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Evaluation of Modified and 'Futy' Kiln on Microbial Load of Five Commercially Important Fish Species in Hadejia Jigawa State, Nigeria

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ABSTRACT

This study examined the effect of two different Smoking Kilns on microbial load in Hadejia Jigawa state of Nigeria. Two smoking kilns tagged FUTY smoking kiln and Modified drum smoking kiln were used to smoke five different fish species. Each was smoked for 0-8 hours smoking duration and the output was compared with the Market smoked fish species. The five species smoked were *Heterotis niloticus*, *Oreochromis niloticus*, *Clarias gariepinus*, *Bagrus bayad*, and *Mormyrus rume*. The nutrient compositions showed that fish smoked with Modified drum kiln gave the best performance in terms of dry matter and protein content of 96.67% and 61.72% for *Heterotis niloticus* while Futy kiln smoked fish dry matter and protein content of 94.02% and 58.80% were recorded for *Bagrus bayad*. Market smoked fish gave 89.87% dry matter for *Clarias gariepinus*, 61.18% crude protein. Microbial load was highest in Market smoked Fish species with the value of 2.89×10^4 and the lowest microbial load of 1.11×10^4 for Modified drum smoking kiln. The results showed that Modified smoking kiln smoked fish are better compared to both FUTY and Market smoked fish.

Keywords: Evaluation, Modified, Futy, Microbial, Fish species

Introduction

Fish as a nutritious aquatic animal constitutes reasonable percentage of human dietary consumption when processed (Abowei and

Tawari, 2011). The principal nutritional constituents of fish include moisture, protein, lipid, mineral and vitamin. The importance of fish production in the tropics in particular and

the world at large cannot be overemphasized. It is a source of stable food, raw materials for our growing industries and creates jobs opportunity for the teeming population (Alamu, 1990). In many countries, the bulk of Fish is sold fresh for local consumption. Processing, where it is done, is either to supply distant market or to produce a range of products with different flavors and textures (Yohanna, 1998 and 2001). He further explicated that fish is an extremely perishable food, in which most fish become inedible within 12 hours at tropical temperatures (32-35°C) after capture, spoilage begins as soon as the fish dies and processing should therefore be done quickly to prevent the growth of spoilage bacteria (Yohanna, 2001). Fish is a low acid food and is therefore very susceptible to the growth of food poisoning bacteria (Yohanna, 1998). Fish when out of water deteriorates fast except immediate steps are taken to preserve its duality. Despite the subsistence nature of our capture fisheries in Nigeria as much as 50% postharvest losses are recorded, that is, half of the total subsistence productions are wasted. The result of this is economic losses to farmers, fish processors and marketers (Bolorunduro, 1996). Processing can be defined as a technique of improving and sustaining fish quality from the time of harvest to the consumption. Processing of fish into forms for human consumption or suitable to be used as a supplement in animal food has been neglected in fish culture practices. This

may be due to the high technology required in some of the processes and the fact that those involved in actual fish production are ignorant of the different processing methods. In order to prevent fish deterioration, every fish processor must strive to employ the best method possible in handling fish in order to maximize returns on processing investment (Davies, 2005). According to Dada and Yohanna (2001) Fish provides a good source of high quality protein and contains many vitamins and minerals. It may be classified as either white (lean) oily fatty or shellfish. White fish such as Haddock and Seer contain very little fat (usually less than 1%) whereas oily fish such as sardines contain between 10-25%. Souness (1990) reported that sardines have high fat content, a range of fat-soluble vitamins (A, D, E & K) and essential fatty acids, all of which are vital for the healthy functioning of human.

MATERIAL AND METHODS

The study was conducted in Hadejia Local Government Area of Jigawa state on Latitude: 12° 28' 37" N, Longitude: 10° 03' 10" E with a Population range of between 20,000 and 50,000 Hadejia has a tropical climate. The average annual temperature in Hadejia is 27.2 °C. The average annual rainfall is 595 mm (TNFDP, 2011).

Description of the Modified Drum Smoking Kiln

The modified drum smoking kiln is measured 34cm in length with the diameter of 24cm Plate I. Three (3) Chimneys one at each side,

left and right hand respectively with the third Chimney which is movable at the upper part of the kiln for either smoke exit or Oxygen (Air) entrance for preservation before consumption which is made up 5mm PVC pipe. In addition the Modified Drum Smoking kiln is a multipurpose kiln with Two (2) Chambers Upper and lower Chamber made up 3x6 inch wire mesh with four (4) supports beneath for load (fish) carriage. However, both upper and lower chambers can be used simultaneously or else lower can be used with Charcoal while upper with Fire- wood, much more, both the chambers can be locked. The Kiln has fire place or hearth measuring 17.5cm wide as shown in Plate I.

Description of the “FUTY” Smoking kiln

Futy Smoking Kiln, it was made of light metal steel in form of a rectangular box having four legs as stand Plate II. The rectangular box has the dimension of 99cm-45cm, and the legs suspended the box from the ground. Joseph (2008) stated that the Sogbesan et al. (2012).

“FUTY” Smoking Kiln fashioned with a door of a projecting design when pulled outside has three trays made of metallic wires and rods and 10cm apart. At the bottom of the box are perforated holes that allow the inflow of smoke and heat in order to be trapped in the smoking chamber. The box has a cover at the surface with perforated holes occupying 119cm² (17cmx7cm) at the middle of the cover which is the chimney of the processor. The chimney allows excess heat and smoke out of the smoking chamber. At the surface of the chimney of metal sheath is suspended on four pipes to prevent inflow rain water into the smoking chamber. Charcoal is ignited and placed at the bottom of the box, producing smoke and heat which will pass through the perforated holes under the box into the smoking chamber and reaching the maximum temperature, excess smoke and heat will be seen leaving the chamber through the chimney in

Plates II



Plate I. Modified drum Kiln

Key: A- Chimney B- Upper Chamber C- Lower chamber D- Cover



Plate II FUTY Kiln

Sampling

The five (5) major carefully chosen fish species are as follows Scientific Name

1. Hetrotis niloticus
 2. Bagrus bayad
 3. Clarias gariepinus
 4. Oreochromis niloticus
 5. Mormyrus rume
- Each of the five (5) selected fish species were smoked with either modified Drum Smoking kiln (Firewood) and Futy Smoking kiln (Charcoal) were degutted and inserted in to salt solution of 10g/100cl of water for five (5) minutes and remove to drain for another five (5) minutes before smoking commences, the smoking however lasted for eight (8) hours. Weights of the fish species were considered at Two (2) hours intervals. The smoked fish were subjected to proximate analysis for Crude protein

(cp), Crude fiber (cf), and Moisture and the results are shown in table 3-5., Fish species were also evaluated to identify microbial load.

Statistical Analysis

All raw data generated was treated with Descriptive Statistics for the mean and S.D. Mean was separated using Duncan multiple range test and one- way ANOVA for significance difference between the values. 32 CHA

RESULTS

Effect of Smoking Duration on the Weight of Fish Species The effect of Smoking Duration and the corresponding impact it had on the weight of fish species are indicated in Tables 1 and 2. There was weight reduction as the time of smoking increased until a constant weight was obtained which signified dryness. The value of Duration and their corresponding

weight for all species ranged from 8hours for 0.2kg to 0hour for 0.8kg.

Proximate Composition of Smoked Fish Sampled from Market

The proximate compositions of smoked fish sample from market are indicated in Table 3consisting of five species which are O. niloticus, B. bayad, H. niloticus, C. gariepinus and M.rume respectively. The crude protein contents of the five fish species ranged between 39.65% and 61.18%; crude lipid (7.98% to 8.80%); fibre (0.95% to 1.10%); (4.10% to 8.00%) and dry matter (85.40% and 95.45 %.)

Proximate Composition of Smoked Fish Using Modified Drum Smoking Kiln

The crude protein contents of the five fish species ranged between 40.05 and 58.10 as indicated in Table 4. The highest was recorded for C. gariepinus while the lowest crude protein of 40.05% was recorded for O. niloticus. The fibre range of 0.78% to 1.21%; ash contents ranged from 4.10% to 5.10% and dry matter content was ranged from 89.29% and 96.67%.

Proximate Composition of Smoked Fish Using FUTY Smoking Kiln

The crude protein contents of the five fish species smoked with FUTY smoking kiln ranged between 40.29 and 58.80. The fibre range of 0.78% to 1.21%); ash contents ranged from 4.10% to 5.10% and dry matter content was ranged from 89.29% and 96.67% Table 5.

Table 1: Effect of Smoking Duration on the Weight of Fish Smoked with “FUTY” Kiln

Fish Species	0 hour	2 hour	4 hour	6 hour	8 hour	SEM
Clarias gariepinus	0.7	0.55	0.38	0.3	0.3	0.04
Oreochromis niloticus	0.2	0.15	0.12	0.1	0.1	0.03
Heterotis niloticus	0.8	0.5	0.45	0.4	0.4	0.04
Mormyrus rume	0.4	0.25	0.22	0.2	0.2	0.02
Bagrus bayad	0.8	0.58	0.41	0.4	0.4	0.04

SEM Standard Error of Mean

Table 2: Effect of Smoking Duration on the Weight of Fish Smoked with Modified drum kiln

Fish Species	0 hour	2 hour	4 hour	6 hour	8 hour	SEM
Clarias gariepinus	0.6	0.4	0.35	0.3	0.3	0.04
Oreochromis niloticus	0.3	0.28	0.25	0.23	0.1	0.01
Heterotis niloticus	0.4	0.3	0.28	0.2	0.2	0.04
Mormyrus rume	0.7	0.6	0.55	0.57	0.6	0.02
Bagrus bayad	0.5	0.4	0.35	0.28	0.3	0.04

SEM Standard Error of Mean

Table 3: Percentage of Proximate Composition of Market Smoked Fish Samples

Fish Sample	Crude %	protein	Lipid %	Fibre	Ash %	Dry matter %	Moisture %
Bagrus bayad	61.05		8.80	1.05	5.00	95.45	7.55
Clarias gariepinus	61.18		8.03	0.35	6.32	89.87	7.13
Heterotis niloticus	50.12		8.45	1.00	5.00	92.31	7.69
Mormyrus rume	56.50		8.05	0.98	8.00	90.00	10.00
Oreochromis niloticus	39.65		7.98	1.10	4.10	85.40	24.60

Table 4: Percentage of Proximate Composition of Smoked Fish Samples using Modified Drum Kiln

Fish Sample	Crude %	protein	Lipid %	Fibre	Ash %	Dry matter %	Moisture %
Bagrus bayad	55.12		8.70	0.78	4.10	89.29	10.70
Clarias gariepinus	58.10		10.10	1.21	5.10	91.67	8.33
Heterotis niloticus	61.72		9.51	0.44	4.52	96.67	3.33
Mormyrus rume	56.20		7.80	0.92	4.80	90.70	9.30
Oreochromis niloticus	45.05		6.60	0.99	4.90	93.55	6.45

Table 5: Percentage of Proximate Composition of Smoked Fish Samples using “FUTY” Smoking Kiln

Fish Sample	Crude %	protein	Lipid %	Fibre	Ash %	Dry matter %	Moisture %
Bagrus bayad	58.80		8.50	0.36	5.30	94.12	5.89
Clarias gariepinus	55.70		9.11	1.01	6.50	86.36	13.64
Heterotis niloticus	57.00		11.20	1.10	6.75	72.59	27.41
Mormyrus rume	50.34		9.20	1.30	7.58	86.36	13.64
Oreochromis niloticus	40.29		7.01	0.11	7.09	90.79	9.21

Mean Microbial Evaluation of the Fish Species Smoked using Modified Drum and “FUTY” kilns

The mean microbial evaluation of the fish species smoked using Modified Drum and “FUTY” kilns was presented in Table 6. The smoked M.rume from Market has the highest microbial incidence of 2.89×10^4 than the species smoked with “FUTY” kiln and modified kiln with the

corresponding higher value of microbial load of 2.45×10^4 from *H. niloticus* gotten from market and *B. bayad* with 2.32×10^4 .

Table 6: Mean Microbial (cfug-1) Evaluation of the Fish Species Smoked using Modified Drum and FUTY Kilns

Fish species	Smoking kiln Modified kiln	Futy kiln	Market	SEM
<i>Heterotis niloticus</i>	1.39×10^4	1.42×10^4	2.45×10^4	0.30
<i>Oreochromis niloticus</i>	1.21×10^4	1.32×10^5	1.06×10^5	0.06
<i>Bagrus bayad</i>	1.33×10^4	1.65×10^4	2.32×10^4	0.30
<i>Clarias gariepinus</i>	1.11×10^4	1.21×10^4	1.34×10^4	0.06
<i>Mormyrus rume</i>	2.01×10^4	2.00×10^4	2.89×10^4	0.26

Conclusion

The fabricated drum smoking kiln can be used by both the rich and the poor, because of the hygiene and aseptic way of handling the smoked product. The average percentage weight loss obtained during the test for the five fish species were generally good.

REFERENCES

- Abowei J.F.N. and Tawari, C.C. (2011). Traditional Fish Handling and Preservation in Nigeria. *Asian Journal of Agricultural Sciences* 3(6): 427-436.
- Alamu, S., (1990). Assessment of women contribution to fishing industry and fish marketing in Kainji Lake Research institutes Annual Report, pp.: 184-190.
- Bolorunduro, P., (1996). Livestock and fisheries production technology for women in Agriculture. In Proceedings of the National Trading Workshop held at NAER, pp:65-68.
- Dada, A.S. and Yohanna, J.K. (2001). *Economic viability of integrated fish farming in Nasarawa state*. Paper presented at the 16th annual national conference and silver jubilee of fisheries society of Nigeria (FISON) Maiduguri, Nigeria. 282 pp.
- Davies, R.M., (2005). Development of Appropriate Technology of fish processing in Nigeria. A paper presented at a one-day workshop on intensive fish farming on Thursday, 24th February. Division, FAO, Rome, Italy.
- Joseph. I. A (2008) A comparison of the quality of smoked fish using traditional smoking drum and FUTY improved processor. B Tech Project Dept of fisheries, Federal University of Technology. Yola.

Souness, R. (1990). Research helps preserve the fish catch. *Agricultural information development bulletin*, United National Building. Vol. 12(3):26-30.

Sogbesan O.A., Onwukike C, Oniyia L.U, Jauro I.A., Maude A.F., Allison, D.S., Aderolu A.Z., Ukaonu S.U. (2012) Comparative Studies of the Efficiency of some Economically Feasible Fish Processors in the North – East Zone of Nigeria. *National Monthly Refereed Journal of Reasearch in Science & Technology Volume .1, No.6*. PP 48-52

TNFP (2011) Third National Fadama Development Project Annual report 2011

Yohanna, J. K. (1998). *The importance of food processing and the extent of food processing industries in the development of agriculture in rural areas*. A paper presented at a workshop organized by Nasarawa State Local Government Commission at College of Agriculture, Lafia.

Yohanna, J. K. (2001). *Fresh fish processing and storage in rural areas: A case study of Doma LGA, Nasarawa State*. Paper presented at the 16th Annual conference and Silver Jubilee of the FISON, Maiduguri, Borno State, Nigeria. Nov. 4-9th.