An Investigation of Post-harvest Fish Curing Technologies in the Artisanal Fisheries of North-western Nigeria

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Target Audience: Fishery Scientists, Extension Officers and Processors, Fish Marketers, Policy Makers

Abstract

The artisanal fisheries of the North-western zone of Nigeria are characterized by subsistence fishing, processing\ preservation, and marketing practices. Limitations imposed on these practices led to the introduction of improved smoking kilns and other innovations in pre-processing and processing stages to reduce post-harvest losses of fish products to the barest minimum. This study was conducted to examine the traditional post-harvest fish handling practices of fish processors and the status of adoption of improved fish curing technologies disseminated by the Agricultural development projects (ADPs) in the zone. Structured questionnaire was administered to respondents in four states using a multi-stage random sampling technique and data collected were analyzed by simple statistical tools. From this study, it was discovered that smoking and sun-drying were the traditional preservation methods, while popular traditional processing equipments included dug-pit and mud-ovens, coal-pot kilns, steel drum oven, and drying racks. These ovens have shortcomings-long processing time, low batch capacity, short life span, high fuel consumption and poor product quality. Four(4) improved smoking kilns were introduced by the ADPs to fish processors in the zone. These are Chokor smokers, Burkinable kiln, Altona and Watanabe kilns. A high percentage (68.1%) of fish processors in the zone were non-adopters of any of the ovens either due to lack of sufficient awareness on their existence, high acquisition cost, or difficult technical features of the ovens, raising the question of enlightenment, maintenance and sustainability. It was recommended that research and extension agencies must improve their awareness campaigns on these ovens and include the elements of affordable cost and simple technical features to the design of improved ovens for fish processors in order to improved adoption levels among fish processors in the zone.

Keywords: Post-harvest, Curing, Adoption.

Description of Problem

Food preservation is a problem in most third world countries. Although the production technologies of agricultural commodities are mainly subsistence, yet excess food that result from such of production are subject to rapid deterioration and spoilage with resultant scarcity at latter times due to poor post-harvest handling. Apart from scarcity of food, enormous economic losses accrue to producers and consumers.

Fish which is one of the most nutritious food item is also incidentally the most perishable. Fish

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loss due to fish spoilage, poor post-harvest handling, storage and preservation have been reported to be as high as 30-05% annually in Nigeria (1,2,3). A major facilitator of this situation is the constraint imposed on traditional fish processing and preservation techniques. Traditional ovens are characterized with low batch capacity, long smoking time, labour intensive operation, and high fuel consumption resulting in poor product quality and subsequently short shelf-life. The problem of transportation from landing or processing sites to urban centers also aggravates the situation. With bad road condition, low moving lorries and exposure of the processed fish; breakage of whole fish and maggot infestation are rampant. A combination of all these factors result in poor product quality at post-harvest and consequent reduction in volumes of processed fish available in the market. The overall objective of this study was to inventorize fish curing technologies available in the zone. While specific objectives were to establish reasons for processing fish, factors responsible for fish losses, the fish curing methods and equipment used.

Methodology

The study was conducted in four states (Kaduna, Kano, Katsina and Kebbi) out of the seven states in the north-western agro ecological zone of Nigeria. A multi-stage sampling technique was adopted in the selection of three (3) ADP zones from each state and one(1) local government area (LGA) of intensive fishing activities from each of the zone. A total of thirty (30) Structure questionnaire was administered to randomly selected fish processors in each of the LGAs i.e an overall sampling size of 360 responets. However only three hundred and thirteen (313) questionnaire were usefully completed and these were used for the analysis by simple statiscal tools of frequencies and percentages. Ther content of the questionnaire included information on respondents' socio-economic characteristics, traditional post harvest handling practices, improved fish processing technologies available in the zone, awareness and adoption status of processors on such technologies, and constraints to adoption.

Table 1. Major Reasons for Processing Fish

Reason	STATES								TOTAL N = 313	
	Kaduna N = 76		Kano N = 92		Katsina N = 70		Kebbi N = 75			
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Increased pricing.	3	3.9	6	6.5	8	11.4	16	21.3	33	10.5
Easier Packaging	3	3.9	2	2.1	9	12.9	12	16.0	26	8.3
Increased shelf-life	68	89.5	25	27.1	15	21.4	25	33.3	133	42.5
Facilitate market	2	2.6	59	65.2	38	54.3	22	29.3	121	38.7

Results and Discussion

Major Reasons for Processing Fish

Fish processors, like farmers, have specific reason(s) for embarking upon any particular practice. Although the ultimate aim is enhanced income and better living standard. In the study area the major reasons advanced by fish processors are spoilage prevention (42.5%) and facilitation of market supply (38.7%) Table 1. By implication the ultimate aim is increased monetary value of the products. Other reasons according to the respondents are increased product pricing value (10.5%) and to enable easier packaging of products (8.3%).

Factors Responsible for Fish Losses

Post-harvest loses of fish products are known to be high in developing countries ranging from between 30-50% (40. In Nigeria, losses are as much as 40% (5,6). About 61% of respondents believe that delay in the commencement of processing is the major factor responsible for losses. Other factors include burns and charring (16%), insect pest damages (10.2%),

Over-drying (8.0%) and fragmentation during transport (4.8%) Table 2. Fish is an extremely perishable food commodity and deterioration sets in within 2 hours of landing due to the activities of microorganisms, Chemical deterioration that

Table 2 Major Factors Responsible for Fish Products Losses.

| Factors | STATES | | | | | | | | TOTAL | |
| | Kaduna N = 76 | | Kano N = 92 | | Katsina N = 70 | | Kebbi N=75 | | N = 313 | |
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Insect pest damage	2	2.6	8	8.7	4	5.7	18	24.0	32	10.2
Over-drying	-	-	8	8.7	8	11.4	9	12.0	25	8.0
Burns & Charring	-	-	24	26.1	17	24.3	9	12.0	50	16.0
Processing Delay	72	94.7	47	51.1	35	50.0	37	49.3	191	61.0
Fragmentation	2	2.6	5	5.4	6	8.6	2	2.7	15	4.8

accelerates rancidity, and enzymatic activities (7). Insect pest damages are usually through oviposition of blow-flies, ants and dermestes beetle attack.

Processing and Preservation Methods

Because fish is a low-acid food, which supports the growth of pathogens, careful handling and rapid processing is essential (7). In the North-western zone, smoke-drying of fish is by far the most popular processing and preservation method either salted (16.9%) or unsalted 948.6%)

accounting for 65.5% of fish processors popular curing practices (Table 3). This is in agreement with the works of various authors that identified smoked dried fish as constituting as much as between 60-70% of post-harvest fish products in Nigerian artisanal fisheries (8,9,10). Salted sun-dried (12.5%) and unsalted sun dried (10.2%) products are also popular accounting for 22.7% of total products. Other methods of processing/preservation like frying (6.1%), fermentation (4.8%), and icing/freezing (0.9%), are not popularly in use either due to anticipated additional processing

cost, absence of infrastructure, high cost of materials or cultural considerations.

Popular Processing Equipments in the Zone

Five major traditional fish processing equipment were popular among processors in the zone. These are mud-oven, coal pot, steel drum, dug pit and racks. Coal pot was however not in popular use in Katsina and Kaduna States (Table 4). About 59.0% of respondents used traditional mud ovens, while 49.8% used steel drum ovens of various sizes and

dimensions. These two are by far the most popular traditional ovens. 35.1% and 30.6% of the fish processors owned drying racks and dug pit oven respectively. Although this investigation did not probe into the capacity utilization of each oven in terms of fish quantities handled, smoking duration and returns in monetary term, it is a common knowledge that traditional fish processing ovens have limitations imposed on them in terms of quantity processed, quality of products, smoking duration and by implications return on investment.

Table 3: Distribution of Respondents by Traditional Preservation Method popularly used.

| Methods | STATES | | | | | | | | TOTAL | |
| | Kaduna N =76 | | Kano N = 92 | | Katsina N = 70 | | Kebbi N = 75 | | N = 313 | |
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Smoking (unsalted)	65	85.5	10	10.9	33	38.6	44	58.6	152	48.6
Smoking (salted)	-	-	46	50.9	4	507	3	4.0	53	16.9
Sun-drying (unsalted)	-	-	2	2.2	10	14.3	20	26.7	32	10.2
Sun-drying (salted)	-	-	30	31.6	6	8.6	3	4.0	39	12.5
Icing/ Chilling/ Freezing	-	-	1	1.1	-	-	2	2.7	3	0.9
Frying	11	14.5	3	3.3	4	5.7	1	1.3	19	6.1
Fermentation	-	-	-	-	13	18.6	2	2.7	15	4.8

Short-comings of Traditional Ovens

From the field investigations a myriad of problems are associated with traditional fish processing ovens. However 74.4% of respondents believed that high construction cost of oven is the major problem encountered. About 34.8% also ascribed labour intensive features to the operation of local ovens. This calls for the introduction of smoking kilns with labour saving devices. Other problems highlighted include long processing time, low batch capacity of the ovens, short life span, high fuel consumption and poor product quality.

Improved fish Smoking Kilns

Shortcomings in traditional fish handling practices with the resultant high percentage losses of products, necessitated the generation and dissemination of improved technologies by research and extension institutions to fisher folks in the attempt to minimize such losses. Four improved fish smoking kilns (Chokor, Burkinabe, Altona and Watanabe) were found in the sampled States as shown in Table 5, although their adoption levels were very low. A great majority of the processors (68.1%) were none adopters of any of

Table 4. Major Traditional Processing Equipments Used by Respondents

| Equipments | STATES | | | | | | | | TOTAL | |
| | Kaduna N = 76 | | Kano N = 92 | | Katsina N = 70 | | Kebbi N = 75 | | N = 313 | |
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Mud-oven	14	18.4	52	56.5	53	75.7	66	88.0	185	59.1
Coal Pot	-	-	10	10.9	-	-	6	8.0	16	5.1
Steel drum	16	21.0	43	46.7	58	82.9	39	52.0	156	49.8
Dug Pit	4	5.3	28	30.4	48	68.6	16	21.3	96	30.6
Drying Racks	42	55.3	17	18.5	49	70	2	2.7	110	35.1

(Note-Table computed from multiple responses by respondents. Percentage total is therefore more than 100%)

the ovens. Chokor smokers had 11.2% adoption level among processors in the four states. Altona kilns had 48% adoption level in Kebbi State, but 13.4% on zonal basis. Burkinabe and Watanabe kilns were available only in Kano State with 19.6% and 5.4% adoption levels or zonal adoption levels of 5.7% and 1.6% respectively. Reasons for low or non-adoption of the ovens by majority of processors included high acquisition cost, non-availability of the ovens and difficult technical features of theses thus raising the question of maintenance and sustained usage among adopters.

Conclusion and Recommendations.

Fish curing technologies in the artisanal fisheries of North-western Nigeria are still dominated by traditional methods and equipment. Although improved kilns have been introduced by Agricultural Development Projects, lack of sufficient awareness of such kilns, high acquisition costs, and difficult technical features of some of the ovens have discouraged adoption by processors and marketers. It is therefore necessary for extension agencies to intensify awareness campaigns on available technologies that have been proven to be cost effective and relevant to the needs of the processor. Due to the subsistence nature of fisher-folks, technologies to be introduced must be cheap and affordable in terms of acquisition cost, have low maintenance cost and easily understandable technical features for ease of maintenance, durability and sustainability. Research and extension agencies therefore have as a challenge the designing and promotion of simple, affordable and efficient fish processing technologies in order to encourage mass adoption by processors. This will invariably lead to reduced handling losses at post-harvest and increases in the quantities of fish products made available to the consumers.

Table 5. Adoption of Improved Fish Processing Equipment by Respondents

| Equipments Adopted | STATE | | | | | | | | TOTAL | |
| | Kaduna N = 76 | | Kano N = 92 | | Katsina N = 70 | | Kebbi N = 75 | | N = 313 | |
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Chokor	12	15.8	2	2.2	16	22.9	5	6.7	35	11.2
Burkinabe	-	-	18	19.6	-	-	-	-	18	5.7
Altona	-	-	6	6.5	-	-	36	48.0	42	13.4
Watanable	-	-	5	5.4	-	-	-	-	5	1.6
None	64	84.5	61	66.3	54	77.1	34	45.3	213	68.1

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