ISSN No:-2456-2165

Quantitative Analysis of Fish Oil Extracted As Deduced By Moisture Contents and Sensory Evaluation of Fish Dried Using an Improved Biomass Convectional Fish Dryer

James Flomo Gaydaybu[1& 2], Adam Abdul-Rahama[1&3], Donatus Asua Kogh[1], and Comfort Akwonya Adadu[1&4]
[1]Centre for Food Technology and Research, Benue State University, Makurdi City, Nigeria
[2]Bong County Technical College, Gbarnga City, Liberia
[3]Wa Polytechnic, Wa city, Ghana
[4]Faculty of Technology, Benue State University, Makurdi City, Nigeria

Abstract:- A quantitative analysis of fish oil extracted using an improved biomass fish dryer was conducted in Benue State University, Makurdi, precisely at Centre for Food Technology and Research (CEFTER). The species dried were Oreochromis niloticus, Auchenoglanisoccidentalis and ClariasGariepinus, procured from Wadata market, Makurdi metropolis. The three samples were dried separately and the oil extracted were collected through a truncated tray fitted with PVC valve at the bottom of the dryer. The valve was used to discharged the extracted oil from the dryer to a plastic cup which was weighed on weighing scale to determine the volume of oil. Sensory analyses were conducted on the fish dried using the improved dryer and the dried fish sold in Wurukum market, Makurdi metropolis by local fish vendors. The data collected were subjected to IBM SPSS version 25 with Analysis of Variance (ANOVA) and Duncan Multiple Range Test (DMRT) used to separate means at p≤0.05. DMRT results are expressed as mean ± SD (Standard Deviation). The results for the moisture content analyses indicated that Oreochromis niloticus (Nile Tilapia) moisture was reduced from 77.13% wb (wet basis) to 12.98% wb with very little oil quantity which was negligible. The Auchenoglanisoccidentalis (Giraffe Catfish) moisture was reduced from 79.32% wb to 13.27% wb with 23 ml (milliliter) of oil extracted while ClariasGariepinus (Mud Catfish) moisture was reduced from 80.08% wb to 13.26% wb with 75 ml of oil extracted. These results for moisture contents showed that oil quantity in fish is a function of moisture content availability. The sensory analyses were conducted on sample A (fish dried using the improved dryer) and sample B (dried fish procured from Wurukum market). There were significant differences between sample A and B in terms of color, aroma, taste, texture and general acceptability. The 20 panelists ranked sample A as the best product in all attributes mentioned.

Keywords:- *Sensory, Oil, Fish, Moisture, Polycyclic, Aromatic and Hydrocarbon.*

I. INTRODUCTION

Reduction of postharvest losses can significantly contribute to the availability of foods that can foster peace and security. According to [1] estimation of post-harvest losses was usually recorded to be in the range of 4% but under a very adverse condition, be nearly as high as 100%. A significant percentage of these losses are related to improper and/or untimely drying of foodstuffs such as fish, meat, cereals, cassava, tomatoes, etc.

Fish is an extremely perishable food which in most cases becomes inedible within twelve hours at tropical temperature [2]. Spoilage, therefore, begins as soon as the fish dies and processing should, therefore, be set in quickly to prevent the growth of spoilage bacteria. It has been estimated that 20 million tons of fish are discarded at sea yearly which forms part of post-harvest loss [3]. About strengthening food security in developing countries, fishmeal production must be reduced and more fish products must be converted to direct human consumptions [3]. The general limitation of knowledge from capture fisheries, coupled with processing has contributed widely to post-harvest losses in the fishery industries worldwide.

Research has proven that fish is a low acidic food and is therefore very susceptible to the growth of food poisoning bacteria [5]. This is another reason why it should be processed quickly. The moisture content of fish is assumed to be in the range of 65 to 90% wet basis, although it is normally in the range of 70 to 80% wet basis. If this is reduced below 25%, bacteria survival is very limited and autolytic activity will be greatly reduced. [2] further stated that at a moisture content of 15 percent or less can inhibit mold growth in most agricultural produce and well-dried fish if stored under the right conditions can be kept for several months without deterioration.

Fish is one of the major sources of protein and other valuable nutrients for human growth. Fish plays a vital role in human health. Taking fish oil or eating fish helps improve the body system by effectively keeping the heart-healthy;

free from heart diseases. A research conducted by [5] shows that an integration of fish oil (80%) with evening primrose oil (20%) can improve reading, spelling, and behavior of children (ages 5 – 12) with Developmental Coordination Disorder. Research has shown that fish oil alone or with vitamin B12 can relieve painful periods and reduces the need for pain medications in women with menstrual pain. Researchers have proven that taking fish oil reduces triglyceride levels in people with abnormal cholesterol levels due to HIV/AIDS treatment. Fish oil added to children meals helps improves their attention, mental function and behavior [6]. For women in the reproductive stage, fish oil also prevents miscarriage and increase live birth rates in pregnant women with the anti-phospholipid syndrome.

Due to the increasing demand for fish and fish oil because of its nutritional values, practical ways of cheaply, sanitarily and economically preserving fish and extracting the oil are needed.

II. MATERIALS AND METHODS

Materials used for the construction of the improved dryer were plywood, aluminous sheet, stainless wire mesh, PVC valve, the fibregrass, metal sheet, binding wire, steel angle bar, and bearings.

The wire mesh was used for the trays while the plywood was for the construction of the dryer fitted with the valve at the bottom to discharge the oil out. The aluminous sheet was used within the dryer to retain or conserve the heat from been absorbed by the plywood.

The metal sheet was used for the construction of the charcoal chamber and the truncated pyramid connecting duct. The fibre grass was filled within the connecting duct since it was double. The steel angle bar served as the stand for the charcoal chamber and the dryer. The bearings were fitted within the charcoal chamber to aid the easy steering of the charcoal in releasing ashes.

- *Method of Data Collection*

The experiment was conducted in Benue State University, Makurdi (7°41′N Latitude and 8°37′W Longitude) from the 15th to the 27th of July 2019. The samples dried were Nile Tilapia(*Oreochromis niloticus*), Giraffe Catfish(*Auchenoglanisoccidentalis*), and Mud Catfish(*Clariasgariepinus*), procured from Wadata Market in Makurdi Metropolis as freshly harvested from ponds and brought to the market. Proud to the drying process, the fishes were degutted, washed with clean water, salted with 50 g of table salt (NaCl) for 30 minutes[7].Fish were placed on a tray for draining of water for 15 minutes and loaded in the dryer while charcoal ignited into the charcoal chamber was connected to the dryer for heating. The parameters considered for data collection were initial mass, final mass, initial moisture content, final moisture content, quantity of oil extracted and also the quantity of charcoal burnt per sample drying. An empty dish was weighed and recorded as initial weight of dish. The oil extracted was discharged through the PVC valve to an empty dish which was weighed and recorded as final weight.

- *Method of Data Analysis*

Data reading were done in triplicate and results are expressed as mean ± SD. The data were subjected to SPSS (Statistical Package for Social Sciences now called Statistical Products and Service Solutions) version 17 using Duncan Multiple Range Test at P value ≤ 0.05 depicts statistically no significant difference. The oil collected were weighed using the digital weighing scale.

III. RESULTS AND DISCUSSION

The experimental analysis conducted on the moisture contents reduction shown in table 1 revealed that the Nile Tilapia Moisture was reduced from 77.13% to 12.98% on the wet basis, the Giraffe Catfish moisture content was also reduced from 79.32% to 13.27% on the wet basis while the Mud Catfish moisture content was reduced from 80.08 to 13.26% on the wet basis. These final moisture contents are safe moisture contents as recommended by researcher [8], [9]and [10]. The oil extracted from each species of fish are shown in table 1 which revealed that the Nile Tilapia oil was negligible due to a very low quantity, the Giraffe Catfish oil was 23 ml while the Mud Catfish oil extracted was 75 ml. The higher the moisture content in fish the more the oil quantity as indicated in table 1. Table 1 deduced that moisture content of fishes is a reflection of their oil content as studied by [11].

The results of the sensory analyses revealed that fish sample (sample A) dried using the Improved dryer was highly and satisfactorily considered at $p \leq 0.05$ in terms of color, aroma, taste, texture and general acceptability over the dried fish sample (sample B) bought in Wurukum market in Makurdi Metropolis. In table 2, the color attribute result shows that sample A fish was dried without soot (Polycyclic Aromatic Hydrocarbon) that causes carcinogenic in foods as recommended by [12] and [13]while sample B had much soot, (PAHs). The sensory evaluation results consented with a research conducted by [14].

Table 1: Moisture Contents and Oil analysis for three species of fish dried using the Improved Dryer

Species	M_i (wb) %	M_f (wb) %	Oil Extracted (ml)
Nile Tilapia	77.13	12.98	Negligible
Giraffe Catfish	79.32	13.27	23
Mud Catfish	80.08	13.26	75

Table 2: Sensory Analysis

Sensory Attribute / *Sample*	Color	Aroma	Taste	Texture	General Acceptability
A	8.6±0.680557[a]	7.65±0.875094[a]	8.35±0.875094[a]	6.75±1.019546[a]	8.25±0.55012[a]
B	5.45±1.145931[b]	6.1±1.071153[b]	4.65±0.988087[b]	5.9±1.209611[b]	4.9±1.020836[b]

Different superscripts in the same columns depicts significant difference at p≤ 0.05

IV. CONCLUSIONS

The above results indicated that fish with higher moisture content contains more quantity of oil. Therefore, higher moisture is a reflection of more oil content in fish. The improved dryer designed was capable of reducing the moisture contents of fish species to a safer moisture contents that inhibited the growth of micro-organizations causing food spoilage. The sensory evaluation results also revealed that fish sample (sample A) dried using the improved dryer was satisfactorily accepted by the 20 panelists as superior over the fish sample (sample B) dried and sold in the local market in Makurdi Metropolis, Wurukum Market. All attributes tested in sample A showed significant difference at p≤ 0.05statistically from sample B.

REFERENCES

[1]. Michael, W.B. (1991).Improving the performance of indirect natural convection solar dryer. Final Report International Development Research Centre project No3 -A – 2069.
[2]. Clucas, I.J. (1982). Fish handling,preservation,andprocessing in the tropics. Part 2 report of Tropical Product Institute, London, UK.
[3]. Kumolu-Johnson, C.A. &Ndimele, P.E. (2011). A Review on Post-Harvest Losses in Artisanal Fisheries of Some African Countries. *Journal of Fisheries and Aquatic Science, (*6), 365-378.
[4]. Fellows, P. & Hampton, A. (1992). Small scale food processing. Southampton Row, London, UK: Intermediate Technology Publication,103 – 105.
[5]. Ruairi, R. (2016). 13 benefits of taking fish oil. Retrieved on November 3, 2018, from https://www.healthline.com/nutrition/13-benefits-of-fish-oil.
[6]. Axe, J. (2018). 13 Fish oil benefits for the major brain, cardiovascular & other disorders, Retrieved on December 12, 2018, from www.draxe.com.
[7]. Oyero, J. O., Sadiku, S. O. E., &Eyo, A. A. (2012). The effect of various smoking methods on the quality of differently salted *Oreochromis niloticus. International Journal of Advanced Biological Research,* 2(4):717-723.
[8]. Alakali, J. S., Faasema, J. & Utongo,N. (2014): Design, fabrication and performance evaluation of an improved fish smoking kiln. *Journal of Food Processing and Preservation,37(5),413-418.*
[9]. Shallcross, L. (2017). Smoking fish at home, University of Alaska Fairbanks, Retrieved on July 2, 2019, from www.uaf.edu/ces.
[10]. Abdel Moneim, E. S. & Waleed, A. M. (2012). Quality characteristics of dried fish obtained from the Eldeim area, University of Gezira, Central Sudan.
[11]. Andulkadir, M., Abubakar, G. I., and Mohammed, A. (2010). Production and characterization of oil from fishes. *ARPN Journal of Engineering and Applied Sciences*, 5(7), 1-5.
[12]. Olayemi, F. F. (2012). Shelf-life and quality characteristics of smoked catfish (*clariasgariepinus*) stored in composite packaging materials (PhD. Dissertation). Retrieved on July 18, 2019, from http://ir.library.ui.edu.ng.
[13]. Pemberton-Pigott, C., Robinson, J., Kwarteng, E. & Boateng, L. (2016). Low PAH improved fish smoking stove design development report. The University of Rhode Island. Retrieved on July 5, 2019, from http://www.crc.uri.edu/projects_page/ghanasfmp.
[14]. Olayemi, F. F., Raji, A. O., and Adedayo, M. R. (2012). Microbiological quality of catfish (Clariasgariepinus) smoked with Nigeria Stored Products Research Institute (NSPRI) developed smoking kiln. *International Research Journal of Microbiology (IRJM),* 3(13), 426-430.