A PRELIMINARY INVESTIGATION INTO THE EFFECT OF DIFFERENT STORAGE METHODS ON THE KEEPING QUALITY OF SMOKED *Oreochromis niloticus*

J.O. OYERO

Department of Fisheries Technology,
Federal University of Technology, Minna,
Niger State.

INTRODUCTION

Fish usually deteriorate very rapidly after death especially in the high ambient tropical temperature. As a result, quite a reasonable proportion of fresh fish never gets to the consumers in a wholesome state. The importance of fish as a rich source of animal protein therefore makes it compulsory that fish should be efficiently processed and well preserved before deterioration can set in (Eyo 1983). It is also necessary to preserve the fish if they are to be conveyed to distant markets.

Fish smoking is the commonest preservation method in Nigeria because of the simplicity of the process which makes it acceptable in remote fishing villages where the technology for other preservation methods are not readily available. The preservative property of fish smoking is attributed to the heat and chemical components present in wood smoke.

Storage'0 is very important after processing of fish products. According to Kazimierz and Zdzislaw (1990), shelf-life of smoked fish depends on many factors, mainly the species and initial quality of the raw materials, the concentration of salt and the corresponding water activity in the meat, the temperature regime during smoking the contents of smoke components; the type of packaging and the hygienic standard of the premises and the temperature of storage. Many of the methods used today in the storage of processed food were discovered long before recorded history began (Amano, 1965). Ideally smoked fish generally being perishable commodities, should be kept under refrigeration (Kazimierz and Zdzislaw 1990). But this may not be ideal in the developing countries due to inadequate supply of electricity to rural fishing settlements. Smoked fish have been stored in local pot traditionally and Keshvani (1964) observed that well dried fish could be stored for up to one year in sealed polythene bags without serious loss of quality. However, Cole (1963) found that the sharp projections of dried marine fish punctured polythene bags. Nevertheless, both Watanable, (1971) and Toots (1972) recommended sealing dried fish in these bags. The latter emphasizing the need to cool the fish after thorough drying and to store the product in a cool shavy place to avoid witness of the product.

This preliminary investigation into the effect of different storage methods on the keeping quality of smoked *Oreochromis niloticus* (a commercially important fish species) was carried out to assess the nutritional qualities of smoked *0. niloticus*. Also to discover the best methods of storage to minimize spoilage and infestation of smoked fish.

MATERIALS AND METHODS

Collection of fish and smoking

Representative samples of *Oreochromis niloticus* used for this study were obtained immediately after they were landed by fishermen in Tagwai Dam in Minna Niger State.

A total of 100 *O niloticus* were used. Pre-processing operations of washing in clear tap water weighing, scaling and gutting were carried out. The fish were kept in deep freezer

at a temperature of -4°C for later proximate analysis.

After thawing at room temperature (29°C) the fish were smoked using traditional smoking kiln. All the 100 *0. niloticus* were arranged on the rack and laid over a smoldering fire and smoked for 12 hours.

Storage of the Smoked Fish

The fish were allowed to cool at room temperature, and were transferred to the laboratory and weighed. The fish were separated into four of 25 apiece and stored differently in Basket (A) Carton (B) Jute bag (C) and Polythene .

The packed samples were kept in the open laboratory under observation for 6 weeks.

Chemical Analysis

Protein, lipid, ash and moisture contents of smoked products were determined according to the Association of Official Analytical Chemists (AOAC, 1980) procedures in each of the stored treatments once every week for six weeks.

Organoleptic Assessment

Following Nyagambi (1986), the following were assessed.

- number of defective fish.
- number attacked by rodents, beetles, etc.
- percentage of fish with mould.

RESULTS AND DISCUSSION

Table 1 shows the result of the proximate analysis. There was no steady trend in any of period of six weeks. At the end of the sixth week, the protein contents in A and D had decreased while the protein contents of B and C increased. The lipid content increased only in A while it decreased in B, C and D. The moisture content generally increased over the period of storage and there was increase in ash content only in C while it decreased in A, B and D.

The fluctuations in the proximate analysis could be attributed to the uneven distribution of heat by traditional method of smoking. The high temperature recorded in the traditional ovens often caused charring of the underside and the high temperature may also affect the nutritional quality of the fish (Worfe, 1975, Rawson and Sai, 1966). The smoked fish kept in the Jutebag had the highest protein contents at the end of the sixth week.

Tables 2, 3 and 4 show the weekly evaluation of appearance and odour, average weekly scores for insect and rodent attack and weekly percentage of fish with mould respectively.

The samples packed in polythene bag suffered about 35% mould infection and in addition, a few of them had been attacked by rodents, with some fouling. Though, lowering the water activity of a fish product can lead to mould growth and production of mycotoxins (Olley *et al.* 1988), but in this study the mould growth could be attributed to the high humidity within the polythene. Also, the attack by the rodents was possible due to the easiness at which they could tear the polythene. Samples packed in jutebag were in good condition, but they were slightly attacked by insect. All samples packed in carton and basket were still in good state, but there were insect attack in the samples packed in the carton.

At the close of the sixth week, samples packed in basket, carton and jute bag were still in an edible state. Package in polythene bags was only ideal for storage in two weeks. Overall, storage in jute bag was the best for storage but could be improved on by disinfecting the bag against insect attack. This work was a preliminary study, thus a further detailed work should be carried out.

Table 1: Proximate Composition of Smoked *Orechromis niloticus*

% Proximate Composition	Treat-ment	1	2	3	4	5	6
Protein	A	51.83	47.00	41.00	49.17	53.61	49.82
	B	48.74	43.00	43.00	46.92	47.40	50.66
	C	54.00	46.00	39.80	49.21	52.79	55.02
	D	53.00	43.00	56.80	48.36	49.27	52.23
Lipid	A	16.40	20.96	21.00	20.44	16.74	17.20
	B	23.37	19.30	20.16	21.81	25.71	20.37
	C	13.32	25.97	26.04	20.20	20.21	18.97
	D	14.00	29.11	26.23	19.55	24.59	13.98
Moisture	A	9.27	11.04	15.00	11.44	7.65	12.98
	B	9.39	15.17	13.84	8.19	4.89	12.97
	C	9.68	11.23	10.16	9.31	5.00	11.01
	D	10.00	14.36	13.24	10.88	6.14	12.98
Ash	A	23.50	21.00	23.00	18.95	22.00	20.00
	B	18.50	21.00	23.00	23.08	21.00	16.00
	C	23.00	19.00	24.00	21.28	22.00	15.00
	D	23.00	18.00	25.00	21.21	20.00	21.00

Table 2: Weekly Evaluation (Appearance and Odour)

WEEKS	A	B	C	D
1	10	10	10	10
2	10	10	10	10
3	10	10	10	8
4	10	10	10	7
5	10	10	10	5
6	10	9	9	4

Table 3: Average Weekly Scores for Insect and Rodent attack

WEEKS	A	B	C	D
1	10	10	10	10
2	10	10	10	9.5
3	10	9.5	10	7
4	10	9	10	7
5	10	9	9	7
6	9	8	9	7

Table 4: Weekly Percentage of Fish with Mould.

WEEKS	A	B	C	D
1	-	-	-	-
2	-	-	-	-
3	-	-	-	15
4	-	-	-	20
5	-	-	-	28
6	-	-	-	35

REFERENCES

Amano, K. (1965). Fish sausage manufacturing. In Borgstrom, G. (Ed). Fish as food New York. Academic Press 3:265-280.

AOAC (Association of Official Analytical Chemists), (1980). Official method of analysis of AOAC (W.Hor twitz Ed.) 13 ed. AOAC Washington D.C., 129-146.

Cole, R.C., Fish curing industry in Adentrop. Prod. Inst. 22/63.

Eyo, A.A., (1983). The significant of Fish Handling, preservation and processing in the Development of Nigeria Inland Fisheries with special reference to Kainni Lake, Fisheries Society of Nigeria 3rd Annual Proceeding p. 115.

Kazimierz, B.M.M. and Zdzislaw, E.S. (1990). Smoking. In Sea food Resources, Nutritional Composition and preservation chapt. 10 pp. 163-178.

Kesh vani, K.J. (1964). Pilot scale production of dried fish of Aba Eastern Nigeria. Res. Rep., Fed. Inst. tr. Nig. 27.

Nyagambi, J.F.M. (1986). Experiment and economic evaluation of improved handling of Fish using insulated containers. FAO Fish Rep. No. 329. Food and Agriculture Organization, Rome.

Olley, J., Doe, P.E. and Heruwati, E.S. (1988). The Influence of Drying and Smoking on the Nutritional Properties of Fish. An Introductory Overview. In Fish Smoking and Drying Ed. J.R. Burt Elsevier Applied Science U.S.A.

Rawson, G.C. and Sai, F.A. (1966). A short guide to Fish Preservation with special reference to West African countries Rome, FAO, 67 p.

Toots, H., (1972). Fish Preservation. Rhod. Agric. J. 69(1), 1-5.

Watanabe, K., (1971). Taste Preference of Zambians for Various Types of Salted and Dry-Smoked Fish. *Fish Res. Bull. Zambia.* 5:225-235

Wolfe, M.L. (1975). The effect of smoking and frying on the Lipids of West African Herring (Sardinella spp). J. Food Technology: 10: 512-522.