Methods adopted in the preservation of fish and their health implications to the people of Sampou, Bayelsa State

Abstract

The methods adopted to preserve fish can affect its nutritional quality owing to the likelihood of deposition of chemical and biological agents, which can also be injurious to health upon consumption. This study aimed to assess the impact of these preservation methods on the health of the people of Sampou. A descriptive cross-sectional study was conducted among people of Sampou, aged between 15-60 years. Data were collected from 364 respondents using interview and self-administered questionnaires and analyzed using Statistical Package for Social Sciences (SPSS) version 20. The study shows that smoking is the most common method of fish preservation in Sampou because it's easily accessible. Result of the study also revealed that fish preservation methods have health implications, such as burns, eye irritation, cough, asthma exacerbation, bronchitis, fever and chest pain. Although, smoking tends to prolong the shelf life of the fish it impacts adversely on health. It was recommended that farmers should seek support to build a solar powered cold room storage in Sampou, while the government should provide funds which will help fish farmers get better equipment. Medical officers and other healthcare workers should encourage regular medical screening and check up for fish farmers.

Keywords: Fish, preservation methods, public health

1.0 Introduction

Fish farming is very popular in Nigeria. A visit to the typical Nigerian market will present you with an array of fishery products, especially in the Southern part of Nigeria, where it is dominant. Nigeria is the 2nd largest producer of fish in Africa after, Egypt, with catfish being the most farmed species, although domestic production does not meets the demand for fish [1,2].

Fishes when killed are not continuously and continually available, hence the need to preserve them from decay and spoilage (by maintaining the quality) until they are consumed or sold [3,4]. Various methods have been developed to meet this need; drying (dehydration), smoking, frying, salting, heating, roasting etc., most of which are practised in developing countries such as Nigeria. The principle behind these preservation methods is the elimination of microorganisms which cause spoilage and to halt biochemical reactions which will facilitate the spoilage, by reducing the water content of the food since moisture is necessary for the survival of microbes in the fish [5-7].

Fish preservation methods are meant to maintain the quality of fish over a longer period of time and make it safe for consumption. Among the traditional methods of preserving fish, smoking is commonly preferred. Smoking could be done using the traditional fish smoking drum, fish smoking mud or smoking kiln. Preservation of fish by smoking has negative impacts on our health, as well as reduce the quality of fish [8]. The concerns are even more

prominent in the rural areas of developing countries where the mainstay of fish preservation is the traditional preservation method. Olaoye et al. [9], reported that the various traditional methods employed in the preservation of fish in the rural areas of developing countries have negative impacts (short term, medium term and long term) on the lives of the users. Females were reported to be more likely to suffer health implications as they are more involved in fish preservation than males [6,10,11].

Adverse health effects might arise from the method used for fish processing [9,12] and from the consumption of smoked fish [10,13]. The presence of microorganisms at high population density in smoked fish samples is of great public health concerns. Health concerns also exist for substantial exposure to polycyclic aromatic hydrocarbons (PAH) with possible carcinogenic human health risk from consumption of smoked fish species [14,15]. Grema et al. [16] reported that because most fish processors in developing countries never had a formal food safety training program, they hardly adopt good food hygiene measures, and this might have implication of general safety of the processed fish.

There is currently a paucity of published studies on the magnitude of ill-health resulting from fish preservation methods in low-income countries [14]. There is urgent need to document the attributable risk of commonly practised fish preservation methods in Sampou, to the occurrence of ill-health, so as to develop evidence-based protocols for preventing and managing ill-health among people practising these fish preservation methods.

2.0 Materials and Methods

2.1 Study area

The study was carried out in Sampou community. Sampou is a rural area in Kolokuma-Opokuma Local Government Area of Bayelsa State. It is bounded by Bayelsa National Forest to the North, river Nun to the Northwest, Kaiama to the Southwest and the East-West road to the South. It is located between latitude 5.1435°N and longitude 6.3525°E. It is indigenous to the Ijaw people who are known for the use of biomass for cooking and food preservation. The community is divided into compounds, these include; Ibene-pele, Isidani, Ezonwari, Ibabawari, Kalamaowei-wari, and New layout.

2.2 Study design

A descriptive cross-sectional study was carried out. This study lasted for a period of 2weeks (October 10^{th}- 24^{th}).

2.3 Study population

The study population is 4,036. This is the population of people older than 15years living in Sampou. The total population of Sampou is 7702, that of under 15 is 3666, under 5 is 1540 and under 1 is 308.

Eligibility Criteria:

- *Inclusion criteria*

The members of the study population may or may not be educated, they should be of age (between 15-60years old), they should have been living there for one (1) year, they should be healthy, physically fit, and they should have basic idea on the farming/food preservation methods common in the community. Respondents may be male or female.

- *Exclusion criteria*

People in Sampou community aged 15-60years old who have certain deformities such as the blind, foreigners, people not present at the time of administration of the questionnaires.

2.4 Sample size determination

The sample size was determined using the Yamane formula, as follows:

$$n = N/ 1+N(e)^2$$

where n = sample size .

N = population size .

e = level of precision

$$= 4036/ 1 + 4036 (0.05)^2$$

$$= 363.93 (\sim 364)$$

2.5 Sampling method

The sampling method used was simple random sampling. The sampling frame was formed by heads of the households that form the study population. The housing units and respondents were visited and administered questionnaires for data collection.

2.6 Data collection

The data for this study were collected via the questionnaires administered. The research instrument for data collection is thus questionnaires. They were issued in two forms; self-administered (for the educated ones) and interview (for the uneducated ones).

2.7 Data analysis

Data obtained using the research instrument (questionnaire) were analyzed using descriptive analysis and inferential statistics. This will be done using Statistical Package for Social

Sciences (SPSS) version 23 software. The descriptive analysis will be focused on the frequency and distribution of demographic variables and research questions, represented on a table. The demographic variables of importance to this research would include occupation, age, gender, marital status, level of education etc.

3. Results

A total of 364 questionnaires were administered, retrieved and analyzed. Table 1 shows that most of the people (92.5%) were educated and were mostly females (67.3%). They were mostly married/cohabiting (78.7%), aged 31-40years (34.3%) and practised Christianity (97.6%). Most of the inhabitants were indigenes (71.9%) and were into farming (50.3%).

Table 2 shows that most households (80.7%) had knowledge of and practiced smoking as their major fish preservation method. Amongst the methods, smoking was most commonly known (86.4%) and practised (51.4%) in the household. Most of the participants preferred smoking because of the longevity it gives the fish (20.4%).

Table 1: Sociodemographic characteristics of respondents

Characteristics	Frequency N = 364	Percentage (%)
Gender		
Male	119	32.7
Female	245	67.3
Age group		
16-30yrs	97	26.6
31-40yrs	125	34.3
41-50yrs	78	21.3
51-60yrs	35	9.7
>60yrs	29	8.1
Marital Status		
Single	52	14.3
Married/Cohabiting	286	78.7
Widowed/Separated	26	7.0
Level of Education		
None	27	7.5
Primary	90	24.8
Secondary	174	47.7
Tertiary	73	20.0

Religion		
Christian	355	97.6
Muslim	5	1.3
African Traditional Religion	4	1.1
Occupation		
Farmer	183	50.3
Civil servant	25	6.8
Trader	60	16.5
Artisan	39	10.8
Others	57	15.6
State of Origin		
Bayelsa	262	71.9
Others	102	28.1

Table 2: Fish preservation method used and reason for using them in Sampou community

Variable	**Frequency N = 364**	**Percent (%)**
Fish Preservation in the household	294	80.7
Fish preservation method known to participants		
Smoking	254	86.4
Sun drying	210	71.4
Cooling	122	41.5
Salting	117	39.8
Method used for fish preservation in the household		
Smoking	151	51.4
Sun drying	88	29.9
Cooling	15	5.1
Salting	15	5.1
Reasons for the fish preservation method used		
Preservation method makes fish last for a very long time	60	20.4
It is a cheap method	49	16.7
Most appropriate fish preservation method	29	9.9
Lack of electrical power supply	27	9.2
It is readily available	27	9.2
Preservation method is convenient	24	8.2
Preservation method is commonly used	15	5.1
Preservation method gives fish good taste	7	2.4

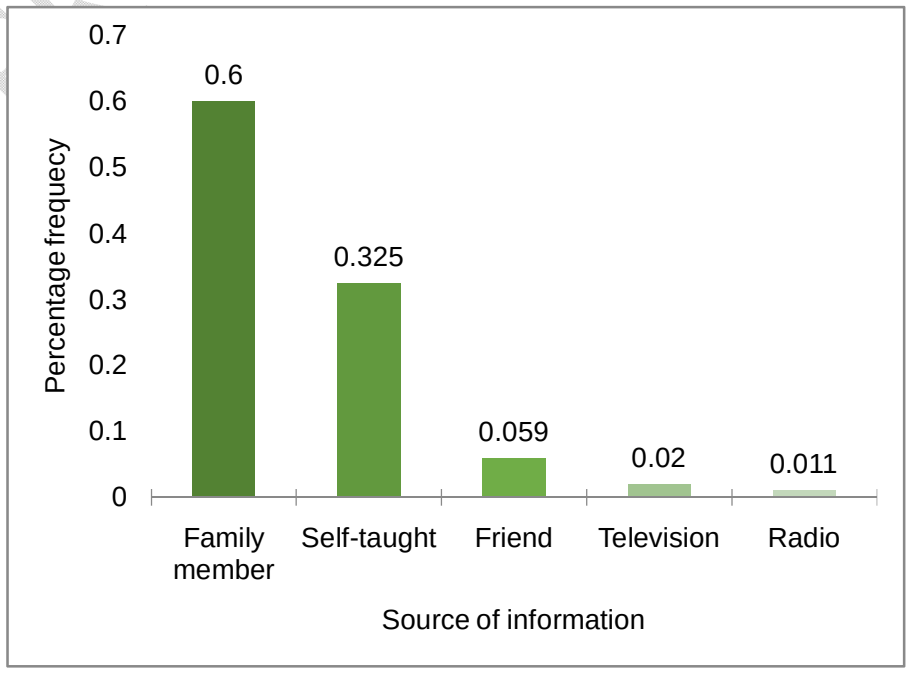

Figure 1: Source of the correspondents' knowledge about the different methods of fish preservation.

Figure 1 shows that most people (60%) learnt fish preservation from their families, and the least source of their knowledge is radio.

Table 3: Health implications of fish preservation methods used in Sampou community

Variable	Frequency N = 364	Percent (%)
Awareness of health implications associated with preservation methods	117	32.1
Respondents who have suffered some health implications	69	18.9
Respondents who knew any sufferer	78	21.5
Health Implications Suffered		
Burns	9	8.7
Eye Irritation	35	50.7
Cough	20	29
Others	8	11.6

4 . Discussion

This study was conducted on 364 households in Sampou community. There were 245 females (67.3%) which shows female predominance in the area of fish processing. This is in keeping with studies done in the past. Odediran and Ojebiyi [17] conducted a study in Lagos State, Nigeria, in which 64.3% of the participants were females. In a descriptive study by Agbebi [10], it was also found that females constituted 70% of the respondents. In a study conducted in the coastal areas of Ondo state, Nigeria, it was observed that females dominated the processing sector (70%) [9]. According to Alonge et al. [6], females are more likely to suffer health implications as they are more involved in fish preservation than males.

The predominant age group was 31-40years (34.3%) followed by 16-30years (26.6%). This shows that the younger age group, because their workforce, was mainly involved in fish preservation. The older ones (>60years) constituted just 8.1%. Gawi and Sogbesan [18] also reported that majority of respondents in their study were women aged 31-40years (40%). Agbebi [12] reported that women aged 21-40years old were more involved than every other age group in fish preservation. This age bracket encompasses the most reproductive and any adverse effect on mother could impact on their children.

Most of them were either married or cohabiting (78.7%), even more so for the cohabiting. This is expected since southerners are known for cohabiting [19]. This also shows the need to feed their families through fish processing as it is a cultural practice among women in this region. Ariadi and Abidin [20] in their study showed that majority of the participants were married.

Most of the participants were educated up to secondary level (47.7%), hence it is not surprising that they had some good knowledge on the research topic. Those with no formal

education constituted the least (7.5%). Ariadi et al. [21] also had similar finding, in which majority of the participants were educated up to secondary level. Most of the respondents were Christians (97.6%), mainly farmers (50.3%) and indigenes (71.9%) of Sampou.

On method used for fish preservation in the household, 294 of respondents (80.7%) affirmed that they engaged in fish preservation in their households. This is largely because of the River Nun that bounds the community, as such one of their main sources of livelihood is fish farming and processing. Out of the 294, only 254 respondents (86.4%) knew about the smoking method and 151 of them (51.4%) used it as their preferred method. This is similar to the findings by Olaoye et al. [9] and Gawi and Sogbesan [18], were they reported that, smoking method is the most common method used for processing. In the present study, smoking method was followed by drying. Only 5.1% used cooling method. A study carried out by Olaoye et al. [9] noted that three main fish processing methods in Nigeria were smoking, frying and drying. Sun drying is a common traditional fish preservation method among locals in developing countries of Kenya [22] and India [23]. However, smoking is very popular in Nigeria [16].

The major reason for their preferred method was that it made their fish last longer. Another important reason why these methods are preferred over cooling (for example) is the lack of electrical power supply and it is also cheaper than the latter as drying uses solar energy. Most people (60%) learnt fish preservation from their families, and the least source of their knowledge is radio. This goes to say that fish preservation has become a way of life for most participants as it is been taught to the younger generation, and they hardly can do without it.

The awareness of health implications associated with preservation methods used was low compared to the overall level of education. Among the 364 participants, only 117 (32.1%) were aware of some hazards associated with fish preservation. Most of them had suffered eye irritation (50.7%), followed by cough (29%), others (asthma, bronchitis, fever and chest pain) (11.6%) and burns (8.7%). This is similar to the study conducted by Olaoye et al. [9] on occupational hazards and injuries associated with fish processing in Nigeria, in which eye irritation, burns etcetera, cough, fever, chest pain, were identified.

Conclusion

Traditional methods of preserving fish such as smoking and sun drying were the methods commonly used for preserving fish by people in Sampou. The decision to use these methods is mainly because they make fish last for a very long time and they are cheap. Respondents were aware of the health implications associated with these preservation methods and reported experiencing burns, eye irritation and cough, which they attributed to the preservation method.

Ethical Approval and Consent

Ethical approval was obtained from the Research and Ethics Committee, Niger Delta University Teaching Hospital Okolobiri, and informed consent was obtained from the Ward

Chairman, Traditional Rulers of Sampou Community, Head of households and respective individuals before interview was administered.

References

1. Olayemi FF, Raji AO, Adedayo MR. Microbiological quality of catfish (*Clarias gariepinus*) smoked with Nigerian Stored Products Research Institute (NSPRI) developed smoking kiln. International Research Journal of Microbiology. 2012; 3(13): 426-430.

2. Food and Agriculture Organization. Fish trade in Africa: an update. [internet]. [cited 2020 December 3]. Available from https://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/338418/

3. Eyo AA. Fish processing technology in the tropics. University of Ibadan Press; 2000.

4. Wafi A, Ariadi H, Muqsith A, Mahmudi M, Fadjar M. *Oxygen consumption of Litopenaeus vannamei* in intensive ponds based on the dynamic modeling system. Journal of Aquaculture and Fish Health. 2021; 10(1): 17-24.

5. Sengor GF, Kalafatoglu H, Gun H. The determination of microbial flora, water activity and chemical analysis in smoked mussels (*Mytilus galloprovincialis*). Turkish Journal of Veterinary Animal Science. 2004; 28: 793-797.

6. Alonge A F Ikrang EG., Wechie, OL Evaluating the different procedures for preserving fish in Rivers State, Nigeria. IOP Conf. Ser.: Earth Environ. Sci. 2020; 445(1):012-013.

7. Kumolu-Johnson CA, Aladetohun N, Ndimele PE. The effects of smoking on the nutritional qualities and shelf-life of *Clarias gariepinus* (LACEPEDE). Afr. J. Biotechnol. 2010; 9(1): 073 – 076

8. Shori AB. Awareness and knowledge about food spoilage and principles of food preservation among Saudi women in Jeddah. J Food Microbiol Saf Hyg. 2017; 2: 120-32.

9. Olaoye OJ, Odebiyi OC, Abimbola OT. Occupational hazards and injuries associated with fish processing in Nigeria. Journal of Aquatic Science 2015; 3(1): 1-5. doi: 10.12691/jas-3-1-1.

10. Sanni RR, Aziegbemhin SA, Igbinosa EO, Ekhaise, FO. Effect of different preservative methods on microbiological, nutritional and mineral contents of selected fish from major urban markets in Benin City, Nigeria. NISEB Journal 2013; 13(3):153-159.

11. Madusari B.D, Ariadi H, Mardhiyana D. Effect of the feeding rate practice on the white shrimp (*Litopenaeus vannamei*) cultivation activities. Aquaculture, Aquarium, Conservation & Legislation-International Journal of the Bioflux Society. 2022; 15(1): 473-479.

12. Agbebi F.O. Analysis of Occupational Hazard of Fish Smoking Among Fisher-Folks in Coastal Areas of Ondo State, Nigeria. International Journal of Rural Development, Environment and Health Research (IJREH). 2018; 2(2):39-47.

13. Teke EC, Immanuel OM, Oku IY, Okafor HC. Microbiological assessment of smoked *Clarias gariepinus* sold in Yenagoa. South Asian Journal of Research in Microbiology. 2022; 15(1): 23-29.

14. Tongo I, Ogbeide O, Ezemonye L. Human health risk assessment of polycyclic aromatic hydrocarbons (PAHs) in smoked fish species from markets in Southern Nigeria. Toxicology Reports. 2016; 4:55-61.

15. Muqsith A, Ariadi H, Wafi A. Financial feasibility analysis and business sensitivity level on intensive aquaculture of vaname shrimp (*Litopenaeus vannamei*). ECSOFiM (Economic and Social of Fisheries and Marine Journal). 2021; 8(2): 268-279.

16. Grema HA, Kwaga JKP, Bello M, Onimisi HU. Assessment of food hygiene knowledge, attitudes and practices of fish handlers in Kaduna state, Nigeria. Adv. Anim. Vet. Sci. 2019; 7(3): 131-137.

17. Odediran OF, Ojebiyi WG. Awareness and adoption of improved fish processing technologies among fish processors in Lagos State, Nigeria. Research Journal of Agriculture and Environmental Management. 2017; 6(3): 046-054.

16. Gawi GO, Sogbesan OA. Fish Processing and Preservation Techniques Selected Fishing Communities along the Upper Benue River, Taraba State. Poultry, Fisheries and Wildlife Science. 2017; 5(2): doi:10.4172/2375-446x.1000184

19. Emeng GI. The Social Problem of Cohabitation. Pinisi Journal of Art, Humanity and Social Studies. 2021; 1(4): 36-43.

20. Ariadi H, and Abidin Z. Study Of Partnership Pattern Among Farmers Of Tilapia Fish (*Oreochromis niloticus*) And Fish Breeding Centre Klemunan In Wlingi Of Blitar Regency. ECSOFIM: Economic and Social of Fisheries and Marine Journal. 2019; 6(02): 194-201.

21. Ariadi H, and Wafi A. Water Quality Relationship with FCR Value in Intensive Shrimp Culture of Vannamei (*Litopenaeus vannamei*). Samakia: Jurnal Ilmu Perikanan. 2020; 11(1): 44-50.

22. Onyango DM, Sifuna, AW, Otuya P, Owigar R. Kowenye C. Lungayia, HBO, Odour AO. Evaluation of fish processing and preservation systems along the shores of lake victoria towards enhancement of sun drying technology. International Journal of Food Science and Nutrition Engineering. 2017; 7(5): 111-118.

23. Shivaji C, Dilip D, Pandurang K, Kalimullah P. Traditional Methods of Fish Processing by Fisher Tribes in Godavari River Basin, Maharashtra State, India. Science Research Reporters. Science Research Reporter. 2015; 5(2): 192-197.