

Physico-Chemical Properties of Dried Cat Fish and Cat Fish Oil Produced From Mitchelogrill Dry Processing Machine in Rivers State, Nigeria

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ABSTRACT

This study examines the physico-chemical properties of dried cat fish using Mitchelogrill dry processing machine. The aim is to analysis for proximate, mineral and oil for fat and fatty acids. Chemical analysis is carried out according to A.O.A.C. method. Ash is determined by muffle furnace while oil is carried out using British Standard Methods of analysis of fats and fatty oils. Results from the proximate composition show that the sample is rich in protein and fat which can be useful in human diet. However, the moisture content of 22.40% is an indication that the sample cannot be stored for long and can only be consumed within a short period of time. The result of the moisture free fatty acid is of good quality. The saponification value obtained for the sample shows that they have good potentials as a source of raw material in the soap industry. Freshly caught fish spoil easily and therefore requires adequate preservation and storage. The results of the analysis of the fish and oil sample is a giant stride in expanding the linkage between agriculture, value food chain and nutrition security and industrialization for national development.

Keywords: *Cat fish, Mitchelogrill dry processing machine and fish oil.*

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INTRODUCTION

The animal protein intake of Nigerians has been very low in recent times primarily due to the decrease in per capita animal production as a result of growth in human population. The sharp increase in the price of egg and poultry product due to current economic challenges is an eye opener to look inwards into the locally manufactured products in the country which are fabricated with available raw materials instead of export dependences. Fishes are the cheapest source of animal protein and fish oil. They play an important role in the diet of many people in both developed and developing countries. Fish is an important ingredient in the Nigerian traditional cuisine. Cat fish is one of the most valued and very diverse groups of bony fish (Kin-Kabari, Barimalaa, Achinewhu and Adenyi, 2011). It has further been stated that fish and its products, apart from satisfying appetite and taste, had become the main source of animal protein to many citizens (Achinewhu and Eke, 2012). The cat fishes are a monophyletic group, belonging to the super-order called the Ostariophysi. Freshly caught fish spoil easily and therefore requires adequate preservation and storage.

Of all fleshy foods, fish is the most susceptible to tissue decomposition, development of rancidity, and microbial spoilage. Fish begin to deteriorate as soon as they leave the water. The preservation of fish is therefore considered to be a major hindrance to its production and utilization especially in the tropical countries in Africa. The four most popular methods of fish preservation are freezing, canning, smoking and pickling. The major preservation method being pickling or salting, has been used for centuries (Kin-Kabari, Barimalaa, Achinewhu and Adenyi, 2011). Calder (2015) has recognized that fish oil especially in whole food is usually associated with a number of health and nutrition benefits including cardiovascular system, immunity and even brain functions. It is important to note that the most of the benefits of fish oil can be traced to two factors namely:

- (1) Their status as an Omega-3 fatty acids and
- (2) The ability to be-formed into prostaglandins, the signaling molecules in cell membrane.

Calder (2015) notes that Omega-3 has the potential to reduce inflammation in individuals, allowing them to train harder and recover faster. Supporting fat loss and improving body composition, Omega-3 also has the potential to help when combined with healthy diet and daily physical activity (Ebrahim, 2009). Studies (Fontani, Corradeschi, Felici, Alfatti, Migliorini and Lodi, 2005; Wen, Dai and Gao, 2014; Miller, Van Elswyk and Alexander, 2014) have also shown

that adequate diet with fish oil reduces risk of cardiac death and decrease in blood pressure. Whole fish oil in its natural form has been shown to improve cognitive function and over all brain function (Guzima, Esteve, Pablos, Blasco and Villegas, 2011 and Gomez-Pinilla, 2011; Buckley, Burgess, Murphy and Howe, 2014).

In Nigeria and other developing countries, especially in the rural areas where protein intake is low and malnutrition prevalence is high, dried cat fish processed from this Mitchelogrill dry processing machine which dry and extract fish oil simultaneously which is hygienic, carbon free, export quality finished product and high shelf life without preservatives calls for serious concern. This could be made acceptable by government partnering with the manufacturer as the machine can be operated in fishing trawler, fish boat, at home with low energy consumption. This reduces post-harvest losses as well as produce fish oil high in Omega- 3 as whole food supplement. It also has good potentials of raw material in the soap and other industries. It is equally imperative to note that the protein can be used at all stages of life cycle development. The fish oil can be used to fortify infant complementary foods and adults whose diets are low in Omega-3. Fish oil reduce serum triglycerides concentration, whereas substitution of Omega -3 PUFA for SFA lower serum LDL. Without changing SFA, fish oil has no effect on serum cholesterol (Vimla, 2010).

One major goal of Mitchelogrill Dry Processing usage is to hydrolyze fish protein, modify and improve the functional properties. Drying treatment is a particular technique to modify protein due to the milder process conditions required for the relative ease of control and minimal formation of by- products. Though methods of drying exist, nevertheless modification in structure, texture and colour manifestation depends on the treated sample, temperature and protein concentration. The uniqueness of fish proteins make them heat sensitive with a greater tendency to denature at elevated temperature (Sikorski, 1994). Human nutrition has an interest in nutrient availability. Hence, this study, physico-chemical properties of dried cat fish and cat fish oil produced from Mitchelogrill Dry Processing Machine in Rivers State.

Study Location

Rivers State is one of the Nigeria's 36 States. It was created from the Eastern Region of Nigeria by Decree No. 19 of 1967. Its Capital city is Port Harcourt. The State is bounded on the south by the Atlantic Ocean, on the north by Anambra, Imo and Abia States; the east by Akwa Ibom State and the west by Bayelsa and Delta States. Rivers State, which is in the Niger Delta, has topography of flat

plains with a network of rivers and tributaries. These include new Calabar, Orashi, Bonny, Sombreiro and Bartholomew Rivers. With a tropical climate, numerous rivers and vast areas of arable land, the people of Rivers State have lived up to their economic expectation on agriculture especially fishing and farming, commerce and industry. Beside oil and gas, the State is blessed with many natural resources including timber, white sand, beaches, clay from ceramics (ash, yellow and red) etc. all yearning for exploration. The State has a population of over 5.6 million people who have a rich and unique cultural heritage. Usually known to be friendly and hospitable, comprises people from various ethnic nationalities namely, Abua, Andoni, Ekpeye, Engenni, Etche, Ibani, Ogoni, Ogba, Ikwerre, Kalabari, Ndoni, Okirika etc. Rivers State has 23 LGAs (Rivers State Government Diary, 2014).

MATERIALS AND METHOD

Cat fish was purchased from Fadama Co-operative Rumuodomaya and Demonstration Fish Farms at A.D.P premises Rumuodomaya Port Harcourt, Rivers State. Others were purchased from Rumuokoro market Port Harcourt in Rivers State. A total of 300 table size cat fish of N150/kg was washed with tap water to remove soils and dirt. The fish were prepared, gutted using kitchen knife and sticks, rinsed with tap water. The prepared fish were arranged inside the Mitchellogrill Dry Processing Machine. The Mitchellogrill Dry Processing Machine is a modern technology to advance the traditional occupation of fish smoking and local food drying methodology that conform to the global best practices. It delivers high quality finished products in larger commercial capacity, hygienically and hazard free, boosting food and nutrition securities and also meets export trade quality. The machine was Omega 100 2P of 150kilogram (300 table size cat fish) capacity. The energy source was a 2kg gas to process full capacity with a drying duration of 10 to 15hours. It has a thermostatically controlled system set at 100⁰c for 1 hour. It has a temperature control system for drying of fish, chicken, beef, vegetable and extraction of oil. The machine is environmentally friendly, made from carbon free finished product. It needs no turning of fish until dry. It has anti rust durable material (Mitchellogrill Dry processing Machine, 2015).

After drying, the fish was allowed to cool at room temperature $\pm 2^{\circ}\text{c}$ and packaged inside cellophane bag and sent to the laboratory for analysis. The process flow chart for the production of cat fish oil is given in fig 1. The dry fish sample was packed into bags. The oil was milled to pass through a mesh sieve (aperture size) and stored in plastic container. Each sample portion was sent into the

laboratory. The proximate composition of the cat fish oil with respect to moisture, crude protein, ash, crude fibre, crude fats, and total carbohydrates was analyzed for free fatty acid (FFA), peroxides and saponification value. One sample of dried cat fish and sample of oil were obtained from the cat fish. The colour of the fish was brownish while oil was dark.

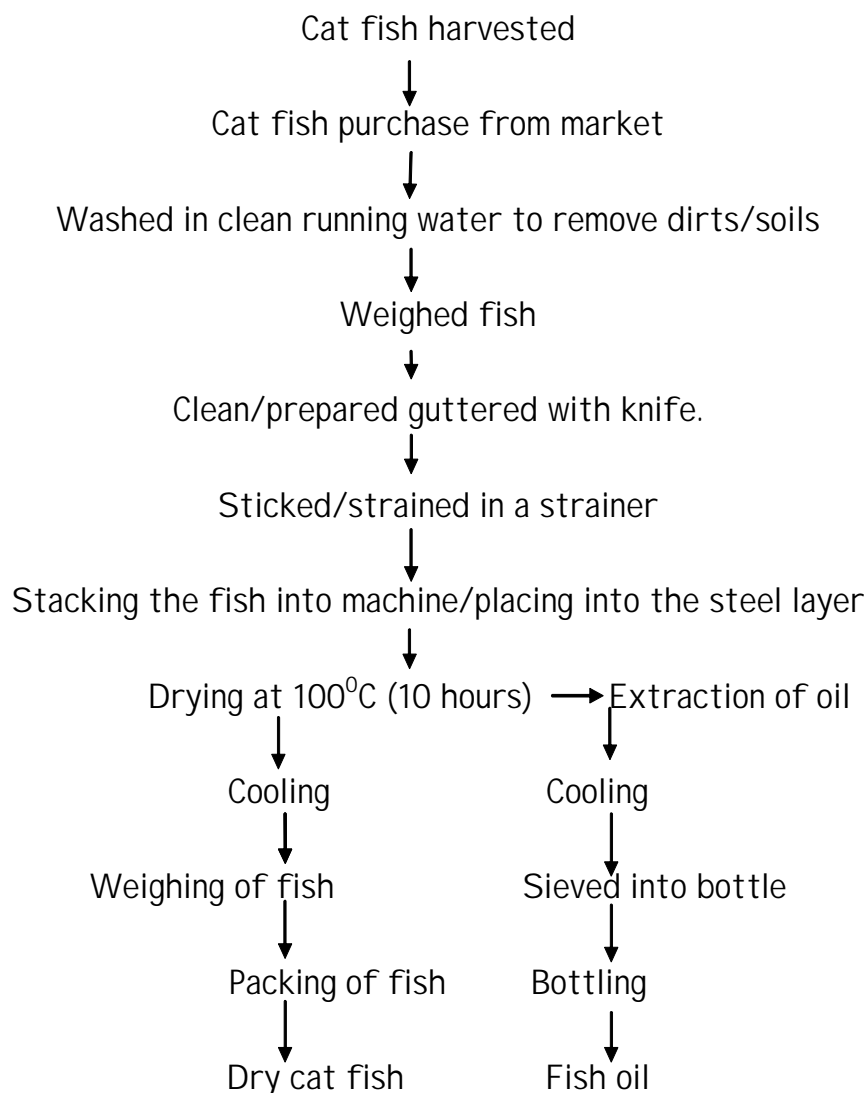


Fig: 1: Process flow chart for the production of oil from cat fish

The proximate nutrient composition of the fish sample was determined by using the standard methods of analysis of the Association of Official Analytical Chemist (1990). While oil sample was by the British Standard Methods of Fats and Fatty Acids (BS 684 211:1976), moisture content of fish sample was determined by air over methods at 105⁰c for 5 hours. The Macro Kjeldahl method was used for the determination of protein content. The crude lipids (fats) content was determined by soxhlet extraction method using petroleum ether as extracting solvent (that is to say, extracting 5g of sample (fish) with petroleum ether boiling point of 40 to 60°C). Ash content was determined by muffle furnace at 550°C for 4 hours until constants weight of ash was obtained. Crude fibre was determined by exhaustive extraction of soluble substance in sample using 1.25% H₂SO₄ and 1.25% NaOH solutions after the residue in ashes and loss in weight was recorded as crude fibre. Total carbohydrate was determined by difference 100 – (% moisture + % protein + % fat + % fibre).

RESULTS AND DISCUSSION

Result from the proximate nutrient composition tables shows that the sample is rich in protein (46.62%) and fat (19.25%) which can be useful in human diet. However, the moisture content of 22.40% is an indication that the sample cannot be stored for too long and can only be consumed within a short period of time. The result in table 2 shows that the moisture free fatty acid is of good quality as at the time of this analysis. The saponification value obtained for the sample (158.0 mgKOH/g) shows that they have good potentials as a source of raw material in the soap industry. This result is anticipated to provide a simple, cheaper, healthier, more environment friendly and safer method of fish preservation in developing countries.

Table 1: Proximate Nutrient Composition of Dried Cat Fish with Mitchelogrill

Nutrient	Percentage
Moisture (%)	= 22.40
Crude protein (%)	= 46.62
Ash content (%)	= 4.56
Crude fibre (%)	= 1.24
Carbohydrate content (%)	= 5.93

Source: Experimentation, 2017

Table 2: Result of some quality parameters of the oil sample

S/N	Parameters	Sample
1.	Moisture	0.58
2.	Free Fatty Acid (mgKOH/g) FFA	3.65
2.	Peroxide value (meg/Kg)	2.0
4.	Saponification value (mgKOH/g)	158.0

Source: Experimentation, 2017

CONCLUSION AND RECOMMENDATIONS

The results of the analysis of the fish and oil sample is a giant stride in expanding the linkage between agriculture, value chain food and nutrition security and industrialization for national development. The result will serve as a guide to nutritionist, companies, government depending on the aims of the use of the samples. Instead of importing fish oil supplements, Nigerians are encouraged to look inward from quality fish extract oil as hygienically extracted using Mitchelorgill Drying Processing Machine.

REFERENCES

- Achinewhu, S. C. and Eke, J.** (2012). The chemical and sensory properties of fermented fish products using *Sardinella* Sp. *Nigerian Journal of Nutritional Sciences* Vol. No. 22 & 23. Pg 47-54.
- AOAC** (1990). *Official methods of Analysis*. Association of Official Analytical Chemicals 15th Edn. Arlington Virginia USA.
- British Standard Methods of analysis of fat and fatty oils**. BS 684 211:1976
- Buckley, J. D., Burgess, S., Murphy, K. J and Howe, P.R** (2014). DHA-rich fish oil lowers heart rate during submaximal exercise in elite Australian Rules footballers. *J Sci Med J. jsams* 2008:10:011
- Calder, P. C.** (2015). Marine Omega-3 fatty acid and inflammatory process; Effects Mechanism and Clinical Relevance. *Bio- Chim Biophys Acta* 2015 1851 (4), 469-484
- Ebrahim, M.** (2009). Omega 3 fatty acid supplements improve the cardiovascular risk profile of subjects with metabolic syndrome including markers of inflammation and auto-immunity *Acta Cardiol* 64 (3): P 321-7 .
- Fontani G., Corradeschi F., Felici A. Alfatti F. Migliorini S. and Lodi L.** (2005). Cognitive and physiological effects of Omega-3 polyunsaturated fatty acid supplementation in healthy subjects. *European Journal of Clinical Investigation*, 35 (11) 691-699. <https://doi.org/10.1111/j.1365-2362.2005.01570.x>.
- Gomez-Pinilla, F.** (2011). Collaborative effects of diet & exercise on cognitive enhancement. *Nutr Health*, 20(3-4), 165-169.
- Guzima, J.F., Esteve, H.C., Pablos, A., Blasco, C. E. and Villegas J. A.** (2011). DHA-rich fish oil improve complex reaction time in female elite soccer player *jssm*, 10,301-305.
- Kin –Kabari, D. B., Barimalaa, I. S., Achinewhu, S. C. and Adeniyi, T. A** (2011). Effects of extracts from three indigenous spices on the chemical stability, of smoke – dried cat fish (*Clarias Lezera*) during storage. *African Journal of Food, Agriculture, Nutrition and Development*, 11 (6), 1684 -5358.
- Miller P. E, Van Elswyk M. and Alexander D. D** (2014). Long chain Omega 3 FA Eicosapentaenoic acid and Docosahexaenioc Acid and Blood pressure: A meta-analysis of Randomized Controlled Trials. *Amemrican Journal of Hypertens*.
- Mitchellogrill Dry processing Machine** (2015). Company profile.
- Rivers State Government Diary** (2014). State profile. www.riverstate.gov.org.
- Sikorski, Z. E.** (1994). *The Myofibrillar Proteins in sea foods*. In: Sikorski, Z.E., Pan, B.S and Shahidi, F (Eds.). *Sea food Proteins*. New York: Chapman and Hall.
- Vimla, V.** (2010). *Advances in Diet Therapy: Practical Manual*. New Age International Publishers.
- Wen, Y. T., Dai, J. H and Gao, Q.** (2014). Effects of Omega 3 F.A on major cardiovascular events and mortality to patients with coronary heart disease: a meta analysis of randomized controlled trials. *Nutr Metab Cardio Vasc Dis* 24 (5) P 470-5