

# THE EFFECT OF TRADITIONAL HANDLING, PROCESSING AND STORAGE METHODS ON THE QUALITY OF DRIED FISH IN SMALL-SCALE FISHERIES IN NIGERIA

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## ABSTRACT:

Most of the fish marketed throughout Nigeria are in either smoked or dried form. The technological requirement for other forms of preservation like chilling and freezing cannot be afforded by the small scale fisherfolk. Considerable quantities of fish processed for distant consumer markets are lost at handling, processing, storage and marketing stages. Significant losses occur through infestation by mites, insects, fungal infection and fragmentation during transportation. This paper attempts to describe the effect of these losses on fish quality and suggests methods of protecting fish from agents of deterioration.

## INTRODUCTION

Fish is becoming increasingly important in the diet of the Nigerian as the cost of beef increases daily. Fish constitutes 40% of animal protein intake in Nigeria at present (Olatunde 1989). Most of the fish marketed throughout Nigeria are derived from remote inland waters at different points along the Niger-Benue rivers, the Kainji Lake and the Lake Chad (Osuji 1975; Uboma *et al.* (1981). Most of this fish are caught, processed and marketed by fisherfolk who employ the old traditional methods of smoking and or sun drying as the major processing technique before the fish are marketed. This paper examines the major processing techniques as practiced in Nigeria with their attendant problems and suggests ways of improving the technology of fish preservation to enhance fish quality.

## FISH PRESERVATION

The major fish preservation methods are sundrying, salting and smoking (Eyo 1992). The traditional techniques adopted in fish processing in the Lake Chad and Kainji districts have been fully described by Osuji (1975) and Eyo (1977, 1983). These techniques as practiced at present pose a lot of problems to the quality of the final product and sometimes even encourage early infestation by agents of deterioration such as fungi, beetles and fly pests.

Because of the high demand for smoked dried fish which is highly relished in Nigerian traditional diets, smoking is mostly inadequate. Mildly smoked fish have been found to contain as much as 35% or more moisture content in Shagunu (Osuji 1975) and Asa dam area (Eyo & Awoyemi 1990). Resmoking is hardly done and these improperly dried fish are packed in cartons by fish mongers to markets in Lagos, Onitsha and other urban areas. This improper smoking and drying leads to considerable losses to fishmongers. There are few reliable estimates available but it is believed that 30-50% of fish processed at Lake Chad is lost by the time the fish arrive at Maiduguri for onward transportation to consumer markets in the Southern States (Proctor 1977). A survey conducted in Ilorin fish market in Kwara State reveals that losses incurred on processed fish arriving from Shagunu, Patagi and even Maiduguri range from 15-20% due to improper smoking at source. There is fungi infestation and fragmentation due to improper packaging (Eyo and Awoyemi 1990). Fragmented fish encourages the rapid development of beetle pests, particularly *Dermestes maculatus* (Degeer) and could endanger whole fish staying too long in storage. The quality of fish produced in the processing methods highlighted above are generally low and losses could be serious when transported over long distances. The main sources of these losses are discussed briefly.

## FUNGAL LOSSES.

Fish that are insufficiently dried having moisture content of 40% or more are prone to attack by *Rhizoctonia spp.*, *Penicillin spp* and *Aspergillus spp*. In a survey of Ilorin fish Markets and Faku (Kainji Lake district) samples of dried fish brought into the laboratory started going moldy about the third day of storage (Eyo and Awoyemi 1990). This is evidently as a result of improper smoking at the processing stage. It is pertinent to mention here that to check these type of infestation redrying or resmoking before sale is often necessary. By this the cost of production increases tremendously to the fish monger and often time these costs are passed to the consumers. Data on the actual losses of dried fish due to fungi infestation are rare in literature. However personal observations at the major fishing villages and markets in the Kainji Lake basin revealed that substantial quantities of fish are usually infested by fungal growth. This infestation requires additional drying before sales thus increasing cost to the fish processor.

## HANDLING LOSSES

Most of the fish caught in Nigerian waters are either caught with nets, hooks, or traps. Fish being removed from capture materials are sometimes roughly handled and most of the time dropped in the open at the canoe bottoms under the usually prevailing high temperatures. Rapid deterioration particularly through bacterial decomposition under the warm conditions that prevail set on. Fish that suffers bacterial putrefaction whether they are later smoked or sundried are generally unsuitable for long distant transportation from processing site to market because of rapid deterioration in storage. Such bacterial infested fish are usually rejected by consumers due to their soft texture which are easily identified. This constitutes an additional loss to the fish processor. Another source of loss of quality that can be attributed to careless handling of fresh fish being prepared for processing is unsanitary way of gutting fresh fish and throwing of wastes all around the processing sites. These activities have been identified to have contributed to the rapid infestation of fish by blow flies particularly *Ghrysomya spp.* and the common housefly, *Musca domestica* at Faku (Kainji Lake), Odore (Asa dam, Ilorin) and Shagunu (Kainji Lake) fishing villages

processing sites (Eyo and Awoyemi 1990). These blowflies oviposit on fish being prepared for smoking and inadequate smoking does not kill the eggs. The ravaging effect of the emerging larvae on partly dried fish reduces the quality of the finished product and the income accruing to the fish monger.

## PACKAGING AND STORAGE

Fish being prepared for market are packed in cardboard boxes or baskets. Cardboard boxes are the most commonly used for fish being prepared for transportation to Southern markets particularly from Shagunu, Yauri, Faku (Kainji Lake areas) and at Baga market - a major fishing market on Lake Chad (Proctor 1976). In a survey of Asa Dam area (Eyo and Awoyemi, 1990), it was revealed that these packages often lead to fragmentation of fish during the long transportation from these sources to Idi-Ape fish market in Ilorin for example. For every 25kg pack of fish about 1.5 kg is lost to fragmentation through rough handling during transportation. Fragmentation does not only lead to quantitative loss of the smaller fragments and down grading of this fraction for use as animal feed but there is a loss of value due to quality reduction since a higher price is often obtained for intact pieces of fish. Fragmentation often also encourages pest damage (FAO 1981) as fragmented particles are favoured for rapid breeding of insects and mites.

Unclean and ill prepared storage houses do cause reduction in the quality of dried fish being prepared for market. Most of the fish stores around Lakes Kainji and Chad are mudwalled. Packaged fish are left directly on the floor of the mud houses. Temperature changes between the fish directly resting on the bare floor and those in the upper units of cardboards, jutes or packet packages have been observed to vary by as much as 15°C by Osuji (1974). This temperature variations encourage infestation by beetle pests and could lead to serious damage to fish quality in storage. Fish at the bottom of packages left directly on the floor sometimes get humid. High humidity not only encourages rapid multiplication of insects but the growth of molds and of various fungal organisms too that make the fish unsightly for marketing.

## INSECT AND MITE INFESTATION

Insects and mites are often found infesting cured fish during and after processing especially in the tropics and subtropics where higher temperatures and humidity are prevalent all the year round. Quantitative losses due to feeding damage by insect and mite pests on cured fish have been reported to be up to 30% due to fly damage during processing and up to 50% due to beetle damage during processing for several months (Haines & Rees 1989). Some examples of world wide losses of dried fish due to insect infestation are given by Poulter *et al.* (1965). James (1977) estimated weight losses of dried fish due to *Dermestes spp.* (Coleoptera) infestation at about 50%. Rollings and Haward (1963) estimated such losses at Lake Chad at 50%. while the FAO (1988) estimated dried fish weight losses due to *Dermestes spp.* damage in a 6 - month storage period at 26 - 34%. The hurry to get improperly dried fish to market increases the susceptibility of processed fish to blowfly infestation and also beetle infestation in storage. The indiscriminate method of mixing wet fish with properly dried ones particularly as observed among fish mongers at Faku and Shagunu markets encourages cross infestation of fish being packaged for distant consumer markets. Consequently products are usually moved into storage with a high level of infestation. The prevailing warmth in the storage environment encourages rapid development of the eggs to larvae which are the most destructive stages on stored dried fish. Within few weeks, most of the infested fish could be reduced to frass and bones. The contaminations of few surviving whole fish by live or dead pests or their cast skins and excreta, also causes a change in visual quality and this may reduce the value of the fish.

Lardoglyphid mites occur on dried fish at various stages in storage and marketing especially during cool wet season. Insect and mite pests often transmit mold spores. The additional heat and moisture produced by heavy infestations can create conditions suitable for fungal growth on fish that have previously been dried but indiscriminately packaged with infested ones. The principal effect of all these activities is the imparting of an unsavoury odour to the commodities and reduction in their aesthetic appeal to consumers.

## ECOLOGICAL FACTORS IN RELATION TO LOSS REDUCTION

The present methods of fish handling, processing and marketing need considerable modification to make fishing a profitable business for fish mongers and to ensure a high quality product for the consumers. Better handling of fish at capture will minimise injury and reduce bacterial decomposition of fish to the barest minimum. The reduction of time between capture and processing will also reduce infestation of fish by blowflies. In particular smoking and or salt-drying are still the major methods of preserving fish for the market in Nigeria. It is going to remain so for some time to come as the technology of freezing and chilling is still too expensive for most fishermen to adopt. Effort should be made to improve on the pre-treatment of fish before smoking and drying to ensure a high quality preservation of dried fish both at storage and marketing stages.

## CONCLUSION AND RECOMMENDATIONS

### (i) Use of Fly-Screens.

Initial infestation of fish is often due to invasion by flying adults of insects which lay their eggs on partially or fully dried fish. Fly-screens around and over drying racks may reduce beetle and fly infestation pressure during processing. The techniques of preventing fish from beetle pests will control mite infestation since beetles usually carry mites to the fish.

### (ii) Prevention of Fragmentation

Fragmentation of the fish flesh should be avoided though careful handling as it increases the surface area of the flesh and consequently encourage heavy mite infestation.

### (iii) Prevention of Infestation.

The use of clean good-quality sacks lined with polythene or thick brown paper to slow down rates of immigration of *Dermestes spp.* and prevent cross infestation in storage is suggested. Infestation may also be initiated by crawling larvae and adults present in fish residues available in dirty stores or by adults emerging from pupation chambers in wooden structures. The risk of such infestation can be reduced by improved hygiene and by treatment

of such wooden structures with recommended insecticide.

#### (iv) Common Preventive Measures

Salting, use of polythene bags for storage and use of oils and neem tree extracts (*Bossia senegalensis*) are some of the non-physical measures employed in protecting fish against agents of deterioration in storage (Walker 1988, Osuji 1975; Amos 1968).

#### (v) Use of Insecticides

Insecticides are also being tried in protecting fish against insect pest attack. Most of the work has centered on the use of pyrethrine, which are normally synergised to some extent with piperonyl butoxide. Other insecticides commonly tried are pirimiphosmethyl (Actellic) and tetrachlorvinphos (Blatchford, 1962; Taylor and Proctor 1979; FAO and Taylor 1982). There is still very little information available on the efficacy of the use of chemicals as fish protectants against insect pest infestation because of the long standing reluctance of fisheries technologists to use insecticides and the general lack of attention paid to fisheries post-harvest sector. Around Lake Chad, it is reported to be a common practice for fishermen to sprinkle fish with Gammalin HCH (lindane) and household aerosols containing lindane (Taylor 1981). Neither of these insecticides is suitable for use in treating consumable food items because of their long persistence and high mammalian toxicity. (Walker, 1988).

The points highlighted above if properly harnessed would guarantee the production of good quality dried fish for the market.

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