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A COMPARATIVE ASSESSMENT OF THE QUALITY OF SOME TRADITIONALLY-CURED FISH IN AKWA IBOM STATE, NIGERIA

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ABSTRACT

An assessment of the quality of four locally processed (smoke-dried) fish species was made over a three-month period both in the market and laboratory. Mean percentage moisture content of the products ranged from 3.1±0.17-3.5±0.06, indicating relatively adequate curing. Laboratory observations showed that of the four species: *Ethmalosa fimbriata, Pseudotolithus elongatus, Chrysichthys nigrodigitatus* and *Arius gigas, C. nigrodigitatus* was the most susceptible to *Dermestes* infestation. Mean weight losses observed in *E. fimbriata* were dependent on the mesh size of the storage containers, while weight increases in *Arius gigas* did not relate to the type of storage containers. The study indicated that the local sleeping mat, calico cloth and polythene material if properly used, could enhance the storage life of fish and minimize infestation and losses.
Keywords: Traditionally-cured fish, market survey, laboratory observations, storage material

INTRODUCTION

The Food and Agriculture Organization of the United Nations (FAO, 1981) defined cured fish as one preserved without the need for freezing and canning. This implies that the cured fish should be able to maintain its quality irrespective of the vagaries or variety of climatic conditions which however, in many regions of the world seem to influence the choice of curing method. In the hot, humid environment of Akwa Ibom State, heat/smoke-curing is the generally used traditional fish processing method.

It is ironical that of the estimated global loss of 3 million tons (wet weight equivalent) per year of dried fish (U. S. National Academy of Sciences, 1978), an enormous proportion occurs in the tropics where there is a general shortage of animal dietary protein (FAO, 1981). Losses are defined as the nutrients from, and value of, fish which are potentially available for human consumption, but fail to be consumed or sold as traditionally cured products (FAO, 1981). Fish losses are said to be among the highest for all processed food commodities. The processing methods (physical handling, preparation and hygiene), organization of products (packaging), storage and distribution are some of the ways through which losses occur (Udoidiong and Moses, 1998). Few sources of information are available in the scientific literature on cured fish in Akwa Ibom State(Akpan, 1981; Adam-Etuk, 1983 and IFAD/UNDP, 1997). This dearth of information on cured fish in Akwa Ibom State prompted the present study.

MATERIALS AND METHODS

Investigations were conducted in three urban markets viz.; Uyo (5°0'N; 7°56'E), Ikot Ekpene (5°20'N; 7°70'E), and Itu (5°13'N; 7°59'E) main markets. The first and second operate on a daily basis and large consignments of cured fish of different species and sizes are sold daily to a large number of buyers. The Itu market operates every four days but it aiso handles large consignments of cured fish brought in from adjoining fishing settlements within the state and from Cross River State, especially from the Umon Island fishing community. The Itu beach market attracts buyers from many parts of the state and beyond. In all three markets the sanitary conditions of the food sections (fish sections inclusive) are poor, thus attracting flies and other pests. However, the odour from fish naturally attracts flies.

Market investigations were conducted using a questionnaire containing 12 items to which the fish seller was requested to respond. Six fish traders (representing sampling points) were randomly selected from each market and maintained throughout the study period, in fortnightly interviews, each representing a sample. Responses were not quantified.

For the laboratory study, 16 boxes (each 2890cm^3) with wooden rims were constructed from four types of materials namely: mosquito net, calico cloth, polythene bag and local sleeping mat woven from the leaves of *Pandanus candelabrum*. Four boxes were made from each material such that samples of each fish species were placed in all four types of containers. Observations and weight measurements were made every three days to assess weight changes or any manifestation of infestation.

Muscle sub-samples were taken from each sample of the smoked fish, weighed, labeled and placed in an oven for 12h at a temperature of 70°C. On removal, they were desiccated for 45 minutes to cool and then reweighed. Percentage of moisture was calculated as in FAO (1981, p.75). Firmness of the products and breakages were assessed by physical examination using the senses of sight and touch.

Beetles were removed and identified with the aid of keys in FAO (1981). Weight data generated from the samples in the boxes were subjected to a One-Way Analysis of Variance (ANOVA) and Duncan's Multiple Range Test according to Little and Hills (1978).

RESULTS AND DISCUSSION

Most of the cured fish sampled came from fishing settlements around the Bakassi peninsular fishing grounds in the Gulf of Guinea. About 22% of the fish sold in the markets were gutted and possibly washed before smoking, while the rest were neither gutted nor washed. In the market stores where fish were kept, 22.4% of the respondents covered their wares with mat while 55% left them uncovered. The remaining respondents (22.6%) stored their wares in polythene materials. Sixty percent of the respondents disposed their consignments within four days while 40% based the duration of each set of products with them on demand forces. Thirty-nine percent of the respondents re-smoked the fish on getting home, depending on the state of the fish, while 61% did not.

After hot-smoking, *Pseudotolithus elongatus* acquired a light brown colour while *Ethmalosa fimbriata* was golden brown. The catfishes, *Arius gigas* and *Chrysichthys nigrodigitatus* were dark brown in colour, and when properly smoke-cured, they presented a glossy appearance. Of the four species, *P. elongatus* and *E. fimbriata* were the weakest in terms of firmness. Fifty percent of *Ethmalosa* and 77.7% of *Pseudotolithus* consignments examined were less firm while *Arius* was firmer than *Chrysichthys*. *Pseudotolithus* and *Ethmalosa* easily got broken in the course of transportation, while the two catfish species were said to be more prone to getting rancid than the other two species.

All respondents agreed that transportation difficulties contributed to a significant proportion of losses incurred per trip, and that *Ethmalosa* and *Pseudotolithus* species were the most susceptible to breakages (50%) in each species). The observed extent of physical damage was low (13.3%) for all four species and the respondents claimed they incurred low losses due to breakages. Infestation of the cured products by beetles, mould and fly maggots was another channel for losses to occur. The respondents agreed that *Pseudotolithus* attracted about 66.6% rate of beetle infestation, followed by *Ethmalosa* (26.7%), *Chrysichthys* (5.5%) and *Arius* (1.2%). These ratings were contrary to laboratory observations which showed that *Chrysichthys* had the highest rate of infestation, followed by *Pseudotolithus, Ethmalosa and Arius,* with respect to *Dermestes ater* attacks in the netted boxes. Many respondents (72.2%) maintained that their consignments were not infested by beetles, while 27.8% claimed that their wares were slightly infested.

Fifty percent of the respondents claimed that *Ethmalosa* was highly susceptible to mould growth due to inadequate curing. *Pseudotolithus* was rated to be 33.3% susceptible, while *Arius* and *Chrysichthys* had 5.6% and11.1% ratings respectively. Laboratory specimens were slightly mouldy and the species of mould was not identified. Maggot infestation was not encountered in laboratory specimens and the traders claimed their products were also not infested.

Smoke-drying in Akwa Ibom State is likely to remain for a long time, since the method and the products are acceptable to consumers within and outside the State. IFAD/UNDP (1997) noted that smoke-drying is dictated by the remoteness of fishing communities and the absence of other more sophisticated preservation techniques. The problems of the fish curing industry include unhygienic handling prior to smoking, losses during transportation, post-curing infestation and poor storage facilities and conditions which reduce the shelf life of the products.

The large proportion of ungutted, smoke-cured fish in the market is said to be due to the quantity available for smoking at a particular time. If the catch is large, as in *Ethmalosa fimbriata, Ilisha africana* and the *Sardinella* species, the fish are not gutted before smoking. The size of fish also matters in this context. Large-sized fish are often gutted and where necessary, cut into pieces to enhance penetration of heat and smoke. Small flattened species are not cut into pieces since they can allow heat penetration easily, hence fast drying. Almost all the respondents agreed that the ungutted fish is highly susceptible to spoilage since infestation usually starts from the intact viscera and gills.

At several beaches where large landings (especially of *Ethmalosa fimbriata)* occur, the fresh fish are handled unhygienically. Fish are often evacuated from boats onto the bare sandy ground where they are measured in basins and arranged in heaps, thus contaminating them with sand and associated germs. Although the fish are washed by the women after purchase, the poor sanitary conditions of the beaches demand that fish should not be evacuated onto bare grounds. Where adequate hygienic practices are employed in pre- smoking handling of the fish, standard quality smoke-cured products have been produced (see Adam-Etuk, 1981). A machine that could help the fish curing industry cope with large landings meant for curing would help produce good quality smoked fish. It is believed that this is possible, just as appropriate technology has greatly improved oil palm and kernel productions in rural areas presently.

All breakages incurred by dealers on smoke-cured fish could not be attributed to poor transportation and handling. A significant proportion is caused by inadequate curing. When the water content of the cured fish is still high, the product is not firm, and breaks easily. Often such products are deliberately produced to enhance weight and aesthetic appeal; but dealers and consumers usually suffer losses due to maggot infestation and breakages, unless re-smoked by dealers before selling to consumers. Smoke-cured *Arius* and *Chrysichthys* are believed to have textural advantage over *Ethmalosa* and *Pseudotolithus,* with relative freedom from breakages. This may be due to more care being exercised on them in transit or during storage, possibly because of their qualitative superiority and hence relatively higher prices.

The claim by respondents that their consignments were not infested could have been a market strategy. The disparate methods of storing gives room for infestation despite the low water content of the products. The stores were not disinfected and many of the dealers did not cover their wares in store. The cosmopolitan beetle *Dermestes ater,* mould and maggots, do attack these products in stores and the only respite is quick disposal. Patronizing broken and infested cured fish appears to be strongly linked to the low socio-economic status of such buyers and not necessarily for any characteristic flavour they impart to dishes as claimed by sellers. However, in Southeast Asia (Subba Rao, 1967) and Mali (Guillon, 1967 in FAO, 1981), it is reported that fish could be deliberately allowed to spoil before processing starts in order to acquire the required flavour.

The mean percentage water content of the smoke-dried products were: *Ethmalosa fimbriata* 3.5±0.06; *Chrysichthys nigrodigitatus* 3.4±0.12; *Pseudotolithus elongatus* 3.3±0.04; *Arius gigas* 3.1±0.17. Information on weight changes in all four species during laboratory observations are shown in Figs. 1- 4. In Fig. 1 the *E. fimbriata* curves show that on the average in all four boxes the products decreased in weight, except the last observation in calico, mat and net where weight increases occurred. The F-test from ANOVA showed a highly significant effect from the containers ($F = 26.04$; df 3, 20: $p<0.001$). Means separation by Duncan's Multiple Range Test showed that mean weight loss in netted box was greatest, followed by calico, mat and polythene. Thus, the fish in polythene box incurred the least weight loss. In Fig. 2 the *Arius gigas* curves indicate weight increases. ANOVA revealed no significant effects from the containers on the increases observed ($F = 0.13$; df 3, 16: $p>0.05$). In Figs. 3 and 4 weight changes in *C. nigrodigitatus* and *P. elongatus* exhibited pronounced fluctuations except those of *P. elongatus* in the polythene box. Further analysis was unrewarding.

The catfishes *Arius* and *Chrysichthys* are more prone to getting rancid than the two other species due to their fatty nature. This perhaps explained the weight increases and fluctuations observed in the laboratory samples. Oxidized fat could have led to rehydration of the samples. In such products the water activity will rise and the storage life will be reduced accordingly. Damaged products by whatever sources, are sold at reduced prices with financial losses to the dealers. Salt treatment, reduced water content and good storage conditions prolong the shelf life of the cured products and help reduce infestation by insects and mould (Udoidiong and Moses, 1998).

The keeping quality of specimens of the four species of fish was enhanced in mat, calico and polythene boxes with polythene box producing the best result. Similarity of the curve profiles from mat and calico data indicates that both materials gave similar results, although samples in the local mat boxes lost relatively more weight than those in calico cloth boxes. The use of these materials to produce containers (boxes) for transportation and storage of cured fish should be encouraged and standardized. The prevailing practice of exposing cured fish on benches and tables in the markets and other sales outlets is not only disease-prone but also leads to losses through insect and mould infestation, breakages and exposure to harsh weather conditions.

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Appendix 1: Data Collection on Cured Fish Sold in Uyo, Ikot Ekpene, and Itu Markets

1. How long does the fish (cured) stay with the seller before being sold completely?

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2. Does the seller re-smoke the products on getting home or in the market? Yes/No.
3. How do they store the products?
   a. Covered with mat? d. Kept in waterproof bags?
   b. Left uncovered? e. All of the above?
   c. Kept above fire?

4. If the seller has mixed species which of them is prone togreater losses through:
   a. breakages

Chrysichthys *Arius* *Pseudotolithus*
Ethmalosa *Cynoglossus*

b. Insect Infestation

Chrysichthys *Arius* *Pseudotolithus*
Ethmalosa *Cynoglossus*

c. Mould growth

Chrysichthys *Arius* *Pseudotolithus*
Ethmalosa *Cynoglossus*

5. How do buyers respond to damaged products?
   a. They do not buy.
   b. They are bought just as good ones.
   c. Their response is mixed.
   d. Purchase is affected due to cheap price.
   e. They prefer the damaged ones.

6. State reasons if damaged products are preferred:

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....

7. Fish preparation before smoking
   A. *Chrysichthys* (i) Gutted (ii)Ungutted (iii)Gills removed (iv) Gills not removed.
   B. *Arius:* (i) Gutted (ii)Ungutted (iii)Gills removed (iv) Gills not removed.
   C. *Pseudotolithus:* (i) Gutted (ii) Ungutted (iii)Gills removed (iv) Gills not removed
   D. *Ethmalosa:* (i) Gutted (ii)Ungutted (iii)Gills removed (iv) Gills not removed.
   E. *Cynoglossus:* (i) Gutted (ii)Ungutted (iii)Gills removed (iv) Gills not removed.

8. How does (7) above affect quality?...
   ....

9. From where did the products come?..
   ....

10. What quantity of the fish has the seller got?..
    ....

11. What quantity is good, broken or infested?
    a. Good...................... b. Broken..................... c. Infested.............

12. Observation:

(a) Colour
   (i) *Chrysichthys*...............................
   (ii) *Arius*.....................................
   (iii) *Pseudotolithus*...........................
   (iv) *Ethmalosa*.................................
   (v) *Cynoglossus*...............................

(b) Physical appearance:
   (i) *Chrysichthys*...............................
   (ii) *Arius*.....................................
   (iii) *Pseudotolithus*...........................
   (iv) *Ethmalosa*.................................
   (v) *Cynoglossus*...............................

(c) Texture (based on muscle firmness and ability to resist breakage)
   (i) *Chrysichthys*...............................
   (ii) *Arius*.....................................

(iii) *Pseudotolihus*..................................
(vi) *Ethmalosa*......................................
(v) *Cynoglossus*....................................

(d) Weight:
(vi) *Chrysichthys*....................................
(vii) *Arius*..
(viii) *Pseudotolihus*.................................
(ix) *Ethmalosa*......................................
(x) *Cynoglossus*......................................

(e) Insect infestation (type, larva/adult)
(i) *Chrysichthys*......................................
(ii) *Arius*...
(iii) *Pseudotolihus*..................................
(iv) *Ethmalosa*......................................
(v) *Cynoglossus*......................................

(f) Mould growth:
(i) *Chrysichthys*......................................
(ii) *Arius*...
(iii) *Pseudotolihus*..................................
(iv) *Ethmalosa*.......................................
(v) *Cynoglossus*......................................

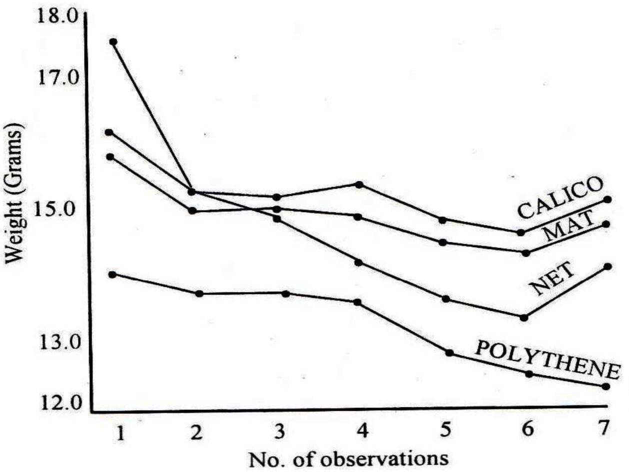

Fig. 1: Weight changes in *Ethmalosa fimbrita* during laboratory observations.

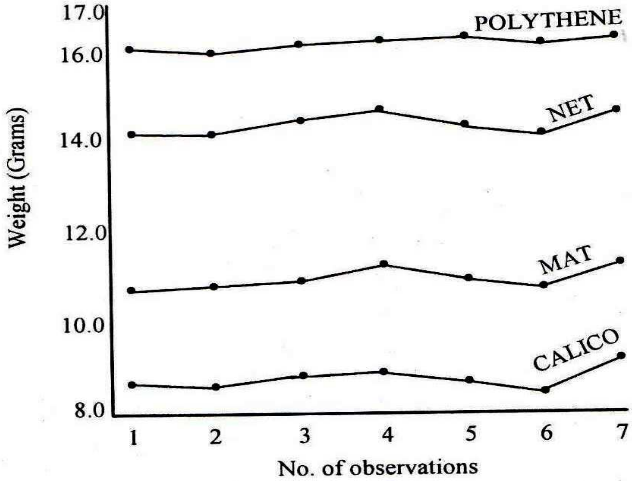

Fig. 2: Weight changes in *Arius gigas* during laboratory observations.

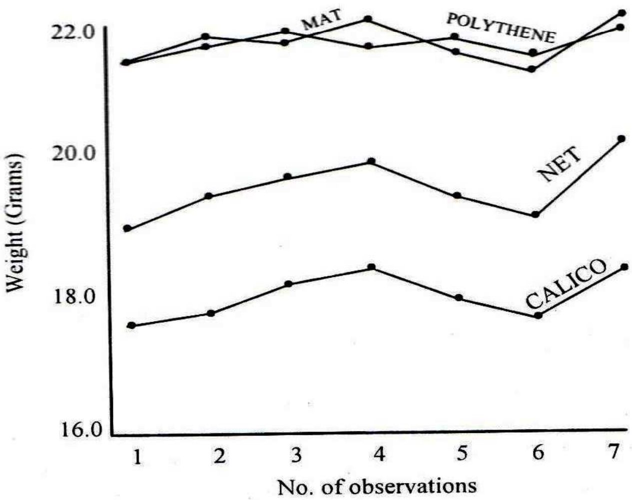

Fig. 3: Weight changes in *Chrysichthys nigrodigitatus* during laboratory observations.

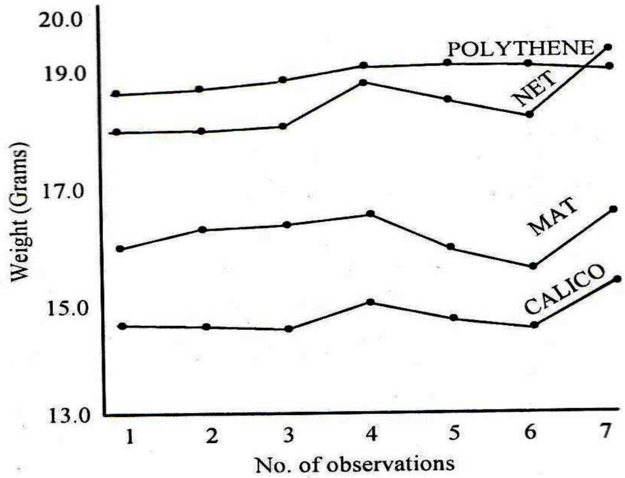

Fig. 4: Weight changes in *Pseudofolithus elongatus* during laboratory observations.