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A Survey on the Processing and Distribution of Smoked Catfishes (*Heterobranchus* and *Clarias Spp.*) in Ekpoma, EDO State, Nigeria

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Abstract

This study was carried out to identify and evaluate the efficient smoke processing, preservation, packaging, storage and distribution methods and marketing of smoked Heterobranchus and Clarias spp. in Ekpoma, Nigeria. The study was conducted with the aid of questionnaires, administered to 120 respondents made up of 40 processors, 40 retailers and 40 customers selected from five (5) markets in and around Ekpoma. The results showed that catfish processing and retailing business in the area were by women (100%), majority of whom are married, with no formal education. It was further shown that the dominant processing method is the traditional hot smoking, in cut-out oil drums (kilns), with smoking duration lasting 2-3 hours. Sales and consumers' preference for smoked catfish were rated high and profitable due to products taste, flavour, and protein value. Finally, the study revealed the existence of a thriving profitable small-scale traditional smoked catfish (Heterobranchus and Clarias spp.) processing, distribution and retailing business in the study area; identified the major constraints in the business and suggested solutions to ameliorate the situation.

Keywords: Catfish processing, storage, distribution, sales, consumption, ekpoma, Nigeria

Introduction

Fish is one of the most important animal protein sources in the tropics and its nutritional value is well suited to human dietary needs and competes favourably with other sources of animal protein[1]. Fish is however an extremely perishable commodity which begins to deteriorate as soon it dies or is caught. The deterioration is as result of series of changes brought about in the dead fish mainly by enzymes and bacteria. In the tropics, fish spoils within 12 – 24 hours, depending on the species, handling, method of capture etc.[2]. Fish therefore requires immediate and proper handling and good preservation soon after catch in order to retain its quality[3].

Smoking is one of the most important fish processing methods aimed at prevention or reducing post harvest losses. Smoking has the effect of imparting pleasant flavour to the product besides the preservative effect of smoke[4]. The longer fish is smoked, the longer is the shelf life[5] and post processing and handling processes such as packaging techniques, storage conditions, distribution and marketing techniques similarly impact on smoked fish shelf life[6]. In Nigeria, smoking and drying (especially hot smoking) are widely used in fish preservation and smoked-dried fish are highly cherished in Nigerian diets[7].

Catfishes especially members of the family Clariidae are very important in Africa and are very abundant in commercial catches in Nigeria especially in the dry season[8]. Members of this family that are very common in the study area include Heterobranchus species *(H. bidorsalis* and *H. longifilis)* and Clarias species (*C. gariepinus* and *C. anguillaris)* and their cultured hybrids (*Heteroclarias*). These species are very important because they not only keep well in both fresh and dried condition, but are highly valued and enjoyed a greater level of popularity among consumers[9]. The economic importance of *Heterobranchus* and *Clarias* catfishes and their hybrids is enhanced by their hardiness and adaptability to adverse environmental conditions, tolerance of high density culture, resistance to diseases, fast growth rate, high consumer ranking and their ability to accept or thrive on cheap feed[10].

Studies on *Heterobranchus* and *Clarias spp*. have shown them to be quality animal protein sources[11]. Essential amino acids in *Heterobranchus* and *Clarias spp.* have been reported to include Lysine, leucine, Isoleucine, arginine, histidine, methionine, threonine, phenylalanine, valine and tryptophan[12]. Other essential amino acids eg alanine, asparagines, glycine, glutamic acid were similarly reported in *Heteroclarias* hybrids[12]. The presence of all these essential amino acids necessary for healthy human life in these catfishes underscores the nutritive value and hence the importance of consumption of these catfishes[13].

In Ekpoma, the headquarter of Esan West Local Government Area of Edo State which is the focus area in this study, catfish consumption especially *Heterobranchus* and *Clarias* species is very popular especially amongst the ever increasing population occasioned by the presence of a local State University in the town. Economic activities including catfish (*Heterobranchus* and *Clarias spp*.) smoke processing, distribution and retailing

have as a result picked up in the area[14]. Besides, Ekpoma by its location midway between Agenebode - Ilushi artisanal fisheries production areas of Edo State, where swamp catfish fisheries production is a major occupation[15] and Benin City the State headquarter, is also important in fish processing and distribution network in the State.

It is against this general background that this study was carried out to determine the efficient smoke processing, packaging, storage and distribution of smoked catfishes (*Heterobranchus* and *Clarias spp*.) in and around Ekpoma was embarked upon. The study also aimed at determining the socio-economic characteristics of smoked catfish processors, retailers and consumers as well as the constraints militating against efficient processing, distribution and retailing of smoked catfishes in the area.

Material and Methods

The survey was conducted across five (5) markets in and around Ekpoma, Southern Nigeria (Lat. 6^O 00 N, 6^O 06 S; Long. 6^O 00 E, 6^O 05 W). Ekpoma is the administrative headquarter of Esan West Local Government Area of Edo State, Nigeria. The population and commercial activities in the town have increased tremendously because of the presence of a State - owned local university. Three of the markets (Ujoelen, Eguare and New Market) surveyed in this study are located in Ekpoma town, while the remaining two are located in adjoining Iruekpen and Irrua towns. The Iruekpen and Irrua markets were surveyed because of their close proximity to Ekpoma. A sketch of the study area showing Ekpoma town and the location of the sampled markets is shown in figure- 1. The five markets were selected because they are the main smoked fish distribution outlets in the area and play host to many fish processors, retailers and consumers. The survey was conducted between April and May, 2011 using a combination of visual observation, group focus discussion and structured questionnaire and personal communication.

120 questionnaires were administered to purposively selected processors (40), retailers (40) and consumers (40) within the named localities. Data generated were subjected to qualitative statistical analyses using the Statistical Package for Social Sciences (SPSS) Version 11 software and descriptive statistics (frequency of occurrence and simple percentages). Statistical tests were carried out using chi-square at 5% level of probability.

Results and Discussion

Socio-economic characteristics: The socio-economic characteristics of respondents in this study are presented in table 1. The results revealed that all catfish processors and retailers are females (100%) and are also the dominant consumers (75%). Age group analysis showed that the highest percentage of respondents were within the 41–50 (37.5%), followed by the age group of 31–40 (28.3%). In terms of marital status, married women were dominant with 45%, followed by widows (23.3%), single women (20.8%) and divorced (10.8%) in descending order. Most processors (37.5%) had no formal education while primary education was highest (32.5%) among those with formal education. Those with secondary education were highest (37.5%) among the retailers while those with higher level education (HND/University) were highest (35%) among consumers. Statistical analyses showed significant differences ($p<0.05$) between the age groups, marital status and education levels of respondents.

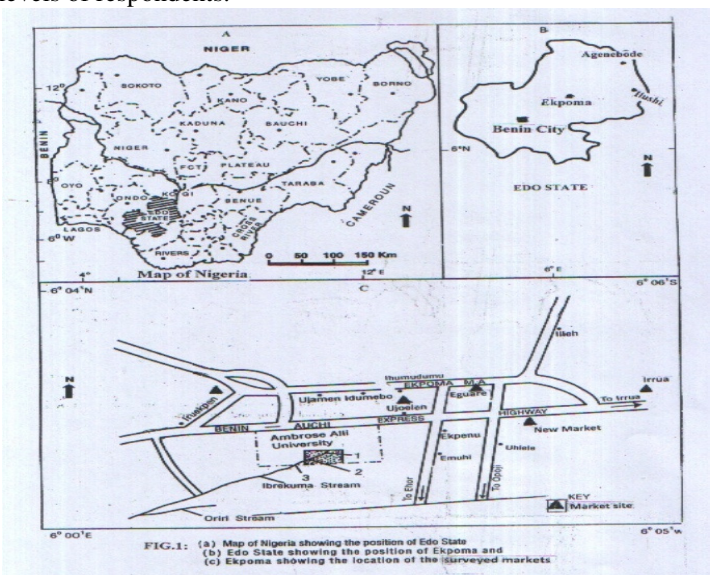

FIG.1: (a) Map of Nigeria showing the position of Edo State
(b) Edo State showing the position of Ekpoma and
(c) Ekpoma showing the location of the surveyed markets

Figure-1
Study Area

24 (60%) of the processors could handle 4 – 6 kg of catfish processing per day, while 15 (37.5%) processed 2 – 3 kg/day. 50% of the respondents (processors and retailers) had daily income of ₦ 1000 – ₦ 1500 and they were significantly higher ($p<0.05$) than the 31.25% with a daily income of ₦ 500 – ₦ 900 and the 18.75% with income of ₦ 1501 – ₦ 2000 income.

The domination of processing and retailing of smoked catfishes by women (100%) recorded in this study is in conformity with reports of earlier studies[13,16,17]. This study also revealed that smoked catfish economic activities in the study area were mainly in the hands of those whose age group was 31 – 50 (65.8%) years. This is not unexpected because majority of people below the age of 30 in the area were still schooling and were not yet economically independent while the older age group (>50 years) considered catfish processing and marketing activities too tedious. According to Abologba and Osifo[7], economic activities in fisheries especially processing and marketing are energy sapping and are dominated by economically active age groups as the older age groups have limitations on such energy sapping activities.

Most respondent processors and retailers of smoked catfish, as per the data of this study, were women married and widowed (68.3%) with few of them single (20.8%) and divorced (10.8%). The possible explanation for low single women involvement is that majority of them were below age 30 and in school. Ekpoma

has an education conscious youth population probably because of the influence of the higher institution (university) in the town. However, this survey also revealed that majority (25 or 31.25%) of the respondents (pooled data of processors and retailers) had no formal education, while 22 or 27.5% were educated to both primary and secondary school levels. The low educational level of most catfish processors and retailers could be lack of opportunity to go to school in this education conscious town or that majority of those with higher level of education considered catfish smoking and marketing as traditional and menial.

92.5% of processors and retailers handle 2 to 6 kg of catfish daily with 50% realizing between ₦1000 – ₦1500. This showed that the level of smoked catfish business in the study area though small scale is profitable. This finding is in conformity with earlier reports that traditional methods of fish smoking and marketing without improved technologies operate at small scale level[13,16,18] and profitable 19.

Processing and Storage Methods: The survey results presented in table 2 showed that the major type off smoking kilns used in the area is the cut out metal oil drum (70%) with fuel wood (67.5%) as source of energy and smoking duration lasting 2 – 3hrs for majority (62.5%) of the respondents. 28.75% of the respondents smoked their catfishes in mud oven, while only 1.25% used the Chokor kiln. Table- 2 also showed that 25% of the respondents utilized charcoal as energy source, while gas (5%) and wood shavings (2.5%) are least sources. Smoked catfish storage data showed that 55% of respondents stored their products in kitchen and smoke houses, followed by storage in kitchen only (26.25%), above smoke house (11.25%) and covered up in open (7.5%) being the least method of storage. Statistical analyses showed significant differences ($p<0.05$) between the methods of processing and storage practiced in the area.

This survey revealed that 70% of respondents engaged in traditional hot smoking in cut out metal oil drums using fuel wood as source of energy. This could be traced to the easy access to abundant fuel wood in the area being tropical and the near absence of cold rooms and other alternative preservation facilities, a situation aggravated by epileptic electricity supply. Another possible reason for adopting hot smoking is that the smoked catfish products are cooked thus increasing the shelf life. It has earlier been reported that hot smoking extended the shelf life of smoked fish products[5,20].

Majority of respondents adopted smoking duration of 2 – 3 hours and storage is in jute bags and baskets kept in kitchen and smoke houses. The duration of smoking enables the respondents cope with the quantity of products handled daily. The finding is similar to those earlier reported that packaging and storage of smoked fish is in jute bags and baskets placed above smoke houses and kitchen[19,21].

Distribution, Sales, Preservation and Consumption of catfishes in the area: Results presented in table 3 showed that 75% of processors sold smoked catfish products direct to consumers, while only 25% of them sold through retailers. Public transport (80%) is the major means of transportation of smoked catfishes used by majority of respondents, followed by use of private vehicle (12.5%), while movement on foot is least (7.5%). Table 3 also revealed that majority (65%) of the respondent processors and retailers rated sales as high, while 22.5% rated sales as very high and only 12.5% rated sales as low. The main preservation method of smoked catfishes was by re-smoking (67.5%). 20% of the respondents preserved smoked catfish products in fridge, while 12.5% adopted hanging over fire. On the quantity of catfish consumed weekly, 52.5% of respondent customers consumed 1 – 5 pieces, while 35% consumed 6 – 10 pieces. 45% of respondents consumed smoked catfish because of a combination of taste, flavour and protein value as against 25% that consumed catfish for reason of protein value alone. Only (10%) of respondents consumed for reason of taste and 5% consumed for reason of flavour alone.

Results on constraints of smoked catfish business presented in table 4 showed that 51.25% of respondents gave lack of adequate finance as a major constraint. Other constraints were high cost of transportation (26.25%), spoilage (15%) and lack of modern processing facilities (7.5%).

According to the results of this survey, 80% of smoked catfish processors transported their products using public transport, while 75% of them sold direct to consumers in a simple but efficient distribution and marketing system. 65% of respondents rated sales as high for reasons of taste, flavour and protein value. A possible explanation for this could be the presence of an enlightened university students and workers population in and around the study area.

Survey also revealed that the most important constraints of smoked catfish business are lack of adequate finance and high cost of transportation. This could be attributed to lack of credit lending agencies in the area and processors and retailers of smoked catfish have to resort to borrowing from fish mongers/money lenders at exorbitant interest rates and the high cost of petrol which has shut up cost of public transport in the area. Although low in respondents' rating, the issue of spoilage and lack of improved processing facilities exist in the area. To mitigate the problems arising from these constraints, it is strongly advocated that those in smoked catfish processing, retailing business in the area be organized into cooperative societies to enable them have easy access to credit facilities granted by Government agencies and Non Governmental Organizations (NGOs) to small scale agricultural businesses in the State. Agricultural extension service in the area should be strengthened with modern input (improved smoking kilns, cold rooms, freezers, fridges etc.) supply scheme to enable the respondents improve their businesses, to the overall benefit of the larger society.

Conclusion

The study revealed the existence of a thriving profitable small-scale traditional processing, packaging, storage and distribution

of smoked catfish (*Heterobranchus* and *Clarias spp.*) business in Ekpoma and adjoining environs. The socio-economic characteristics of smoked catfish processors, retailers and consumers in the area as well as the constraints they contend with in the business have been identified and possible solutions to ameliorate their situation suggested.

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Table-1
Socio-economic characteristics of respondents

Variables	Respondents			Percentage (100)
	Processors (40)	Retailers (40)	Consumers (40)	
Gender: Male	-	-	10	8.33
Female	40	40	30	91.67
Age (Years): < 18	2	2	5	7.50
18 – 30	4	6	9	15.83
31 – 40	12	10	12	28.33
41 – 50	20	15	10	37.50
51 – above	2	7	4	10.83
Marital Status: Single	8	8	9	20.83
Married	18	16	20	45.00
Widow	10	12	6	23.33
Divorced	4	4	5	10.83
Level of Education				
No formal Education	15	10	2	22.50
Primary	13	9	6	23.33
Secondary	8	15	8	25.83
OND / NCE	4	6	10	16.67
HND / University	-	-	14	11.67
Quantity of fish Processed daily (kg)				
2 – 3	15	21	-	45.00
4 – 6	24	14	-	47.50
7 – 10	1	5	-	7.50
Daily Income (₦): 500 – 900				
1000 – 1500	12	13	-	31.25
1501 – 2000	20	20	-	50.00
	8	7	-	18.75

Table- 2
Types of smoking kilns; source of energy; duration of smoking and storage methods

Variable	Processor (40)	Retailer (40)	Percentage (100%)
Kilns : Cut out Drum	26	30	70.00
Mud Oven	13	10	28.75
Chokor Kiln	1	-	1.25
Total	40	40	100.00
Source of Energy: Fuel Wood	30	24	67.50
Charcoal	8	12	25.00
Wood shaving	2	-	2.50
Gas	-	4	5.00
Total	40	40	100.00
Duration of Smoking: 2 – 3 hrs	25	-	62.50
4 – 5 hrs	11	-	27.50
> 5hrs	4	-	10.00
Total	40	-	100.00
Storage			
Covered up in Open	3	3	7.50
Stored above Smoke House	4	5	11.25
In Kitchen	9	12	26.25
In Kitchen and Smoke House	24	20	55.00
Total	40	40	100.00

Table-3
Distribution, sales, preservation and consumption of smoked catfishes in this study

Variable	Frequency	Percentage
Distribution Channel		
Processor – Retailer - Consumer	10	25.00
Processor – Consumer	30	75.00
Total (Processors)	40	100.00
Transportation Method		
By Foot	3	7.50
Private Vehicle	5	12.50
Public Transport	32	80.00
Total (Processors)	40	100.00
Sales		
Very High	18	22.50
High	52	65.00
Low	10	12.50
Total (Processors & Retailers)	80	100.00
Preservation Methods		
Re-smoking	27	67.50
Chemical	-	-
Fridge	8	20
Hanging over Fire	5	12.50
Total (Processors)	40	100.00
Consumption Rate		
1 – 5 pieces/day	21	52.50
6 - 10 ,, ,,	14	35.00
> 10 ,, ,,	5	12.50
Total (Consumers)	40	100.00
Reasons for consumption		
Taste	4	10.00
Flavour	2	5.00
Protein Value	10	25.00
Taste and Flavour	6	15.00
Taste, Flavour & Protein Value	18	45.00
Total (Consumers)	40	100.00

Table-4
Constraints encountered by Processors and Retailers

Constraints	Processors	Retailers	Percentage
Lack of adequate finance	20	21	51.25
High cost of Transportation	10	11	26.25
Spoilage	4	8	15.04
Lack of Modern Processing Facilities Total	6	-	7.50
(Processors & Retailers)	40	40	100.00