

Fish Processing Methods: A Case Study of Argungu Local Government Area, Kebbi State, Nigeria

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Abstract: This paper presents findings of a study carried out in Argungu Local Government of Kebbi State, Nigeria. Four districts were purposively selected where fish processing activities were predominant. Fish processing methods were assessed using a total of 80 respondents who were randomly sampled for the study. Structured questionnaire was used to find out information on socio-demographic features of the respondents, methods of fish processing, business transaction, marketing and major constraints to fish processing. Descriptive statistics, net farm income, profitability indicators were used to analyze the data generated. Frying and smoking were the two common processing methods practiced by the dwellers of the area with 35% and 25% level of participation respectively. Variable inputs were found to be higher for fish samples subjected to frying than samples of smoked methods. Both methods of processing were profitable; however, gross margin and profit margin were higher in frying method. The returns on investment per Naira were higher in smoked method (2.56). It was found out that the major problems encountered by the processors include inadequate equipment, lack financial aid, rapid spoilage fire incidence and erratic power supply. It is recommended that the Local authority should come to the aid of the processors through provision of loan facilities in form of cash and kind to facilitate and motivate them in becoming self reliant.

Key words: Fish • Frying • Smoking • Gross Margin • Profit Margin

INTRODUCTION

Nigeria is endowed with vast Fisheries resources with many large rivers, natural and man-made lakes, Creeks, Lagoons and about 200 nautical miles of Marine water under the Exclusive Economic Zone (EEZ) [1]. Fish is a good rich source of protein that contains amino acids, vitamins, minerals and polyunsaturated fatty acids not found in other sources of fat from aquatic environment [2]. Fish is extremely perishable food item, soon after death begins to spoil. In the healthy live fish, all complex biochemical reactions are balanced and the fish skin is sterile. After death however, irreversible change results in fish spoilage begin to occur, the resultant effect is decomposition of the fish [2]. It is a very important source of animal protein that contains high level of amino acids ranging between 17-20 % comparable to

other sources of protein. This makes the flesh easily digestible by human body and complementary to the high carbohydrate in land animals [3]. Fish harvesting, handling, processing, storage distribution and marketing provide livelihood for millions of people as well as providing foreign exchange earnings to many countries [4, 5]. Processing method is applied to fish from the time of harvest to the consumption period. Fish processing is to give the product a form which is attractive to the consumers as well as extension of the storage life of the products. The characteristics of a processed fish to be stored should ensure full health safety of the product, proper sanitary conditions as well as rendering it impossible for the development of harmful microorganism [6]. Processing of fish into forms for consumption or suitable to be used as a supplement in animal food has been neglected in fish culture practices. This may be due

to high technology required in some processes and the fact that those involved in actual fish production are ignorant of the different processing methods. In order to prevent fish deterioration, every fish processor must strive to employ the best method possible in handling fish to maximize returns on processing investment [6]. There are many methods of fish processing employed farmers in northern, Nigeria, however two most practiced ones by the majority of the farmers sampled were frying and smoking methods. Thus, this paper examined these two major common methods of fish processing practiced in the area by local smallholder fishermen who contribute significantly to the economic development of the Fisheries sub-sector of the area.

Objectives of the Study: The objectives of this study are to determine the various processing activities including fish handling, marketing and economic variables which describe the profitability of the fish processing method. Similarly, this study intends to find out the problem associated with fish processing in the study area.

Statement of the Research Problem: Despite the growing interest for fish processing in the study area, it remains under-utilized and this can be attributed to lack of good and enough processing facilities. Fish being a highly perishable product, is prone to rapid spoilage especially during handling operations. The perishability and the wide gap between production and demand make it imperative to study the subject with a view to evaluating the economics of fish processing in the study area.

MATERIALS AND METHODS

Study Area: The study was carried out between June and July, 2013 in Argungu Local Government area of Kebbi State located in the northern part of State. It has a population of 955,000 people [7]. The area lies between the latitude 12°N to 13°N and longitude 4°E to 5°E. The area has a number of inland rivers, lagoons and reservoirs which empties/drains in to River Niger. Argungu is well known for its annual International Fishing Festival where fishermen display their artisan, expertise, experiences in catching the biggest weight fish in the competition. Fishing is one of the important farming activities of the inhabitants of the area. Four major landing sites were purposely selected where fish processing activity took place for the study namely: Lelaba, Merawa, Natsini, Matanfada.

Sampling and Data Collection: A sampling frame of the processors was established for the selection of the respondents in each landing site. From each landing site, a total of twenty respondents were drawn giving a total of 80 respondents (which constituted the sample size). Data was collected by a structured questionnaire to illicit information on demographic features of the respondents, method of fish processing, quantity processed, inputs used in processing, marketing, constraints encountered and profitability assessment.

Data Analysis: The data generated was analyzed using descriptive statistics such means, averages, frequency distribution, percentages and budgeting technique. The budgeting technique employed was Net Farm Income to determine the profitability of the two major methods of fish processing/preservation. The difference between Gross Revenue (GR) and the Total Cost (TC) gives the Net Revenue INR). The Net Farm Income (NFI) is expressed as

$$NFI = GR - TC$$

Where

NFI	= Net Farm Income
TC	= (TVC-TFC)=Px. X
GR	= Py. Y (Gross Return on processing method)
Py	= Unit price of output
Y	= Quantity of output
X	= Quantity of input
TC	= Total Cost (N)
TFC	= Total Fixed Cost (N)
TVC	= Total Variable Cost (N)
A	= Variable Cost
B	= Fixed Cost
A + B	= Total Cost
C	= Total Revenue
C – (A + B)	= Net Farm Income

RESULTS AND DISCUSSION

Age Ranges of the Respondents: The result in Table 1 showed that age range of 21-40 years of the respondents constituted the highest percentage (62.5). By implication, this age group is considered as the most active stage of production in human development. Similarly, this age group has the capacity to provide the energy needed for processing more quantity of fish per period. Next to this

Table 1: Demographic Characteristics of the Respondents

Variable	Frequency	Percentage
Age		
10-20	4	5
21-40	50	62.5
41-60	24	30
61- above	2	2.5
Marital Status		
Married	79	98.75
Single	1	1.25
Types of Education		
Qur'anic education	60	75
Adults education	-	-
Primary	9	11.25
Secondary	11	13.75
Higher	-	-
Others specify	-	-
Major Occupation		
Fish processing	74	92.5
Student	6	7.5

Table 2: Handling and Preparation of catches

Activity	Frequency	Percentage
Preparation		
Gutted	3	3.8
Gilled	-	-
Bled	17	21.2
Cleaning	60	75.0
Cutting of Fish		
Smaller fillet	18	22.1
Large fillet	21	26.2
Ventrally	21	26.2
Dorsally	20	25.0
Surface of Preparation		
Ground	29	36.2
Rock	1	1.2
Table	44	55.0
Chopping board	6	7.5
Years of Experience		
77 years	9	11.25
6-9	23	28.75
10 and above	48	60

group is the 41-60 years old which was found to constitute 30% of the sampled farmers who are into the fish processing business. This group had also acquired some experiences due to the years they put in the enterprise and the knowledge gathered over the period. The age bracket of 11-20 years were found engaged in the processing in form of providing assistance to elders and at the same time learning the skills of the business/trade from seasoned elders.

Educational Status: It could be observed that the educational level of all the respondents were largely Quranic (Islamic) type of education which exposes the respondent to the tenants, ethics and art of the fishing,

processing and marketing activities relating to the enterprise. The younger ones constituting only 9% of the respondent were found attending primary school with the view to further their education and improved the business. This is due to awareness on the importance of Western Education to the lives of Nigerian citizen. People have now realized that ignorance is the key to all social vices in our society and poverty to mention a few.

Handling and Preparation of Fish: Table 2 shows that the different handling and preparation activities undertaken by the processors ranging from fish preparation, cutting and surface preparation for spreading the fish. The handling and preparation activities differ from one processing method to another. The method chosen by the farmers determines which of the handling and preparation activity to be undertaken. The result shows that cleaning had 75% in any of the methods; this means that general hygiene and cleanliness of the fish must be ensured to prevent early deterioration of the fish samples. The cutting/filleting of fish as an activity is carried out in all methods either in small or large fillets, dorsally or ventrally. The surface preparation adopted by the farmers was to spread the fish on tables (55%) in any of the methods of processing used. This is followed by ground surface (36%) where fish are spread on ground level on mats, thatch or other low level surface depending on the affordability of the farmer, this in line with the findings of FAO [8] that farmer use different methods of handling fishes in particular environment most convenient to them. Farmers' years of experience in the processing business was recorded, those with over 10 years of experience in the enterprise constituted the majority (60%). This higher percentage as far as experience in the business is concerned indicates that the processing activity was conducted by experts, which may not be unconnected the fact that fish is a delicate product that needs urgent, fast and experienced individuals to handle and prepare before it develop rancidity to distract customers from purchase.

Methods of Fish Processing: Table 3 shows the various methods of fish processing practiced by the fishermen in the area. The aim of each method was to preserve, to add value form for the consumer or extend the shelf life of the products for future use. From Table 3 it is indicated that six methods of fish processing were used; smoking, sun drying, boiling, freezing, frying and salting. Among these, smoking and frying constituted 25% and 35% respectively, of the sampled population. This showed that

Table 3: Methods of Fish Processing

Method	Frequency	Percentage
Method		
Smoking	20	25.0
Sun-drying	19	23.8
Freezing	3	5.80
Boiling	4	5.00
Frying	28	35.0
Salting	6	7.50
Equipment		
Extended drum drier	3	3.80
Drying rack	12	15.0
Local circular oven	9	11.20
Frying pan	56	70.0
Quantity in kg		
20 kg	7	8.75
30 kg	32	40.0
50 kg	28	35.0
Above 50 kg	13	16.25

Table 4: Capital base of the enterprises

Capital base	Frequency	Percentage
Enterprises		
>20,000	27	46.25
21,000-40,000	24	30
41,000-100,000	14	17.5
Above 100,000	5	6.25
Total	80	100

farmers in the area preferred these two methods due to a number of reasons; they are easy to conduct, inputs are readily available, equipment to be used is easy to operate. Sun drying is only an additional processing for some that combine it with either smoking or frying. Presently, the method is not practiced independently; reason why it is not treated as an entity. The equipment used by an individual processor differ depending on the chosen method of processing; those engaged in drying make use of either drying drum or drying rack which are more common in the area. The processors who chose Smoking as a method make use of local circular oven made from local raw materials. From Table 3 it is clear that frying method is the most widely used among the processors with 70% of the respondents belonging to this group. The quantities processed by farmers vary in number, depending on the capital base of the respondents, experience, productive capacity/ age and marketing strategy. Farmers with 20 kg had the least (8%) of the respondents, while those with (40%) (Equivalent to 30kg) obtained the highest percentage of the respondents. This is due to the fact that there was more able aged group whose productive capacity in the area of processing activity as a means of occupation and livelihood is not contestable. However, (16%) were found

to process above 50kg, this group had higher capital, more experience and marketing strategy deliver the processed product to far and near consumers.

The results of the capital base of the respondents are depicted in Table 4. It shows that the capital base of the processors ranged from N 20, 000 to above N100, 000.00 thousand naira. Majority of the respondents (46.25%) operate their fish processing business with less than N 20, 000. 00 as their capital base because most of them are small holder entrepreneurs who could not afford processing large quantity of fish due to lack of funds. It is on this note that Ataguba and Olowosegun [9] observed that Nigerian fishermen need to be assisted with some loans to improve their capital base with a view to improving profit and make the enterprise attractive. It could be seen from Table 3 that those processors with capital base of more than one hundred thousand naira constituted the minority having only five processors representing 6.25% of the total respondents. This group was found to process over 50 kg weight of the processed fish products. This group is expected to have more customers, facilities for processing large quantity of fish, more labour and in turn higher returns to the business.

Table 5 showed the various inputs or items required for the processing of fish in smoked or fried form. It could be observed that the processes of smoking and frying use different inputs (except fire/firewood which is common to both). The cost of these items varied depending on the locality and availability. The Total Revenue is the price per basket of fried and smoked fish as at the time of the study, which was N 15,000 for fried basket of about 15kg weight and N12,500 for that of smoked fish.

The inputs required for processing were categorized into variable and fixed costs.

Variable cost vary with quantity of fish processed per circle while fixed costs are items used for more than one processing circle or period of time, hence had some depreciation value after period of usage, however, the depreciation value in this fish processing was considered negligible due the small scale nature of the fish processors' enterprise and the salvage value of the items after tear and wear over a period of time. Among the variable items in the frying methods, oil constituted 46.15% of the total variable cost followed by spices with 15.38%, these spices are condiments that add value to the products and at the same time attract consumers attract consumers. Table 5 indicated that fixed items such as baskets, frying pans, tables etc had the highest percentage of the cost (43.47). This is understandable because they would be used for several processing

Table 5: Cost and returns between frying and smoking method of fish processing per basket (15kg)

Frying method			Smoking method		
Item (A)	Variable cost	%	Item	Variable cost	%
Oil	1,500	46.15	Salt	300	11.41
Salt	100	3.07	Firewood	1000	36.02
Firewood	400	12.30	Nylon	150	5.70
Nylon	100	3.07	Spies	500	19.01
Spies	500	15.38	Paper	300	11.41
Paper	300	9.23	Detergent	100	3.80
Detergent	150	4.61	Transport	280	10.15
Transport	200	6.15			
Total Variable Cost	3250	100	Total	2630	100
Item (B)	Fixed Cost			Fixed Cost	
Basket	400	17.39	Basket	250	11.11
Frying pan	300	13.04	Wire mesh	400	17.78
Table	1000	43.47	Table	1000	44.44
Market tax	200	8.69	Market tax	200	3.89
Blade	750	10.86	Blade	250	11.11
Sleve-spoon	150	6.52	Market	150	6.67
Total fixed Cost	2800	100		2250	100
Total Cost (A+B)		6050			4880
(C) Total Revenue (TR)		N 15,000.0			N 12,500.0
Net farm Income C-(A+B)		N 8, 950.0			N 7,620.0
Total Variable Cost (TVC)		N 3,250.0			N 2630.0
Total Fixed Cost (TFC)		N 2,800.0			N 2,250.0
Profitability Indicators					
Profit Margin (TR-TC)		N 8,950.0			N 7,620.0
Gross Margin (TR-TC)		N 11,750.0			N 9870.0
Gross Return per Naira (TR/TC)		2.47			N 2.56

activities before they worn out; if handled well, some fixed items can last several years. In the smoking methods, variable cost item that contributed most is the firewood (36.02%) used in varying quantity, it is used in heating the fish in an open air or in drums usually carried out by a skilled person to avoid damage, overheating and mass wastage. Among the fixed items used in smoking process as far results of this research is concerned showed that table had the highest cost representing 44.44% of the total fixed cost used. The total revenue/income gained by the processors per basket (average weight of 15kg) used as standard measure of either fried or smoked products were sold at the rate of N 15, 000.00 and N 12, 500.00 respectively as at the time of this study. The Net Farm Income which determined the profitability of the enterprises, fried and smoked fish were found to be profitable with net profit margin to the farmer of N 8, 950 and N 7, 600 for Fried and Smoked products respectively. It could be observed the frying method is more profitable than the smoked method this could adduced to the fact on daily basis fried fish served on many table food menu. The fried form is mostly preferred in area, in addition it is fast and the fresh flavor, taste of the fish is felt. Fried fish is quickly consumed because the life shelf is short

compared to the smoked. However, the smoked fish used in the preparation of certain dishes or used as condiments. The life shelf of smoked fish is longer and could be transported to longer distance with less risk of spoilage, though general fish is fragile commodity requiring proper and careful handling to prevent smashing and molding. Gross margin was calculated to be 11,750 for fried fish and 9,870 for smoked fish indicating that despite the higher percentage total variable cost encountered in frying methods, yet it is more profitable because of the turnover in the frying methods. However, gross return on naira invested in the two methods shows that the smoked fish had high rate of returns to investment on naira N 2.56 for smoked and N 2.47 on fried, this indicates that on the long run smoked method of fish processing might be more profitable than fried because it is less riskier than the fried in terms shelf live and marketability.

This result indicates that fish production is profitable irrespective of the enterprise component an individual wish to invest. This was confirmed by the studies of Per and Siebren [10] and Olagunju *et al.* [11]; Inoni [12] and Kudi *et al.* [13] that fish production enterprise both artisanal and landside are profit making ventures.

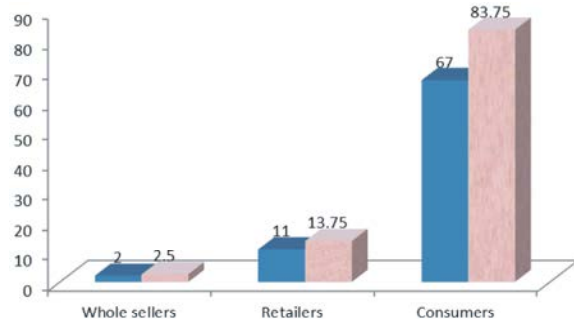


Fig 1: Marketing Channel of Fish

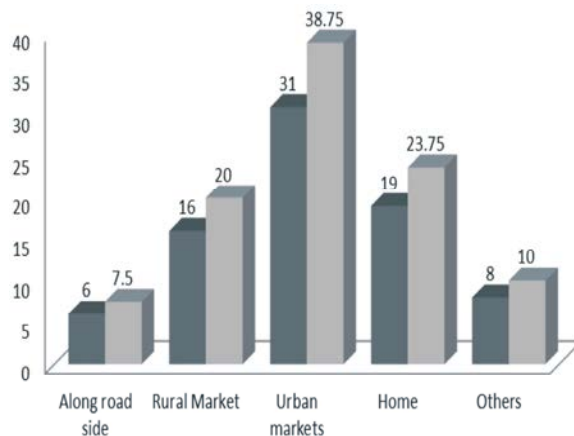


Fig 2: Selling Depots of Fish

The result in figure 1 had shown that the major pathway of the final processed fish reached the consumers directly (83.75%), meaning that consumers did patronize the processors directly at any meeting point to transact business. This signifies that the processors had direct access to consumers. This direct contact between processors and consumer might likely reduce the long chain exchange between one group and another thereby reducing the additional cost of the commodity at each chain before reaching the final consumer. The advantage of this direct contact could manifest by consumers requesting the desired product from the processors. Other channels used by the processors to reach out to consumers are retailing (13.75%) and wholesale with only (2.5%) however, few processors used them.

The result in figure 2 identified a number of points designated as selling depots where consumers and processors transact. Urban markets (38.75%) are major depots where fish processors assemble their products for consumers to purchase, it could be so because urban area inhabitants are expected to have more income for demand of processed fish and had varied sources of proteins. This was followed by home (23.75%). In this type of

marketing, processors had regular customers whom the processed fish are delivered to their homes, or alternatively the consumer move to the homes of the processors to collect the product. Rural markets days (20%) in the area were also depots for the sales of the processed fish products. Along the major roads in villages or towns are points where the processors target consumers for the sales of their products. Other depots constituted (10%) of the sampled respondents which included points where crowd gather, hawkers and other public places where processors searching for customers and consumers identify potentially viable for their businesses.

CONCLUSION

The study concludes that among the different methods of processing frying and smoking are the most commonly used in the study area. Farmers are smallholder except for few due capital base to set up the business. Both methods were found to be profitable, thus could serve as a means of livelihood in the area.

Problems and Recommendations: The problems associated with the fish processing activities as expressed by the respondents include among other things as inadequate processing equipment, lack of access to loan facilities, rapid spoilage due to high ambient temperature, fire incidence and erratic power supply by the power Holding Company of Nigeria.

Considering the enormous fish processed by the community and their contribution to the economic development of the area, it is hereby recommended that that the local government authority be made to identify the constraints and opportunities regarding establishment of modern smoking and frying with a view to producing hygienic products that will meet international standards. In furtherance to this, efforts geared towards empowering these processors to acquire facilities that will enable them processed large quantity of fish be intensified. Access to credit facilities through bank of agriculture (BOA) and other commercial banks with low interest rate should be explored with a view to strengthening their exportation capabilities of the products.

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