Journal of Agricultural, Food Science & Biotechnology

JAFSB, 1(2), 104-111, 2023
https://doi.org/10.58985/jafsb.2023.v01i02.012
ISSN(Print): 2959-3417

Research Article

Health effects of fish processing among artisanal fish processors in Epe local government area, Lagos state, Nigeria

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Article Information
Received: 11 February, 2023
Revised: 16 March, 2023
Accepted: 12 April, 2023

Academic Editor
Gian Carlo Tenore

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Keywords
Fish processors; effects; health issues; artisanal; processing; hazard.

Abstract

This study aimed to assess the health effects of fish processing among artisanal fish processors (AFP) in Epe Local Government Area, Lagos State, Nigeria. A total of 120 respondents were selected using multi-stage sampling procedures. Stage one is purposive selection of Epe LGA, stage two is the selection of eight (8) wards from 19 wards in the LGA, lastly, random selection of 15 AFP from each of the ward selected. Descriptive statistics and logistic regression analysis were used. Results revealed that majority (97.5%) of the processors were female with mean age of 38 years and mean household size of 7 persons. Furthermore, 59.2% of the fish processors processed sea fish with average processing experience of 13 years and mean monthly income of ₦55,784.00k. The major health effects of fish processing in the study area were eye irritation, back pain and sprain, excess heat/cold, respiratory ailment, malaria, skin cuts and burns. Treatment sought during illness was traditional and orthodox (54.2 %) and higher proportion (58.3%) depends on family and friends as a coping strategy during illness. Logistic regression revealed that sex, age, marital status, years of fish processing ($p<0.01$) labour source, frequency of processing ($p<0.10$) and processing medium ($p<0.05$) were significantly associated with the health issues experienced by AFP. It can be concluded that AFP in the study area was affected by various occupational health issues. Thus, it is recommended AFP should be sensitized on preventive measures (such as regular use of masks, gloves, gumboots, check-ups etc.) to minimize occupational health hazards associated with fish processing.

1. Introduction

Fishing like any other hunting activities has been a major source of protein for human race and has put an end to the unsavory outbreak of anemia, kwashiorkor and so on. Fish is one of the most diverse groups of animals known to man with more than 20,500 species in existence, there are more species of fish than any other vertebrates. According to [1]. Fishery sub-sector was reported to have contributed an average of about 10% of agricultural GDP between 2008 and 2012, fisheries are also known as an enviable sub sector which provides employment to the large proportion of the nation's population (about 65-70%) especially those in riverine and fishing communities. Fish farming also generates employment directly and indirectly in terms of people employed in the production of fishing output and other allied businesses. In Africa, marine and inland fisheries contribute towards the food security of 200 million

Africans and the income of 10 million engaged in production, processing and trade [2]. Studies have shown that between 40% and 45 % of rural workforce in Lagos state engage in small scale artisanal fisheries. Artisanal fisheries according to Pauly, [3] are the sector that employs traditional methods in carrying out their operational activities which includes capturing, preservation (processing) and distribution of fish and fish product. Fish processing involves all the activities that are associated with fish and its products from time of fish harvest to the time the fish is on the consumer's table [1] Several methods such as smoking, frying, boiling, drying, fermentation and canning have been used for processing. However, the most commonly used methods among the Nigerian small scale fish processors have been smoking and drying [4]. Fish processing is the most hazardous aspect of fish farming that poses several occupational health hazards. Fish processing workers are often susceptible to many physical, chemical, ergonomic and biological hazards in the course of their work. All fish processing activities are hazardous due to their nature and working environments. Considering that most of these AFP do not put in place necessary safety aids, absence of improved fish processing technologies and the fact that training were not acquired on the different processing activities [5] Thus, AFP are often faced with various occupational hazards which ranges from redness/swelling of the eye (which is the commonest) to mechanical and electrical accidents, bacterial and parasitic infections, noise induced hearing loss, allergic respiratory diseases (Smoke inhaled by processors smoking fish and fryers is of serious health risks as it can cause asthma and other respiratory ailments.), and stress related health problems. The occupational hazards, safety concerns and risks to health in the fish processing industry are based on the types of operation, scale of production and the specific species of interest. Processing is often handled and processed in unhygienic conditions causing spoilage, contamination with disease causing germs and leading to loss of fish, the farmers' income and indirectly affect the health of the processors. The U.S Government accountability office [6] identifies poor health in the agricultural workforce as one of the major causes of chronic malnutrition (food insecurity) in sub-Sahara Africa. Poor health has a significant negative impact on the growth of developing countries. Good health is central to fishing activities but the fishers are prevented from putting their maximum efforts into fish processing due to common illnesses such as cold, fever, typhoid, flu and many others that affect their maximum production efficiency [7] thus, whatever affect the work force will affect fish production (processing).

Therefore, it is in this line that the study tends to;

i. Describe the socio-economic characteristics of the artisanal fish processors in Epe LGA.
ii. Identify the respondents fish processing characteristics in the study area.
iii. identify the prevalent and frequency of health issues associated with fish processing among artisanal fish processors in Epe LGA, Lagos state, Nigeria.
iv. Investigate the constrains of fish processing in the study area.

2. Materials and methods

The study was conducted in Epe Local Government area of Lagos State Nigeria. Epe is a city located in the North-east of Lagos State, bounded to the South by the Lagos Lagoon, to the north by a boundary with Ogun state (Ijebu-O de). Epe has a total land area of 965 km2 (373 sq m) and Coordinates at 6^0 35'40.54N and 3^0 58'39.59E, with current population of over 184711,000 (Census,2006). Fishing, crop farming and trading is their major occupation. Multi-stage sampling procedure was adopted in this study. The first stage involved the purposive selection of Epe local government area, (LGA), due to the prominence of fish farming, rearing and processing in the local government. The second stage is the purposive selection of 40% wards from 19 wards in the LGA which gave eight (8) wards. Stage three involved the use of simple random sampling selection of fifteen AFP from each of the communities. This gave a total of one hundred and twenty (120) respondents which constitute the sample size of the study. Data collected were analysed using descriptive statistics and Logit regression model. Specifically, logit regression was employed to determine the effect of fish processing and socio-economic factors on the health of the respondents. "The logit model assumes that the probability of a fish processor falling sick (Pi) as a result of fish processing is a function of an index (Zi),

which is the inverse of the standard logistic cumulative function of Pi. Zi is also the inverse of the standard logistic cumulative function of Pi, i.e.,

Pi $[Y = 1]$= f$[Zi \ldots\ldots\ldots\ldots\ldots\ldots]$

The probability of a fish processor falling sick is given by

pi $[Y = 1] = 1/1+e^{zi}$……

The probability of not falling sick is given by
Qi$[Y = 0]$=1-Pi$[Y = 1]$.

The dependent variable (Yi) is a dummy. It takes the value of 1 if the farmers fall sick and 0 if otherwise.
In regression analysis, a dummy variable is a regressor that can take only two values: either 1 or 0 they are typically used to encode categorical features.

Zi = bo + biXi+ b2X2+ b3x3 +……bn+Xn

Where:
Z = Probability of falling sick
x= Coefficient of explanatory variable which increase or decrease
X1= Age (in years)
X2= Sex (male or female)
X3= Educational level (years spent in school)
X4= Marital status
X5= Household size (No of people)
X6= years of processing
X7= labour source
X8=processing methods
X9= frequency of processing
X10= access to credit
X11= cooperative membership
X12 = monthly income (₦)
X13= Extension contacts
E = Error term
b_o= constant

3. Results and discussion

The findings in Table 1 reveal the socio-economic characteristics of the respondents. It reveals majority (97.5%) of the respondents were female while 2.5% were male. This implies that fish processing activities ~~is~~ are mostly dominated by women and they play vital role in fish industry. This is in line with [8]. The results in the Table 1 also reveals that, 54.2% of the fish processors were in the age range of 31-40 years, 40.8% were between 41 and 50 years old, while 9.1% and 4.2.7% were in age ranges of 20 - 30 years and older

Table 1. Socio-economic characteristics of the respondents

Characteristics	Frequency (n= 90)	Percentage	Mean
Age			
20-30	5	4.2	
31-40	65	54.2	
41-50	39	32.5	
≥50	11	9.1	38years
Sex			
Female	117	97.5	
Male	3	2.5	
Educational status			
No formal education	33	27.5	
Primary	22	17.5	
Secondary	61	50.8	
Adult/Vocational	2	1.7	
Marital status			
Single	11	9.2	
Married	98	81.7	
Divorced	7	5.8	
Widowed	4	3.3	
Household size			
≤5	12	10	
6-10	85	70.8	
≥10	23	19.2	7 persons
Religion			
Christian	71	59.2	
Islam	42	35.0	
Traditional	7	5.8	
Major activity			
Fish rearing	26	21.7	
Fish farming & processing	49	40.8	
Processing alone	45	37.5	
Processing experience(yrs.)			
≤5	28	23.3	
6-10	23	19.2	
11-15	29	24.2	
16 and above	40	33.3	13years
Monthly income (#)			
≤30,000	44	36.7	
31,000-60,000	56	46.7	
61,000-90,000	15	12.5	
≥90,000	5	4.2	#55,784.00
Type of Labour			
Hired	15	12.5	
Family	89	74.2	
Both	16	13.3	
Access to credit			
Yes	87	27.5	
No	33	72.5	
Extension contacts			
Yes	7	5.8	
No	113	94.2	
Cooperative membership			
Yes	45	37.5	
No	75	62.5	

Source: Field Survey data, 2022

than 50 years respectively. The mean age was found to be 38 years. This is an indication that artisanal fish processors in the study area were still within the active economic age group and are still proactive and productive in their occupation. Majority (50.8%) of the respondents attained secondary education, 27.5% had no formal education 1.7% obtained adult/vocational education. Education appears to play a vital role in every individual disposition knowledge on activities done and adoption of technology. This agrees with the study of [9]. The Majority (81.2%) of the fish processors were married while 9.2 % were widows. Only about 5.8% and 3.3% were divorced respectively. The proportion of married fish processors could be to ensure food security to the household at easy daily reach. This is in line with the findings of [10] which reported that marriage is a highly cherished institution with great responsibility ~~to~~ for household needs. Also, the mean household size was about 7 persons. Fish processing requires more manual labours, consequently, households with a larger number of family labours are more likely to work efficiently and productively. Table 1 also shows that 59.2% of the respondents were Christian while 35.0% of them were Islam and 5.8% practice traditional worshiping. This indicates that religion is not a barrier when it comes to artisanal fish processing. Major activities of the respondents were fish farming and processing (40.8%) while 37.5% and 21.7% were involved in fish processing and fish capturing alone, their average years of processing experience was 13 years with the mean monthly income of #55,784.00 this implies that artisanal fish processors are well groomed in fish processing activities which however, commensurate with their income. Finally, Table 1 also reveals that majority (74.2%) of the fish processors used family labour, while 72.5% had no access to credit facilities with 62.5% not belonging to any cooperative society and almost 94.2 % all of the fish processors once had contact with an extension service agent.

3.1 Processing characteristics and methods

Table 2 reveals the fish processors' characteristics. It shows that majority (72.5%) of the artisanal fish processors processed frozen fish, results in Table 2 also reveal that smoking (55.8 %) is the major method of processing fish in the study area which they engaged on a daily basis (70.8%) This indicates that smoking is the major method of fish processing in the study area. The results show that the brick kiln (Agbado type) was commonly used by 55.8% of the fish processors as compared with the Altona smoking kiln and drum type which were used by 26.7% and 17.5% of the fish processors respectively. This result is supported by the findings of [11] who positioned that primitive means of smoking is still in operation in some rural areas. It also corroborates with the findings of [12] who characterized artisanal fishery by low technology application. Furthermore, based on pre-processing activities, results show that close to two-thirds (65.8 %) of the respondents allowed the fish to deice before degutting. Also, almost all (93.3%) of the artisanal fish processors practiced degutting before smoking their fishes while one-third of the respondents salts their fish before processing.

Table 2. Processing characteristics of the respondents in the study area

Variables	Frequency (n= 120)	Percentage
Type of fish process		
Frozen	87	72.5
Sea fish	33	27.5
Processing method		
Frying	44	36.7
Smoking	67	55.8
Drying	8	6.7
Solar drying	1	0.8
Frequency of fish processing		
Daily	85	70.8
Once in a week	5	4.2
Twice a week	26	21.7
≥ Thrice	4	3.3
Types of smoking kiln used		
Brickkiln with mesh tray (agbado)	67	55.8
Drum type	21	17.5
Altona kiln	32	26.7
*Pre- processing activities**		
Soaked to deice	79	65.8
Degutting	105	93.3
Clean with water	92	76.6
Salting	52	43.3

Source: Field survey data, 2022

3.2 Common health issues associated with fish processors in the study

Table 3 presents the common health issues associated with artisanal fish processors, from the table it revealed that eyes irritation, back strain and sprain, Excessive heat and cold, Respiratory ailments,

Malaria, Skin cuts and burns, Sting from fish spines and headaches were the common health issues associated with fish processors in the study area with (85.8, 79.1%, 68.3%, 65%, 56.7%, 55.8%, 50.8% and 50.8%) respectively. This result conforms to the finding of [13], who reported that every aspect of fishery activities has a peculiar occupational hazard that is associated with their operational mode [14] and observed that fish processing workers have a higher incidence of chronic respiratory symptoms compared to workers in other sectors due to their frequent exposure to fish aerosols, which presents a significant risk for the development of respiratory diseases. Also, the International Food Policy Research Institutes [15], stated that the higher incidences of skeletal muscular and postural health problems such as joint pains and back pains are perhaps indicative of work-related health hazards. This may be due to the long and consistent bending, sitting and standing posture of the fish processors during production. The Bone dislocation was the least common health issue, reported by only 6.7% of respondents. Some respondents mentioned that they had fallen due to the slipperiness of their working environments.

Table 3. Common health issues associated with fish processing in the study area

Health issues	Frequency (n= 120)	Percentage
Respiratory ailments	78	65.0
Excessive heat and cold	82	68.3
Back Strain and Sprain	94	79.1
Bruise	48	40.0
Eyes irritation	103	85.8
Sting from fish spines	61	50.8
Skin cuts and burns	67	55.8
Whitlow	58	48.3
Headache	61	50.8
Malaria	68	56.7
Typhoid	43	35.8
Broken bone or dislocation	8	6.7

**Multiple response: Source: field survey data, 2022*

Results in Table 4 reveal the episodes of health issues in a year and treatment sought. It shows that majority (62.5%) of the artisanal fish processors experienced health issues 1-3 times a year, followed by 31.7% and 5.8% of the processors who experienced health issues between 4-6 times in above 7 times in a year respectively the average episodes of ill health in Table 3 shows that half (54.2%) of the artisanal fish processors implore the use of traditional and orthodox treatment during ill health. This implies that the respondents have access to modern health facilities in the study area, yet still rely on the use of local herbs and some mention because it is freely available. The major coping strategy during health issues is to fall back on their savings (58.3%) or borrow (50.8%) from friends while 41.7 % just stop fish processing during illness. This finding contrasts with the findings of [16]), who reported that intrahousehold labour substitution was the most common coping strategy among fisher households in Lagos State.

3.3 Effects of fish processing and socio-economics factors on the health of artisanal fish processors in Epe LGA.

Results in Table 5 present the effect of fish processing and socio-economic factors on the health of artisanal fish processors in the study area. The Nagelkerke R^2 was 0.875 which indicates that about 87 % of the variation in effect of fish processing on the health of the respondents was jointly explained by the independent variables included in the model. The Chi-Square of 78.01 ($p<0.01$) was significant attesting to the goodness of fit of the model. The results reveal that sex, age, marital status, household size, labour type, years of fish processing, processing method and frequency of processing were significant factors

Table 4. Episodes of health issues in a year and treatment sought (n= 120)

Variables	Frequency (n= 90)	Percentage	Mean
Episodes of health issues (yrs.)			
1-3	75	62.5	
4-6	38	31.7	
>6	7	5.8	3.87±0.954
Treatment sought			
Traditional	39	32.5	
Orthodox	10	8.3	
Traditional and orthodox	65	54.2	
None	6	5.0	
Coping strategies adopted			
Hired labour	15	12.5	
Family and friend	12	10.0	
Savings	70	58.3	
Borrowing	61	50.8	
Stop work	50	41.7	

Source: field survey data, 2022.

Table 5. Logit regression results on effects of fish processing and socio-economics factors on the health of artisanal fish processors in Epe LGA.

Characteristics	β Coefficients	Wald	Significance			
Age		2.832		4.431***	0.000	
Sex	0.442		2.623***	0.009		
Educational status	0.013		0.151		0.880	
Marital status		-0.257		-3.539***	0.001	
Households size	0.273		1. 843*	0.080		
Labour type		-0.089		1.845*		0.089
Years of processing	0.208		3.469***	0.001		
Access to credit	0.382		1.658		0.044	
Cooperative membership	2.863		1.658		0.884	
Extension contacts		-0016		-2.453		0.832
Processing methods		-0.098		-2.407**	0.053	
Frequency of processing	1.354		1.833*		0.070	
Constant			1.064		0.369	0.785
Model summary						
Loglikelihood ratio= 210.64						
Nagelkerke R^2 =0.875						
Chi-square = 78.01						

Significant at * 10%, ** 0.5 *** 1%; Source: field survey data, 2022.

influencing the health of the artisanal fish processors in the study area.

The coefficient of age of the respondents was positive and significant at 1% level of probability. This implies that the probability that the fish processors will fall sick increases with age. The older processors were more likely to fall sick as a result of fish processing than the younger ones. This agrees with [17] and [18] that the body's immune system becomes weak with age. The coefficient of sex had a positive significant relationship with probability of falling sick at 1% alpha levels. This implies that the likelihood of experiencing health issues increases with the female processors in the study area. In the same vein, labour type and frequency of fish processing were found to be positively significant at one-tailed test. The positive significant relationship of labour type implies that, fish processors reliance on family labour will increase the probability of falling sick. This might be because members of the family were engaging in off-farm employment thereby reducing their participation in fish processing activities in the study area. Furthermore, the probability of the fish processors falling sick or having health issues as a result of fish processing increases with the frequency of fish processing by 10% in the study area. This suggests that the more exposure of the processors are to smoke, cold fish, cuts etc. the more they experience health issues. A day increases in the frequency of processing will increase the probability of falling sick by 1.833% in the study area. This result affirms the reports by [19] that the probability that agro-food processors would fall sick increased with the time spent working.

Conversely, the coefficients of marital status ($p<0.01$), household size ($p<0.10$) and processing method ($p<0.05$) had negative significant relationship with the probability of the fish processors falling. This implies that probability of falling sick decreases with these variables in the study area. Based on marital status, it is expected that numbers of health issues episodes experienced by the fish processors will reduce due to assistance/support from their spouse i.e they will be less susceptible to health challenges than their single counterpart. This is corroborated by [20] studies who concluded that single people had substantially higher risk of driver injury than the married people. Also, household size will reduce stress and fatigue associated with fish processing due to the availability of more members to work. This concurs with the findings of [21].

3.4 Constraints of fish processing in the study area

The results in Table 6 explain the constraints faced by artisanal fish processors in the study area. A 5-point Likert-like scale (ranging from strongly agree, agree, undecided, strongly disagree and disagree) was used. Value of the discriminating index was calculated:

(5+4+3+2+1)/ 5= 3.0. Thus, the mean value greater than or equals to 3.0 indicates that the respondents agreed (A) to the variable as a constraint and any mean less than 3.0 implies that respondents disagree (DA) with such variable as a constrains to fish processing in the study area. The constrains were ranked according to their means which indicate the level of severity of these constrains as a limitation to the fisherfolks production efficiency and profitability. This includes cost of inputs ($\bar{x}$=4.89), transportation ($\bar{x}$=4.72), poor access to credit ($\bar{x}$=4.59), market price fluctuation ($\bar{x}$=4.46), low pricing of fish ($\bar{x}$=3.78) and heavy workload ($\bar{x}$=3.59) were the major constraints faced by the fish processing in the study area as identified by the respondents. According to some of the respondents the increases in prices of firewood and transportation has really reduced their market returns. "*If the price of all these inputs continue increasing, we may stop fish processing business as stated by one of the fish processors*". Thus, it become expedients for the government to intervene on the alarming constrains in the fish processing industry. This is in consonance [22] who also identify the major constraints faced by women fish processors to be insufficient capital, lack of improved processing facilities, and storage facilities.

Table 6. Mean scores of constraints of fish to processing in the study area (n = 120)

Constrains	χ	Rank	Remarks
Cost of inputs (charcoal, salts etc.)	4.89	1st	**A**
Transportation cost	4.72	2nd	A
Poor access to credit	4.59	3rd	A
Market price fluctuation	4.46	4th	A
Poor pricing of fish	3.78	5th	A
Heavy workload	3.59	6th	A
Inadequate water supply	2.78	7th	DA
Spoilage of fish	2.69	8th	DA
Discrimination	2.43	9th	DA
Poor market access	2.38	10th	DA
Cost of labour	2.35	11th	DA

Source: Field Survey, 2022. A= Agreement DA= disagreement

4. Conclusions

In conclusion, this study has highlighted the significant health risks and hazards associated with fish processing among artisanal fish processors in Epe Local Government Area. The study showed that majority of the artisanal fish processors in the study area processed frozen fish on daily basis using the old traditional brick kiln known as agbado. The study identified various health issues that ranged from respiratory ailments, eyes irritation, back strain and sprain, excessive heat and cold, malaria, skin cuts and burns, sting from fish spines and headache. The study further indicated that sex, age, and years of fish processing, households' size, labour type and frequency of fish processing and processing medium are significantly associated and contributing to the frequency and forms of health issues experienced by the fish processors in the study area. Therefore, recommends some measures to help lessen the frequency at which artisanal fish processors experienced health issues associated with fish processing in the study area.

i. Government intervention through bank of agriculture (BOA) in the area of loans and credit availability for fish processors to help acquire inputs that will facilitates their production.
ii. Also, government provision of improved processing mediums such as solar dryer, gas oven, and Altona smoking kiln will help to reduce their constant exposure to smoke inhalation and all other job hazards.
iii. Sensitization by extension contact agent on how to take precautionary measures against the occupational hazards (such as regular use of mask, gloves, gumboots etc.) and how to promptly deal with the consequences lest their families lose their source of livelihood. As well as awareness and introductions of improved processing technology to the artisanal fish processors.
iv. Regular medical check-ups and health education should be provided to artisanal fish processors to improve their health status and well-being.
v. Further research should be conducted to investigate the specific occupational health hazards and risks associated with the different types of fish processing methods and processing medium used in the study area.

Authors' contributions

Contributed to the paper idea, title, questionnaire design, data analysis and wrote the manuscript, O.A.A.; Analysed data and assisted in writing the manuscript, F.O.A.; Collected and coded data, O.B.S.

Acknowledgements

The authors hereby acknowledge the efforts of Odubitan Semiat Oluwaseun of Yaba college of technology who also assisted in collection of data

Funding

This research was self-funded by the authors and did not receive funding from any source.

Availability of data and materials

All data will be made available on request according to the journal policy.

Conflicts of interest

Authors have declared that no competing interests exist.

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