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# **Adaptation of a Quality Assurance Methodology to Traditional Fish Drying in Mali**

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## **Abstract**

This paper summarizes the results of a project conducted in Mali, West Africa, to adapt a HACCP-type (Hazard Analysis and Critical Control Points) approach of quality assurance to the traditional dried fish supply chain, involving the main stakeholders of the chain (small fishermen, women processors, traders and the regulatory authorities for fisheries).

## **Introduction**

Fish is a very important foodstuff in developing countries, due to its high protein content and nutritional value. However, it is a greatly perishable product, especially in hot climates and tropical areas where cold preservation techniques are often missing. Quality losses can occur very rapidly after catch. Fish salting/brining, drying or smoking, are traditional techniques for improving preservation and storage, which increase availability to consumers.

In Mali, West Africa, freshwater fishing in the Niger River is economically important as an employment source for more than 150 000 people (fishermen, processors and traders). Sun-drying is very common as a means of preservation. This traditional home-scale technique is mainly performed by women. Nevertheless, the quality of the dried fish is poor, both irregular and uncontrolled. Microbial contamination or insect infestation occur frequently during processing, storage and marketing. Increasingly, local consumers (mainly in the urban areas) and regional traders are demanding higher quality.

This paper reports on how a quality assurance methodology following HACCP principles was adapted to this traditional dried fish chain. The methodology was put in place through a collaborative project (1989-1992) funded by the French Ministry of Cooperation, involving the supply chain actors and institutional partners. This included CIRAD, ISFRA (Institut Supérieur de Formation et Recherche Appliquée, Bamako, Mali), LHM (Laboratoire d'Hydrobiologie de Mopti, Mali), OPM (Office des Pêches de Mopti, Mali), the fishing communities of Mopti – the main fishing region of Mali – including fishermen and processors (mainly women) and some traders (from Mopti and the capital city, Bamako).

## Methodology

The project aimed to identify factors and constraints responsible for post catch losses of the fish (*Tilapia spp.*, a tropical carp) and to control quality along the chain, up to the point of end-product marketing. The methodology used was inspired by the HACCP concept widely used in the industrialized countries, with adaptations and simplifications to take into account the constraints and possibilities within the Malian context. A sequence of six steps was followed:

- (1) Identification of the quality criteria for dried fish (*Tilapia*) as required by the local consumers and regional markets.
- (2) Observation and analysis of the traditional fish processing in Mopti region, as performed by the fishing communities (fishermen, processors and traders). This involved observing fish handling at all levels of the supply chain, i.e. at catch, landing, processing and marketing. The critical points were identified and reported as the major risk and hazard factors for end-product quality. The observation process was repeated with different fishing communities, in both dry and rainy seasons.
- (3) Fish sampling at the four levels of the chain (catch, landing, processing, marketing) and analysis at laboratories (in the Malian partner institutions and at CIRAD labs in France). Microbiological, physicochemical and biochemical measurements were performed to link the critical points identified in (2) to changes in product quality. This allowed to establish a relation between the fish handling, major risks and evolution of the product's quality.
- (4) A particular attention was focused on the drying operation during fish processing. Parameters such temperature, relative humidity and velocity of the ambient air were measured in both dry and rainy seasons. Correlations were found between these measurements and the evolution of product quality (performed in 3). This led to the recommendation to use an artificial convective hot air drying system during the rainy season, and to advice on the conception of adequate equipment by the Malian institutional partners.
- (5) Simple hygiene recommendations were proposed to solve some critical points identified in (2). Their acceptability to the fishermen and processors was assessed.
- (6) The use of some food preservatives, available in Mali, to increase the shelf life of traditionally dried fish was tested with the processors. The microbiological quality of the preservative-treated fish was assessed at the laboratory. The treated fish samples were also tasted by a panel of Malian consumers for sensory evaluation and appreciation of their acceptability, according to the local food habits and traditional quality requirements.

## Results

There were four principal outputs of this work: (1) recommendation of simple means for improving the quality of traditionally dried fish in Mali, within the local context (processing methods, food habits and consumer requirements); (2) proposal of quality specifications for dried fish, adapted to the Malian markets in particular and regional West African markets more generally – such norms had not existed prior to the project and led to problems in regional trade dealings; (3) transfer of on-site laboratory tests for quality control of traditionally dried fish, with training of the Malian partners ; and (4) adoption of the quality

assurance methodology by the local institutional partners and the fishery authorities responsible for regulating trade and following the quality of the end-products on markets.

The application of this methodology proved to be very fruitful and demonstrated that the HACCP concept, conceived and used mainly in industrialized countries, can serve as a basis for reflection and planning of actions for improving quality in tropical food supply chains. To be sure, the adaptation of the concept to the Malian context led to certain difficulties, including the lack of laboratory materials (the project financed the purchase of equipment and chemicals without which it would not have been possible to conduct the work) and the limitations of the local infrastructure (complicating moving equipment and supplies to Mopti). The strength of the method resides in the possibility to develop adaptations in close collaboration with local actors of the supply chain, which made it possible to propose actions that were acceptable to them, taking into account their customs and practices.

It is nevertheless clear that improving traditionally dried fish in Mali will remain dependant on numerous factors which are outside of the reach of the project itself, including public health issues (water quality, infestation by insects and meat flies, toxicological studies to evaluate the impact of banned insecticides used in an uncontrolled manner by the local fishermen, etc.) as well as questions at the policy level (improvement of storage and transport infrastructure, strengthening of the regulatory body for fisheries, etc.) and at the social level (need to organize the fishermen and processors to raise their capacity to benefit from improved techniques).

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