source of essential polyunsaturated fatty acids (PUFA), mainly eicosapentaenoic acid (EPA), docosahexaenoic acid and linoleic acid (DHA) (Harris, *et al.*, 2008, Baum, *et al.*, 2012).

Aquaculture is one of the fastest growing food-producing sectors in aquatic field and is set to play a key role in meeting the rising demand for fishery products due to increase in human population and decline natural fisheries resources (FAO, 2018). One of the priorities of aquaculture is the increase in the production of fish because the amount of fish capture from natural resources is no longer capable to meet the demand of the increasing population due to the almost stabilized catch yields since 2011 according to FAO (2016). *Oreochromis niloticus* is a cichlid fish native to Africa. It has been successfully farmed under

a wide range of environmental conditions and is an important aquaculture fish species in many parts of the world, particularly in tropical and sub-tropical countries (El-Sayed, 2006; Dagne *et al.*, 2013). It is considered to be one of the most productive and internationally traded food fishes in the world (Chakraborty and Benerjee, 2012; Hernandez *et al.*, 2013; Siddik *et al.*, 2014). Today, *O. niloticus* has become the shining star of aquaculture with many farms beginning and others expanding as consumption rate increases across the globe (Fitzsimmons, 2005; Ogello *et al.*, 2014). The success of *O. niloticus* is related to the fact that it grows and reproduces in a wide range of environmental conditions, has a low trophic level for feeding and tolerates stress induced by handling and poor water quality (Liti *et al.*, 2005; Tsadik and Bart, 2007; Dagne *et al.*, 2013). The acceptance of fish or fisheries products by the consumer depends on several attributes of fish qualities like flavor, texture, odour and colour (Alam, *et al.*, 2012). Factors that affect the sensory properties of both wild and cultured fish are grouped to be endogenous and exogenous factors. Species, sex, size, age and strain of the fish are the major endogenous factors of the fish while feeding, nutrition, seasonal variation, environmental factors, culture practices and processing conditions are exogenous factors (Huss, 1995). Thus, the aim of the present study is to evaluate the influence of the environment on the fatty acid profiles and sensory evaluation of *O. niloticus* from different culture facilities (plastic, sandcrete tanks and earthen ponds), with the view of finding out if there is any difference in their nutritional status, which will help the consumers to make a good choice in tilapia consumption.

## **Materials and Methods**

### **Samples Collection**

Nile tilapia (*Oreochromis niloticus*) used for this study was obtained from different culture facilities (plastic, sandcrete tanks and earthen ponds), at the Teaching and Research Farm of the Department of Fisheries and Aquaculture Technology, the Federal University of Technology, Akure, Ondo State. Twelve fish samples of average weight  $127 \pm 2.03$ g from each facility were selected for sensory evaluation and fatty acid profile.

### **Sensory Evaluation**

This was undertaken to determine the taste, odour, mouth feel (texture) and general appearance (colour) of the smoked fish from the three different culture facilities. The sensory evaluation panelists comprised of ten trained individuals (5 male and 5 female) from the Teaching and Research Farm of the Department of Fisheries and Aquaculture Technology, Federal University of Technology, Akure, Ondo State, Nigeria. They were selected based on their availability and capability. Questionnaires for the panelists score were prepared using five-point hedonic scale described by Eyo (2001) as follows: 8-7 very good; 6-5 good; 4-3 fair; 2-1 poor and 0 - Bad

### **Fatty Acid profile**

The oil used for the fatty acids was extracted from the experimental fish using hexane extraction method (AOAC, 1995). The fatty acids composition of tissue of *O. niloticus* was determined using methyl-esters, prepared by standard method on Gas Chromatography/Mass spectrometer (GCMS) with model number GCMS-QP2010 Shimadzu, Japan with flame ionization detector. The injection and detection temperature were 250°C and 250°C respectively. The carrier gas used was Nitrogen at the flow rate of 3ml/min.

### **Data Analyses**

The data collected were analysed by one-way

analysis of Variance (ANOVA) at 95% confidence level using SPSS (version 22) as described by Steel and Torrie (1980). Comparisons among means were separated using Duncan Multiple Range Test (DMRT) at  $p < 0.05$ .

### Results

The sensory evaluation (appearance, texture, odour and taste) of *O. niloticus* obtained from the three different culture facilities (plastic, sandcrete tanks and earthen pond) are presented in figure 1. There were no significant difference ( $p > 0.05$ ) in the mean values of appearance,

texture and odour. However, the mean value of taste shows significant difference ( $p < 0.05$ ) in the three culture facilities. Result reveals that the panelist takes preferences in the taste of earthen *O. niloticus*. However, the taste of *O. niloticus* reared in earthen pond had the highest score of  $(6.60 \pm 0.16)$  while *O. niloticus* reared in sandcrete and plastic had the lowest values of  $5.80 \pm 0.13$  and  $5.80 \pm 0.13$ , respectively. However, texture analysis determined higher firmness value for sandcrete tank and earthen pond ( $4.50 \pm 0.17$  and  $4.50 \pm 0.17$ ) when compared to plastic tank ( $4.40 \pm 0.16$ ).

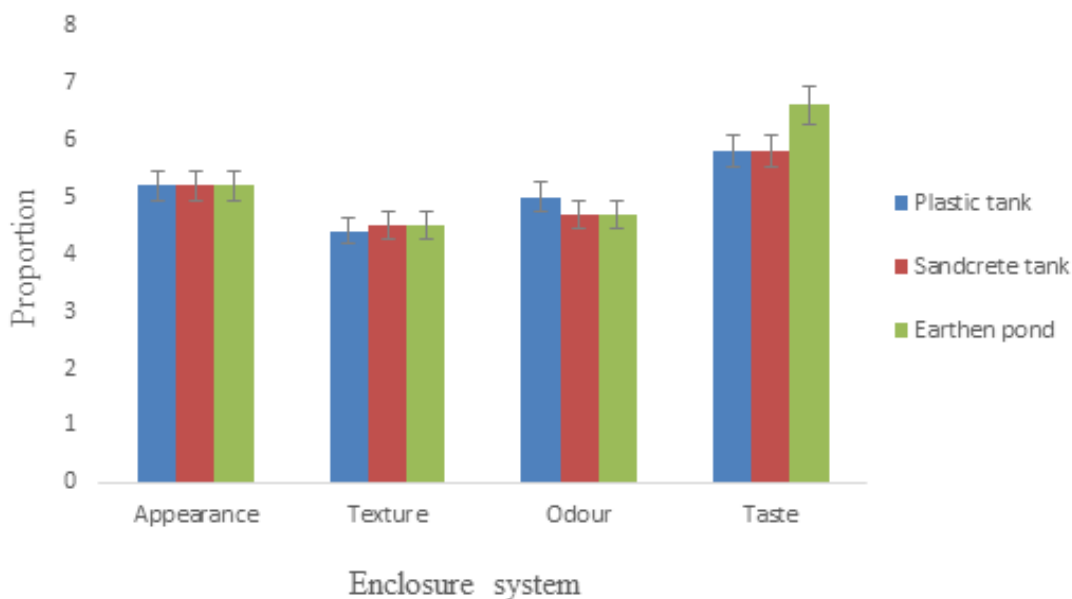


Figure 1: Sensory evaluation of *O. niloticus* reared under three different culture facilities (plastic tank, sandcrete tank and earthen pond)

### Fatty Acids Profile

The result of the fatty acids profile of *O. niloticus* from this present study showed the occurrence and proportion of saturated and unsaturated fatty acids in the three culture facilities (plastic, sandcrete tanks and earthen ponds) respectively as shown in Table 1 was significantly difference ( $p < 0.05$ ).

However, the occurrence of C12:0 (lauric acid), C14:0 (myristic acid), C16:0 (palmitic acid), C18:0 (stearic acid), C20:0 (arachidic acid), C22:0 (behenic acid), C16:1 (palmitoleic acid), C18:1 (oleic acid), C20:1 (gadoleic acid) and C22:1 (cetoleic acid) were noticed in *O. niloticus* from the three different culture facilities.

**TABLE 1: Fatty acid profile of *Oreochromis niloticus* from the Three Culture Facilities (Plastic, Sandcrete Tanks and Earthen Pond)**

Fatty Acid	Plastic Tank	Sandcrete Tank	Earthen Pond
C12:0 Lauric Acid	0.08±0.01 <sup>a</sup>	0.09±0.01 <sup>ab</sup>	0.10±0.00 <sup>c</sup>
C14:0 Myristic Acid	4.42±0.01 <sup>a</sup>	4.43±0.01 <sup>a</sup>	4.68±0.04 <sup>c</sup>
C16:0 Palmitic Acid	33.8±0.01 <sup>a</sup>	34.1±0.01 <sup>b</sup>	36.8±0.06 <sup>c</sup>
C 18:0 Stearic Acid	9.52±0.01 <sup>a</sup>	9.55±0.03 <sup>a</sup>	10.4±0.06 <sup>c</sup>
C 20:0 Arachidic Acid	0.35±0.01 <sup>a</sup>	0.38±0.01 <sup>b</sup>	0.43±0.01 <sup>c</sup>
C22:0 Behenic Acid	0.61±0.01 <sup>a</sup>	0.64±0.01 <sup>b</sup>	0.68±0.01 <sup>c</sup>
<b>Total SFAs</b>	<b>48.6</b>	<b>49.19</b>	<b>53.08</b>
C16:1 Palmitoleic Acid	8.34±0.01 <sup>a</sup>	8.36±0.01 <sup>b</sup>	9.40±0.00 <sup>c</sup>
C18:1 Oleic Acid	10.45±0.01 <sup>a</sup>	10.52±0.01 <sup>b</sup>	11.31±0.06 <sup>c</sup>
C20:1 Gadoleic Acid	0.22±0.01 <sup>a</sup>	0.23±0.01 <sup>a</sup>	0.27±0.01 <sup>b</sup>
C22:1 Cetoleic Acid	0.20±0.00 <sup>a</sup>	0.21±0.00 <sup>a</sup>	0.24±0.00 <sup>b</sup>
<b>Total MUFAs</b>	<b>19.21</b>	<b>19.27</b>	<b>21.22</b>

Means in the same row with different superscripts are significantly different at (p<0.05)

## Discussion

Sensory evaluation in this study revealed that the score of graded parameters of *O. niloticus* such as: appearance, texture and odour show no significant difference (p>0.05) from the three different culture facilities. However, the result revealed that there was significant difference in the taste of *O. niloticus* reared in earthen pond with higher value of (6.60) than sandcrete/plastic tank value of (5.80 and 5.80). The sensory evaluation as observed by the response of the ten (10) trained panelists showed that people preferred *O. niloticus* reared in earthen pond than sandcrete and plastic tank. The present study was in agreement with the observation reported by Adetuyi *et al.* (2012) on proximate composition and sensory analysis of *Clarias gariepinus* harvested from different sources in Ondo State, Nigeria.

From consumer point of view, all fish are

considered to be of similar nutritional value, and selection is chiefly based on availability, freshness, flavour and similar factors (Hearn and Sgoutas 1987). On the other hand, results of clinical and epidemiological research suggest that fat composition is very important because of their beneficial effects on human health (Simopoulos, 2002). Therefore, when fish are suggested as a means of improving health, fat quality must be considered (Roche, 1999). The quality of fat has been described using different fatty acids groups such as PUFA/SFA, n-3/n-6 and n-3 HUFAS distribution (Ahlgren *et al.*, 1994; Muller-Navarra *et al.*, 2000).

The fatty acid profile values obtained in the present study, showed variations in the composition and proportion in *O. niloticus* reared in the three different culture facilities. The range of the values recorded for Palmitic acid (33.8-36.8), Stearic acid (9.22-10.4), Palmitoleic acid (8.36-9.40) and Oleic acid (10.45-11.31) in the present study agreed

with the value range recorded by Ashraf *et al.* (2008) on fatty acid composition of Nile tilapia *Oreochromis niloticus* muscles with the values of Palmitic acid (23.92- 38.18), Stearic acid (9.23-11.77), Palmitoleic acid (2.21- 11.96) and Oleic acid (6.46- 15.13). However, the value of Lauric acid, Myristic acid, Arachidic acid, Behenic acid, Gadoleic acid and Cetoleic acid gotten from the three different culture facilities from this present study was lower than the values recorded by Osibona *et al.* (2009) on fatty acid composition and amino acid profile of *Clarias gariepinus* and *Tilapia zillii*.

The occurrence of these compounds varied with culture facilities. Palmitic acid which is known to increase blood cholesterol was the dominant saturated fatty acids in *O. niloticus* from the three culture facilities. This was similar to the report of Ibhaddon *et al.* (2015) who reported that palmitic acid was a key metabolite in fish.

### Conclusion

From the experiment carried out, it was generally found out that the results of this research have established a reference value regarding the selected sensory evaluation and fatty acids profile of *O. niloticus* under the three different culture facilities (plastic, sandcrete tanks and earthen pond) employed in this study.

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