TATARI ALI JOURNAL,
Volume 1, Issue 3, 2023. Pp. 8 – 17
ISSN - Online: 2006-6427
https://tatarialijournal.com

Received: date: 25th October, 2023
Revised: date: 30th October, 2023
Accepted: date: 5th November, 2023
Published: date: 17th November, 2023

Biochemical Changes in Smoke Dried *Clarias Gariepinus* Obtained from Markets and Landing Site of River Aljannare in Dakingari District, Kebbi State, Nigeria

Oladele Sunday Mathew[1], Abdulrahman Dantani[1], Oyero Olusegun Johnson[2]
Kebbi State Polytechnic, Dakingari, Kebbi State
email: oladelesundaymathew@gmail.com[1],
[2]Federal University of Technology, Minna, Niger State

Abstract: The purpose of this research was to evaluate the Biochemical changes in smoke-dried *Clarias gariepinus* obtained from markets around and landing site of river Aljannare in Dakingari district, of Kebbi state, Nigeria. This study assessed the comparative changes in the biochemical quality of freshly collected *Clarias gariepinus* samples from the river Aljanare landing sites smoked on improved smoking Drum (CRT) and four differently smoked market samples (Mk1, Mk2 Mk3, and Mk4). At the Laboratory, these five samples were stored in metal baskets at ambient temperature and assessed in triplicate samples for biochemical analysis on 0, 4, 8, 12, 16, 20, and 24 days. Biochemical parameters determined were Total volatile-based Nitrogen (TVB-N) (mgN/g), moisture (%), and fat (%) respectively. The result obtained showed significant changes in the biochemical analysis of the five smoked fish samples. From the overall performance, freshly processed smoke-dried fish samples were the best stable samples biochemically having the least mean TVBC range of 1.47 x 10^3. It is therefore concluded that *C. gariepinus* (CRT) smoke cured with improved smoking drum had better shelf life and nutritional qualities and was most preferred for consumption than other four different market samples cutting across Aljannare and Dakingari District.

Keywords: Biochemical changes smoke-dried *Clarias gariepinus*, River Aljanare, Dakingari district.

1. Introduction

Fish has become an increasingly important source of protein and other element necessary to maintain and keep a healthy body. Fish serves as an important food component for a large section of the world population (Sunday and Toyosi, 2023; Asma, 2015). Fish and fish products provide an excellent source of high-quality protein consumed as food all over the world. Many people strongly depend on fish as their primary source of animal protein (Emilin *et al*., 2021). Fish and fish products are dominantly marketed in the international trade of more than 50 billion dollars indicating consumer keen interest in the commodity (Kumolu-Johnson and Ndimele, 2011). Fish is a more perishable commodity, than cattle, sheep, and poultry, and get spoiled very easily even in temperate climates (Omeji, *et al.*, 2022; Gulshan, *et al*., 2014). The high ambient temperature occurring in many areas in Nigeria favours the spoilage rate of fish. Unless it is disposed of quickly after capture, it must be preserved in some way. Fish being highly

perishable after harvest requires proper preservation and storage to increase the shelf life (Ibrahim, 2017).

The aim of fish processing and preservation is to inhibit microbial growth, improve acceptability and above all extend the shelf-life of the products either by way of using preservatives, refrigerating or traditionally by either salt-curing or smoking (Kumolu-Johnson and Ndimele, 2001). In Nigeria, the social-economic status of rural fish farmers and consumers make smoking the most preferred choice of processing. According to Felix *et al.* (2015), smoking reduces the moisture content of fish to a point that it impairs the activities of spoilage microbes (Kpodekon *et al*., 2014; Bosede and Obire, 2021).

Fish is one of the major sources of livelihood for the people living around River Aljannare. Most of the landing beaches lack electricity and this makes it impossible for the fishermen and fish processors to have cold storage facilities. Processing is done in the form of smoking, sun-drying or frying (Felix *et al*., 2015). The treatments employed in the processing are mostly inadequate resulting in the spoilage of the processed fish products. The objective of this study is to assess the Biochemical Changes in Smoke dried *Clarias gariepinus* obtained from markets around and landing site of River Aljnnare, in Dakingari District, Kebbi State, Nigeria.

2. Materials and Methods

Forty-eight smoke-dried samples of *Clarias gariepinus* with twelve each were obtained from four different markets around River Aljanare, in the Dakingari District. They were labeled, and kept in cooler boxes, indicating their site of origin. In addition twelve fresh fish of 60g were purchased directly from River Aljanare landing site were smoked on improved smoking Drum for seven hours at a temperature range of 39 - 48.9ºC. The temperature was controlled by regulating the burning of the fuel wood. Smoking temperature was monitored by ensuring that the fish on the rack were uniformly heated by the smoking temperature and dipping a thermometer into the fish flesh. Total smoked samples of sixty (60) *Clarias gariepinus* was used for this study. Biochemical analysis was done on all the samples at the Department of Fisheries Technology, Kebbi State Polytechnic, Dakingari. The labeled samples of smoke dried *C.gariepinus* from four different markets and landing site were stored in metal baskets on the shelf at an ambient temperature Triplicate samples each from five labeled smoked fish samples were taken at every 4 days (i.e., 0, 4, 8, 12, 16, 20, 18 and 24); making up eight testing days respectively. The experimental period were carried out within 28 days. The proximate composition of fish was determined using conventional method of AOAC (1998).

Estimation of Moisture contents of smoked dried *Clarias gariepinus* samples

About 5 gram of *Clarias gariepinus* samples were taken into each known weight basin and weighed in a digital balance and allowed to dry into the oven at 105°C for 24 hours in order to remove the moisture until constant weight was attained after which the basins containing the samples were taken out of the oven. They were then cooled in a desiccator and weighed in a

digital balance. Percentage of moisture in the samples were calculated as weight loss divided by original weight of samples taken multiplied by 100.

Total Volatile Base Nitrogen (TVB-N)

TVB-N content was expressed as mgN/100g of fish flesh. TVBN = (V × C × 14 × 100) /10, where V was the volume of hydrochloric acid added and its concentration (C), 10 represented the weight of the sample while 14 was the molecular weight of nitrogen (Goulas and Kontominas, 2005).

Estimation of Fat contents of smoked dried *Clarias gariepinus* samples

About 5 g of the homogenous sample were taken into conical flasks with addition of 10 ml of folch reagent into the sample, homogenized properly and kept in air-tight condition for 24 hours. Reaction of fat contents present in fish muscle happened with the solvent. After 24 hours the flask solution were filtered in another weighed conical flask through a filter paper of which the flasks were given a hot water bath to dry up and removed the solvent. The flasks were put into an oven for an hour to get the actual fat content. Then the flasks were weighed in an electronic balance to get the amount of fat content. The percentage of fat in the smoked dried fish samples was then calculated by weight of the residue multiplied by 100 divided by weight of sample taken.

3. Statistical Analysis

The data were subjected to Analysis of Variance and significant test. On the other hand the differences between samples means were done using Duncan's Multiple Range test at 1% level of significance.

4. Results

Biochemical Evaluation of Clarias gariepinus Samples

Table 1: Proximate composition of Moisture (%) in fish samples

Sample	Storage in days						
	0	4	8	12	16	20	24
CRT	25.25 ± 0.01a	21.58 ± 0.02b	22.15 ± 0.02b	16.52 ± 0.02c	16.23 ± 0.03c	14.54 ± 0.02d	12.44 ± 0.65e
MKT 1	39.21 ± 0.02a	24.52 ± 0.02b	20.50 ± 0.02c	18.53 ± 0.01d	15.05 ± 0.02e	14.40 ± 0.02f	13.25 ± 0.01g
MKT 2	40.22 ± 0.02a	21.40 ± 0.02b	19.57 ± 0.02c	18.37 ± 0.02d	17.34 ± 0.02e	15.58 ± 0.01f	13.53 ± 0.00g
MKT 3	42.58 ± 0.02a	22.57 ± 0.02b	21.42 ± 0.02c	18.56 ± 0.02d	18.98 ± 0.02e	17.57 ± 0.02f	14.05 ± 0.01g
MKT 4	43.64 ± 0.02a	23.08 ± 0.02b	21.95 ± 0.02c	19.65 ± 0.02d	19.95 ± 0.02e	18.28 ± 0.01f	16.58 ± 0.02g

Mean ± Standard error of mean (SEM) on the same row followed by different letters are significantly different ($p \leq 0.05$)

Moisture (%) value of Clarias *gariepinus* samples for 24 storage days

There were significant differences ($p<0.05$) between the moisture value percentage of all the five smoke dried fish samples (Table 1). The highest percentage moisture value of 43.64 was recorded for MKT4 sample at day 0 which reduced to 16.58 by day 24; this can be attributed to the fact that this sample was exposed to the least duration of smoking. CRT Sample showed the least moisture content percentage of 25.25 at day 0 which was smoke dried with smoking Drum for the duration of 7 hours. The moisture content can be used as a pointer to the rate at which deterioration occurred in fish samples resulting in the early decomposition.

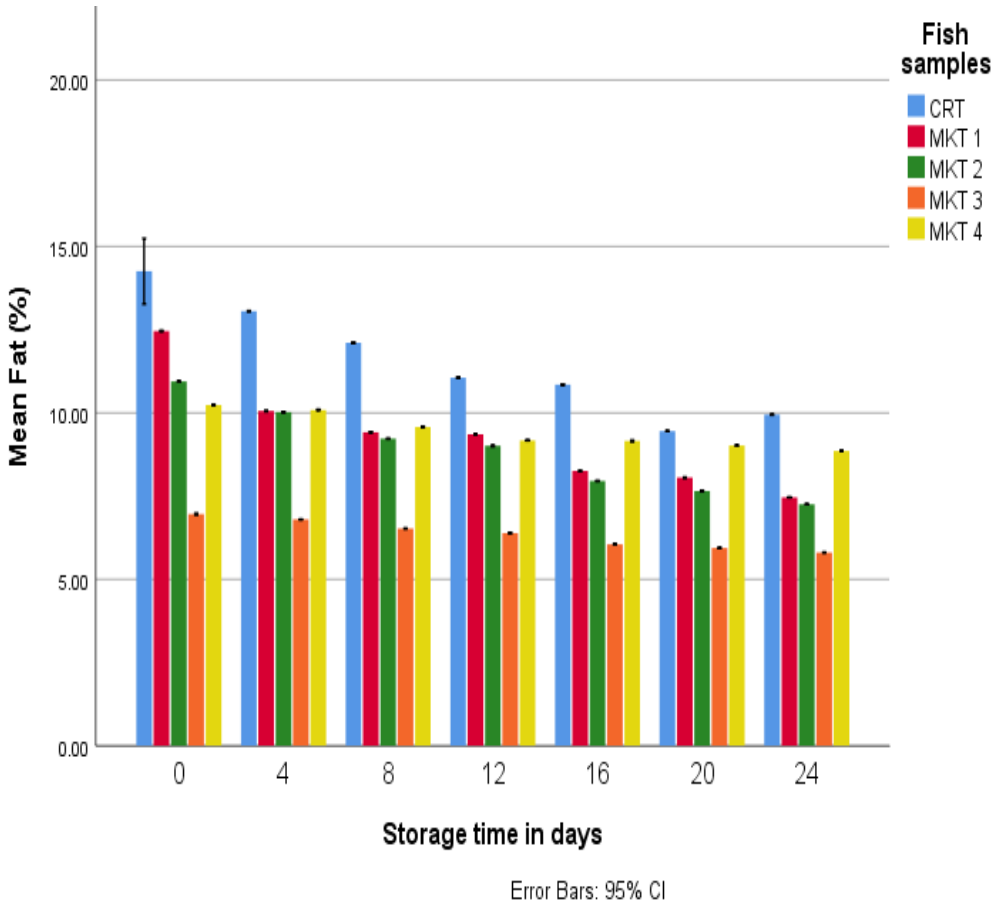

Figure 1: Mean Fat (%) of five Clarias *gariepinus* samples

Fat (%) value of five Clarias *gariepinus* samples for 24 storage days

The percentage of fat contents for five different smoke dried fish samples at ambient temperature recorded at day 0 were 14.25 (CRT), 12.46 (MKT1), 10.95 (MK2), 6.96 (MK3) and 10.23 (MK4) which at day 24 reduced to 9.95, 7.46, 7.25, 5.80, and 8.85 respectively in Figure 1.

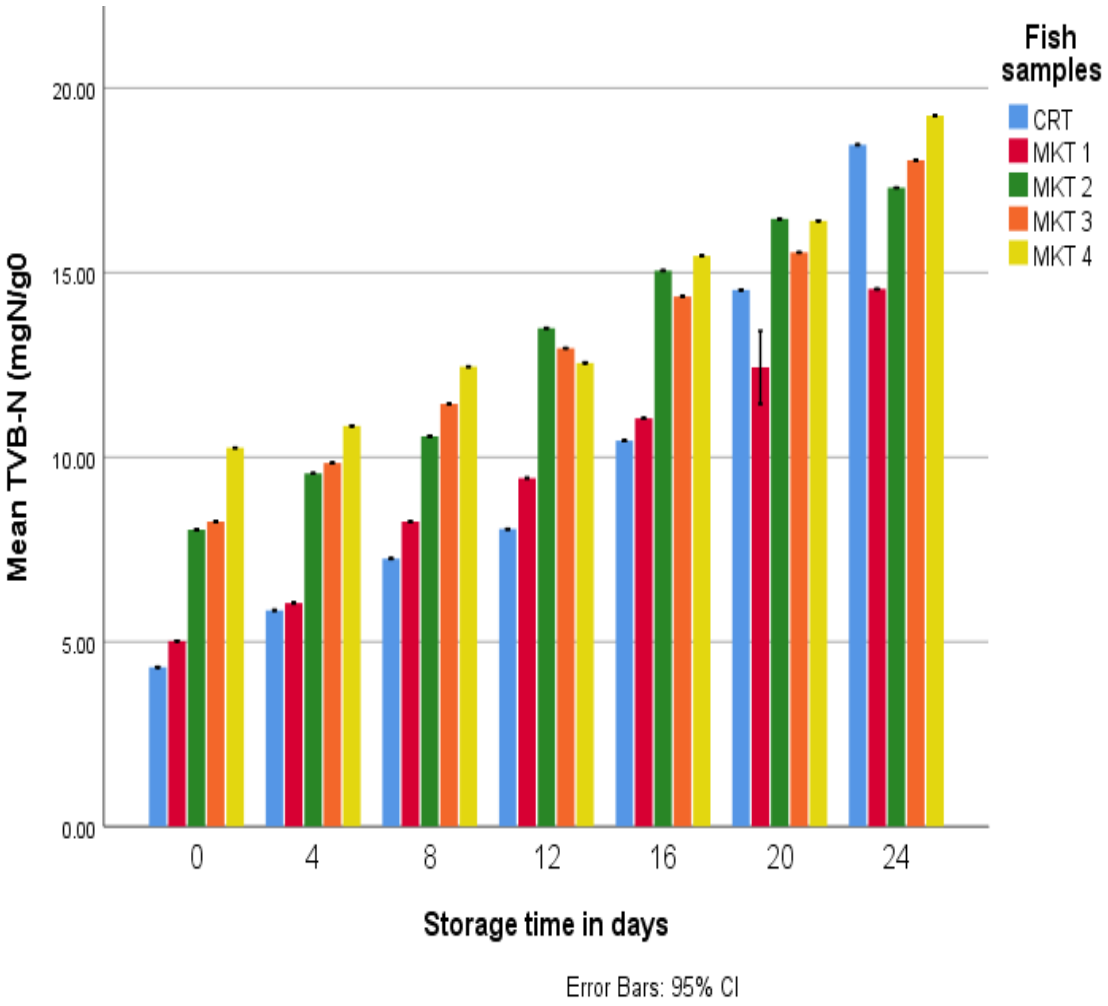

Figure 2: Mean TVB-N (MgN/g) of *Clarias gariepinus* samples

TVB-N (MgN/g) of *Clarias gariepinus* samples for 24 storage days

TVB-N levels were monitored as the main parameter of fish muscle freshness. The initial (0 day) TVBN values obtained from smoke-dried *Clarias gariepinus* sampled from CRT, MKT1, MK2, MKT3 and MKT4 in mgN/g were 4.31, 5.02, 8.04, 8.26 and 10.25 respectively (Figure 2) According to figure 2 it was observed that the TVB-N value of freshly smoke-dried Clarias gariepinus at 0 day in mgN/g of CRT, MK1, MK2, MK3 and MKT4 ranged from 4.31, 5.02, 8.04, 8.26, and 10.25 to 18.65, 14.56. 17.30, 18.05 and 19.25 respectively.

5. Discussion

Biochemical Assessment of smoked dried fish samples

Percent of Moisture (%)

There was significant difference ($p<0.05$) between the moisture content percentage of the five smoked fish samples (Table 1). This is in agreement with the findings of Olayemi *et al.* (2012)

which stated that the difference in moisture content after smoking is a confirmation of the fact that *C.gariepinus* has high water content which predisposes it to high microbial spoilage if not well preserved after harvest. The highest percentage moisture content of 43.64 was recorded for MKT4 sample at day 0 which reduced to 16.58 by day 24; this can be attributed to the fact that this sample was exposed to the least duration of smoking. CRT Sample smoke dried with smoking drum showed the least moisture content percentage of 25.25 at day 0. The initial (0 day) percent of moisture CRT, MKT1, MK2, MKT3 and MKT4 were 25.25%, 39.21%, 40.22%, 42.58%, and 43.64% respectively which later reduced to 12.44%, 13.35%, 13.53%, 14.05% and 16.58%. This conforms to the findings of Ricketts (2019) which stated that water activity is directly proportional to the moisture content of the fish samples which can be lowered by smoke drying, consequently retarding the growth of microorganism such as bacteria and mould to give fish product a required nutritional stability.

Percentage of Fat in smoked dried fish samples

The percentage of fat contents for five different smoke dried fish samples at ambient temperature recorded at day 0 were 14.25 (CRT), 12.46 (MKT1), 10.95 (MK2), 6.96 (MK3) and 10.23 (MK4) which at day 24 reduced to 9.95, 7.46, 7.25, 5.80, and 8.85 respectively. The value of fat decrease during the smoking process could be the resultant effect of evaporation of moisture which agrees with the findings of Mosarrat *et al*. (2016); Ogbonnaya and Shaba (2009); Daramola *et al*. (2007); Bouriga *et al*. (2012) and Bilgin *et al. (2008).*

Total Volatile Base Nitrogen (TVB-N) (MgN/g)

TVB-N levels were monitored as the main parameter of fish muscle freshness. The initial (0 day) TVBN values obtained from smoke-dried *Clarias gariepinus* sampled from CRT, MKT1, MK2, MKT3 and MKT4 in mgN/g were 4.31, 5.02, 8.04, 8.26 and 10.25 which had risen to 18.46, 14.56, 17.30, 18.05 and 19.25 mgN/g respectively in Fig. 2). There was continuous increase in the TVB-N value of all the smoke-dried samples all throughout the period of storage.

6. Conclusion

The present study assessed the biochemical changes associated with smoke-dried *C. gariepinus* samples on improved smoking Drum (CRT) in comparison with differently smoked *C. gariepinus* samples obtained from four different markets MK1, MK2, MK3, and MK4 respectively. It was observed that smoke drying process had a significant biochemical composition on CRT samples more than the other smoked dried market samples for safer and acceptable nutritional stability. Proximate composition showed that fish from improved smoking Drum had the lowest moisture value and highest crude protein, an indication of better keeping quality and acceptability. Smoke-drying methods are efficient in the post-harvest management of fishery products which could adequately improve the preservative strategies of dried fish thereby extending their shelf life before final consumption. Fish from MK4 has the highest percentage moisture value. . Measurement of biochemical quality and safety standards of smoked fish products will be instrumental to minimization of the occurrence of food poison and for improvement of health of fish products consumers.

7. Recommendation

Fish smoking and processing should be properly done to facilitate extended shelf life quality of the smoked fish. This will go a long way to enhancing fish biochemical composition and general acceptability by consumers in Aljannare and Dakingari District as a whole. Smoked fish should be purchased in quantities that can be consumed as quickly as possible since prolonged storage at ambient temperature can result to fish spolage. Smoke dried fish should be sealed and put inside the freezer until the time of consumption since reduced temperature can be instrumental to retarding the fish microbial activity. Fish should be properly handled right from harvesting to time of processing, even to when they would be consumed. Introduction of new technology, self-development skills for fishing communities and enhanced access to refrigeration facilities should be established throughout the district. Fish sellers buying fish from fishermen in River Aljannare should use ice block to preserve the quality of the harvested fish before reaching their shops or markets and even before further fish preservation and processing.

References

AOAC, 1998. Association of Official Analytical Chemists. 16th Ed. Published by O.M.A. Washington, D.C., U.S.A. Chap. 35. pp:7.

Asma, A. A. (2015). Post-Harvest Losses of Fish in Developing Countries. School of Life Sciences, Faculty of Science and Technology, AlNeelain University, Khartoun, Sudan.

Bilgin S, Unlusayin M, Izci L, Gunlu A (2008). The determination of the shelf life and some nutritional components of gilthead seabream (*Sparus aurata* L., 1758) after cold and hot smoking. Turk. J. Vet. Anim. Sci. 32(1): 49-56.

Bosede, A. A. & Obire, O. (2021). Microbial Flora of Smoke dried Catfish (Clarias gariepinus) processed and sold in some Abbattoirs in Bayelsa and Rivers States. African Journal of Environment and Natural Science Research. ISSN: 2689 – 9434 Volume 4. Issue 4. 2021 pp 123 – 133.

Bouriga, N., Ben, H., Ismail, M., Gammoudi, E. F. & Trabelsi, M. (2012). Effect of Smoking-method on Biochemical and Microbiological Quality of Nile Tilapia (*Oreochromis niloticus*). *American Journal of Food Technology, 7: 679-689.* **DOI:** 10.3923/ajft.2012.679.689

Daramola, J.A. Fasakin, E.A. & Adeparusi, E.O. (2007). Changes in physicochemical and sensory characteristics of smoke-dried fish species stored at ambient temperature. African Journal of Food, Agriculture, Nutrition and Development. 2007, 7(6).

Emilin, R.; Deepak, V. S.; Jamila, P.; Prakash, P. and Antony, V. (2021). Biochemical, Microbiological and Sensory Quality of Underutilized Marine Gastropod Smoked Products from *Chicoreus ramosus* and *Volegalea cochlidium.Biointerface Research in Applied Chemistry.* Volume 11, Issue 1, 2021, 7605 – 7613.

Felix, O., Akinwumi, K., & Adegbehingbe, T. (2015). Microbiological Analysis of Three of Smoked Fish Obtained from the Ondo State, Nigeria, *Food and Public Health*, Vol. 5

No. 4, pp. 122-126. doi: 10.5923/j.fph.20150504.04.

Goulas, A. E. & Kontominas, M. G. (2005). Effect of Salting and Smoking Method on The Keeping Quality of Chub Mackerel (*Scomber japonicus*): Biochemical and Sensory Attributes. *Food Chemistry* 93, 511 – 520.

Gulshan, A. L., Subhash, C. C., Mohajira, B., Farzana, B. F., & Mosarrat, N. N. (2014). Comparative Study of Quality-Analysis of Three Different Bangladeshi Smoke-Dried Lean Fishes Using Salt and Turmeric Stored at Refrigeration Temperature (4°C). *American Journal of Food Science and Technology*, 2014 2 (6), pp 209-215. DOI: 10.12691/ajfst-2-6-7.

Ibrahim, B. U. (2017) Assessment of the Nutritional Quality of Smoked Catfish (Clarias Gariepinus) In Lapai, Niger State, Nigeria. *Science World Journal Vol 12 (No 1) 2017. ISSN 1597-6343*

Kpodekon , M., Sessou, P., Hounkpe, E., Yehouenou, B., Sohounhloue, D., & Farougou, S. (2014). Microbiological Quality of Smoked Mackerel (*Trachurus trachurus*), Sold in Abomey-Calavi Township Markets, Benin, *Journal of Microbiology Research*, Vol. 4 No. 5, 2014, pp. 175-179. doi:10.5923/j.microbiology. 20140405.01.

Kumolu-Johnson, C. A., & Ndimele, P. E. (2001). Effect of Salting, Brining and Sun Drying on the Shelf Life of *Clarias gariepinus*. *Journals of Resources. Rev. Science.* 2, 21 –25. Retrieved from docsdrive.com/pdfs */academic**journals**/jfas/0000/*

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. *Doi=jfas.2011.365.378*

Mosarrat, N. N, Gulshan A. L, Subhash C. C., Farzana B. F. & Mohajira B. (2016) Comparison of shelf life quality of salted smoke-dried freshwater fish; Chapila (Gudusia chapra) Kaika (Xenentodon cancila) and Baim (Mastacembelus pancalus) at refrigeration storage (40C). *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 10, Issue 12 Ver. II (Dec. 2016), PP 08-14 www.iosrjournals.org*

Olayemi F. F., Raji A. O. & Adedayo M. R. (2012). Microbiological quality of catfish (*Clarias gariepinus)* smoked with Nigerian Stored Products Research Institute (NSPRI) developed smoking kiln. Int. Res. J. Microbiol. 3(13):426-430.

Ogbonnaya C. & Shaba I. M. (2009). Effects of drying methods on proximate composition of cat fish (Clarius gariepinus). World J. Agric. Sci. 2009, 5(1):114-116.

Omeji, S., Obande, R.A. & Yusuf, I.J. (2022). Survey of Bacteria and Pests of smoked Clarias Gariepinus/African Catfish obtained from Ikpayongo, Abinsi and Daudu Markets. International Journal of Agriculture and Enviromental Research. Volume 28, Issue 01 "January – February, 2022". ISSN 2455 – 6939

Ricketts AO (2019) Biochemical and Microbiological Assessment of Smoked Dried *Clarias gariepinus*. J Food Process Technol 10: 775. doi:10.4172/2157-7110.1000775

Sunday, E.O., & Toyosi, E.M. (2023). Impact of Combination of Onion bulb, holy basil and turmeric rhizome on shelf-life, flesh and microbial quality of smoked Clarias gariepinus. Aceh Journal of Animal Science (2023) 8(1): 24 -29. www.journal.unsyiceh.ac.id/AJAS