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Comparative Study of Proximate Composition of Oil Extracted from African Catfish Viscera (*Clarias gariepinus*) and Red Palm Oil

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ABSTRACT
The proximate and fatty acid composition of oil extracted from catfish viscera (*Clarias gariepinus*) and red palm oil was carried out in this study, fish oil was extracted using wet rendering method. The result of the proximate composition shows moisture content of 64.81±2.37% for catfish viscera and 5.75±1.40% for red palm oil, protein content 16.40±2.66% for catfish viscera and 3.27±0.11% for red palm oil, ash content 120±0.20 and 1.04±0.30% for catfish viscera and palm oil, respectively lipid content 3.00±0.10 and 50.40±0.84%, Peroxide Value (PV) 16.60±0.40 and 1.0±0.42% and Iodine Value (IV) 140.05±0.14 and 51.07±0.47% for catfish viscera and red palm oil, respectively. There was significant difference ($p<0.05$) among the means of moisture, protein, lipid, PV and IV but the ash content shows no significant difference ($p<0.05$). The result of the fatty acids composition shows that red palm oil has the highest saturated palmitic acid and monounsaturated oleic acid 44.29 and 40.62%, respectively. The 10.20% palmitic acid and 6.20% oleic acid was observed in catfish oil. 13.26 and 8.59% linoleic acid, 1.40 and 0.40 stearic acid was observed in catfish oil and red palm oil, respectively. Catfish oil shows dominant unsaturated linoleic and oleic acid, saturated palmitic acid and stearic acid. The result shows that catfish oil is rich in polyunsaturated fatty acid (PUFA), which lowers total serum cholesterol level.

Key words: Catfish, viscera, palm oil, fatty acid

INTRODUCTION
African catfish (*Clarias gariepinus*) occupy a large area of aquaculture in Africa, European and South Asia for its great economic interests, faster growth rate, omnivorous feeding habit and high resistance to environmental stress. It is also considered one of the most important tropical catfish species for aquaculture (Osibona, 2005).

Fish oils are rich source of natural bioactive lipid components. These lipids components are commercially used in pharmaceutical and food industries and in human health supplements. Fish is being considered as an important diet due to its polyunsaturated fatty acid (PUFAS) contents. The curative and preventive effects of fish oils are well recognized in treating cardiovascular diseases, autoimmune disorders and various kind of inflammation (Weaver and Holob, 1987).

Fish oil is derived from the tissue of oily fish. It contains Omega-3 fatty acids, eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) precursors of certain eicosanoids that are known to reduce inflammation in the body (Moghadasian, 2008). The highly unsaturated fatty acid (HUFAS), eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) consumption is linked to the development of brain and nervous tissue in infants and visual function and reduces incidence of coronary heart disease (Dauqan *et al*., 2011; Shahidi and Miraliakbari, 2004).

Palm oil derived from the indigenous palm tree of West Africa, has long been recognized for its versatility as cooking oil. About 75% of the palm oil produced is used in food products, while the remaining oil finds its way to industrial uses.

Many studies have been carried out on the extraction and purification of fish oil, quality and fatty acid profile of fish oil from salt water fish species (Khoddami *et al*., 2009; Sarker *et al*., 2012; Babalola *et al*., 2011), while few studies has been carried out on extraction of oil from fresh water species and the chemical quality of oil from fresh water fish compared to vegetable oil. Palm oil was chosen for this study based on their economic importance and the fact that they are ever ready in Nigeria markets (FDF, 2004). This study was undertaken to determine the proximate composition of oil extracted from *C. gariepinus* and African oil palm *Elaeis guineensis*.

MATERIALS AND METHODS

Collection of samples and preparation: A total of 20 kg of *C. gariepinus* and 25 mL red palm oil were purchased from a local market in Owo Local Government, Ondo State. The fish were washed, gutted and the viscera were separated. The wet weight of the viscera was found to be 2.85 kg and freeze at -18±1°C for 24 h.

Proximate composition: The methods for proximate analysis were standard procedure of (AOAC, 1994). Crude protein content was calculated by converting the nitrogen content, determined by Kjeldahl's method (6.25×N). The lipid contents were determined by high and dyer method as described by AOAC (2005).

Extraction of oil: The extraction of the fish oil was carried out by rendering method of Sathivel *et al*. (2008). The viscera was frozen at -18°C for 24 h. The thawed 1.5 kg portion of the viscera was finally ground and mixed with 3 L of water; the mixture was heated at 70°C for 20 min. Centrifuge was used to separate the water and the crude oil, 200 mL of oil was extracted.

Fatty acid composition: The 200 mL of the fish oil was esterifies using hexane and sodium methoxide as a catalyst based on Christie (1993) method. The fatty acids composition was analyzed by High Pressure Liquid Chromatography (HPLC). The peroxide value and iodine value were determined by AOAC (1994) method.

Statistical analysis: Data was subjected to one way analysis of variance (ANOVA). Fisher's Least Significant Difference (LSD) test was used to identify significant differences at $p<0.05$.

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of the catfish viscera and the red palm oil. The fatty acid composition of the catfish viscera and red palm oil are shown in Table 2.

The moisture content of the catfish viscera and the palm oil was 64.81±2.34 and 5.75±1.40, respectively. The moisture content of the catfish viscera recorded in this study was slightly higher than that reported by Sathivel *et al*. (2008) and Brooks (1982). This might due to the keeping

Table 1: Proximate composition of catfish viscera and red palm oil

Composition (%)	Catfish viscera	Red palm oil
Moisture	64.81±2.37[a]	5.75±1.40[b]
Protein	16.40±2.66[a]	3.27±0.11[b]
Ash	1.20±0.20[a]	1.04±0.30[a]
Lipid	3.00±0.10[a]	50.40±0.84[b]
Peroxide value	16.60±0.60[b]	10.40±0.42[a]
Iodine value	140.05±0.14[a]	51.07±0.47[b]

Values with different letter across the rows are significant different ($p<0.05$)

Table 2: Fatty acid composition of catfish oil and red palm oil

Fatty acid	Catfish oil	Red palm oil
Palmitic acid	10.20	44.27
Stearic acid	1.40	0.40
Oleic acid	6.25	40.62
Linoleic acid	13.26	8.59

quality of the fish and the available water in the food that is able to react chemically. Catfish viscera have the highest protein of 16.40±2.66 compared to palm oil of protein value of 3.27±0.11. Protein is present in all organs of fish and make up a large of the structure of the cell, thus making fish a very good source of animal protein. The ash contents of the catfish viscera and the palm oil was 1.20±0.20 and 1.40±0.30, respectively. There is no significant difference ($p<0.05$) between the ash content of the fish viscera and the palm oil. The lipid of the catfish viscera was 3.00±40 while that of palm oil was 50.40±0.84. There is a significant difference ($p<0.05$) between the lipid content of the catfish viscera and palm oil. The lipid content of fish varies widely than the moisture, protein or mineral content Eyo (2001). The *C. gariepinus* lipids showed highest Peroxide Value (PV) of 16.40±0.40 while palm oil lipid indicated Peroxide value (PV) of 1.0±0.4. There is a significant difference ($p<0.05$) between the lipid of catfish and palm oil.

Free Fatty Acid (FFA): The major fatty acid present in catfish viscera were linoleic (C18:2), palmitic acid (C16:0), stearic acid (C18:0) and oleic acid (C18:1). Palmitic and oleic acid were prominent in palm oil. The result in Table 2 shows that linoleic acid (C18:2) was the highest polyunsaturated fatty acid (PUFA) 13.26% present in the catfish viscera oil followed by palmitic acid 10.20%, oleic acid 6.25% and stearic acid 1.40%. The fatty acid profile found in this study for catfish viscera was similar with earlier result reported by Effiong and Fakunle (2013), Sathivel *et al.* (2009) and Ollis *et al.* (1999). The polyunsaturated fats found in fish oil reduce atherosclerosis associated with causing heart disease (Balk *et al.*, 2006).

The percentage composition of fatty acids identified in palm oil in Table 2 shows, that palmitic acid was the highest (44.27%) followed by oleic acid (40.26%), linoleic acid (8.5%) and stearic acid (0.40%). A study by Obasi *et al.* (2012), showed similar result. El-Hadad *et al.* (2010) also observed similar results when they studied the fatty acid composition in red palm oil. The study shows that palm oil contains a high proportion of palmitic acid as well as considerable quantities of oleic and linoleic acids which give it a higher saturated fatty acids. High dietary intakes of saturated fatty acids (SFA_S) is a risk factor for development of obesity, cardiovascular disease (Butler *et al.*, 2008; Gunnars, 2013). Several studies shows that palm oils contain high level of omega-6 polyunsaturated fatty acids, high consumption of omega-6 fatty acids has been liked with cardiovascular disease (NMCD, 2013).

CONCLUSION

This study shows that catfish *C. gariepinus* viscera eliminated and discarded as a waste by most people can serve as a good source of polyunsaturated fatty acids and can generate a significant income to processing individual and industries. The findings from this study show that palm oil contains high saturated fatty acids which are allegedly raises blood cholesterol and increase the risk of cardiovascular disease. The World Health Organization in its report (WHO, 2003) states that there is convincing evidence that palmitic oil consumption contributes to an increased risk of developing of cardiovascular diseases.

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