ISSN: 2695-2556 (Online

ISSN: 2651-5679 (Print)

AKSU Journal of Agriculture and Food Sciences 8(3) 17-32, 2024

Comparative Assessment of Occupational Hazards among Fish Processors Using Improved and Traditional Methods in Ogun State, Nigeria

[1]Olalekan J. Olaoye, [2*]Wahab G. Ojebiyi, [3]Francisca.O.A. George, [4] Funmilola F. Oyebanji, [5]Abiodun A. Adeola, [3]Misturat T. Abdulsemiu, [3]Akeem O. Adeniji, [3]Maria O. Monsuru, [3]Peter Onkpe

[1]Agricultural Media Resources and Extension Centre, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria
[2]Department of Agricultural Extension and Rural Development, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria
[3]Department of Aquaculture and Fisheries Management, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria
[4]Department of Environmental Management and Toxicology, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria
[5]Institute of Food Security, Environmental Resources and Agricultural Research, Federal University of Agriculture, P.M.B. 2240, Abeokuta, Nigeria

*Corresponding author email: oluwagbemiga2013@gmail.com; Tel: +2348067768470

Abstract

Protecting the health and well-being of fish processors is essential for enhancing the safety and efficiency of fish processing methods. This study comparatively assessed the occupational hazards associated with fish processing using improved and traditional methods in Ogun State, Nigeria. A cross-sectional survey research design was adopted and data were obtained with an interview schedule. A total of 60 fish processors using improved fish processing methods (IFPMs) and 198 fish processors using traditional fish processing methods (TFPMs) were sampled through multistage sampling procedure consisting of snowballing and convenient sampling techniques respectively. Data were analyzed using frequency counts, percentages, means, standard deviation and independent student-t test analytical techniques. Results revealed that majority of respondents using TFPMs (97.0%) and IFPMs (96.7%) had experienced work injuries. Higher proportions of respondents using TFPMs (59.6%) and IFPMs (96.7%) were working under safe conditions. Also, 98.0% and 100.0% of fish processors using TFPMs and IFPMs were exposed to less severe hazards respectively. Results of student-t test indicated that fish processors using IFPMs worked under conditions that are significantly of better quality ($t = 6.4894, p<0.01$). Also, there was a significant difference in the severity of occupational hazards of fish processors using TFPMs and IFPMs ($t = 9.9491, p<0.01$). The study concluded that the quality of working condition and severity of occupational hazards experienced by fish processors were *influenced by the fish processing methods. It was recommended that all fish processors should employ the use of improved technologies in their fish processing business.*

Keywords: Ergonomic hazards, Injuries, NIOMR smoking kiln, Physical hazards, Working condition

1.0 Introduction

The fisheries sub-sector, a vital part of the global agriculture sector, plays crucial roles in economies worldwide. Over 10% of the global population relies on fisheries for employment (Organisation for Economic Cooperation and Development - OECD, 2020). With the world population projected to rise from 8.1 billion to 9.7 billion by 2050 (Macrotrends, 2024a), there is an increasing demand for food and resources. Nigeria, currently ranked sixth in global population contribution, is expected to rank third by 2050 with over 377 million people (Macrotrends, 2024b), intensifying pressure on natural resources. The fisheries sector is pivotal for global food security (Food and Agriculture Organisation - FAO, 2020; Odioko and Becer, 2022), especially in Nigeria, where fish is a crucial source of affordable protein (FAO, 2020). Despite increasing domestic production, Nigeria's fish supply lags behind demand due to the growing population and alternative fish uses (Bello et al., 2018). Postharvest losses, caused by inadequate infrastructure and traditional methods, further reduce fish availability (Nwankwo et al., 2019). Thus, fish processing is essential to ensure fish reaches consumers, contributing significantly to food security, employment, and income, particularly in rural and coastal areas (Omoruwou et al., 2017; FAO, 2020). In Ogun State, fish processing is vital to the local economy, providing livelihoods through various processing operations.

Fish processing, albeit significant economically; is linked to a number of workplace concerns that endanger the health, safety, and welfare of those who work in the industry. Many physical, chemical, biological, ergonomic, and psychological dangers are associated with fish processing jobs. These risks might arise from equipment operation, processing activities, working conditions, and environmental factors (Olufayo et al., 2018). Fish processors' productivity, means of subsistence, and quality of life may be negatively impacted by these risks, which can also result in diseases, musculoskeletal disorders, respiratory issues, and psychosocial stress. The type and intensity of occupational hazards faced by fish processors are greatly influenced by the various processing techniques used, including both conventional and advanced techniques. Because traditional fish processing methods (TFPMs) frequently entail manual labour, antiquated equipment, and antiquated processes, processors may be more vulnerable to accidents, ergonomic strains, and exposure to dangerous materials including smoke and fumes (Kura et al., 2019). Conversely, automated machinery, standardised protocols, and contemporary technology are all included into improved fish processing techniques (IFPMs), potentially reducing occupational risks and enhancing worker conditions (National Institute of Oceanography and Marine Research (NIOMR), 2018).

There are few studies that directly compare the old and enhanced fish processing processes, despite the fact that both have been the subject of numerous investigations. This disparity indicates a lack of knowledge on the relative occupational hazards connected to each approach. Comparative assessment-focused research is necessary to determine which approaches are riskier and in what situations. Most research that has been done on fish processing hazards has concentrated on particular areas, such as ergonomic risks (Gonçalves & Ribeiro, 2022; Khan & Khan, 2021), exposure to hazardous materials (Lee & Cho, 2023), or injury rates (Reddy & Kumar, 2022). In Gonçalves and Ribeiro's (2022) study, for instance, ergonomic concerns associated with fish processing were examined; however, these risks were not compared between different processing methods. By filling in this knowledge gap, this comparative study can offer a more comprehensive understanding of the relative safety of various methods.

The broad objective of this research is to comparatively assess the occupational hazards associated with fish processing using improved and traditional methods in Ogun State, Nigeria. Specifically, the study described the socioeconomic characteristics of fish processors, ascertained the processing characteristics of the fish processors, and identified the injuries experienced by fish processors using improved and traditional methods, determined the working conditions of fish processors using improved and traditional methods, and determined the severity of occupational hazards experienced by fish processors using improved and traditional methods. The study tested the hypotheses that there were no significant differences in the quality of working condition and severity of occupational hazards between fish processors using improved and traditional processing methods.

2.0 Materials and Methods

2.1 Study Area, Sampling Procedure and Sample Size

This study was conducted in Ogun State. Ogun is one of the Southwestern States in Nigeria. Fishing, fish farming, fish processing, other fisheries related activities, and farming are the primary occupation of the residents, especially those in the rural fishing communities. Fish processing in rural communities is mostly done with traditional technologies, although some processors in urban cities also employ improved methods. The cross-sectional survey research design was adopted in this study with the use of an interview schedule.

A multistage sampling procedure was used during data collection. At stage 1, two of the four agricultural extension zones - Abeokuta and Ijebu-Ode were randomly selected. The second stage involved the purposive selection of fishing communities with high intensity of fish processors in the selected zones. The third stage entailed the convenient sampling of fish processors using traditional methods based on availability and readiness to participate in the study. The fourth stage involved the use of snowballing technique for sampling fish processors using improved methods. A total of 258 fish processors served as the sample size for this study.

2.2 Measurement of Key Variables

2.2.1 Quality of Working Condition

This was measured using an 8-item scale on four response options. Always, Occasionally, Rarely, and Never with assigned scores of 3,2,1 and 0 respectively. The expected minimum and maximum scores are 0 and 24, respectively**,** while 12 serve as the cut-off points. The lower the working condition quality score, the better the quality of working condition. This means that respondents with a total score of less than 12 are considered to be working under good/safe conditions, while those with a score of 12 and above are working under poor conditions.

2.2.2 Levels of Hazards Associated with Fish Processing

This was measured with a 26-item scale using 5 points response options of Very serious, Moderately serious, Slightly serious, Not serious and Never experienced with scores of 4,3,2,1, and 0, respectively. Items with cut-off point of at least 2.00 were considered as serious while those with mean values below 2.00 were considered as not serious. The minimum and maximum scores of the scale were 0 and 104, respectively. The respondents were categorized based on total scores obtained as High (71-104), Moderate (36-70) and Low (0-35).

2.3 Methods of Data Collection

Data for this study were obtained with the aid of an interview schedule which was administered through a face-to-face interview. The contents of the interview schedule were read to the fish processors in their local languages and their responses were recorded by the interviewer (a researcher). The interview schedule was used to obtain quantitative data since not all the fish processors could administer a questionnaire on their own due to their low level of educational attainment.

2.4 Methods of Data Analysis

Collected data were coded, cleaned and entered into Microsoft Excel Spreadsheet and then exported to the Statistical Package for Social Sciences version 21.0. The data were subjected to descriptive (frequency counts, percentages, and means), and inferential (independent sampled student-t test). Descriptive statistics were used to describe the specific objectives of this study while the independent sampled student-t test was used to test the research hypotheses at 0.01 levels of significance.

3.0 Results

3.1 Socioeconomic Characteristics of Fish Processors using Traditional and Modern Methods

Results in Table 3.1 reveal that 94.4% of the fish processors using traditional methods were female while 45.0% and 55.0% of those using the improved fish processing methods (IFPMs) were female and male respectively. Majority of the fish processors using traditional (93.4%) and improved (100.0%) were married. The highest proportion (55.6%) of the fish processors using traditional fish processing methods - TFMPs had primary education, 27.8% and 16.7% had no formal education and secondary education respectively while majority (83.3%) of fish processors using IFPMs had tertiary education. With respect to religious affiliation, 54.0% of fish processors using TFPMs practiced Christianity while 55.0% of those using IFPMs practiced Islam. Also, 24.2%, 41.9% and 24.7% of fish processors using TFPMs were within the age brackets of 31-40, 41-50 and 51-60 years respectively while 60.0%, 25.0% and 13.3% of those using IFPMs were within the same age brackets. The mean ages were approximately 46 ad 40 years for those using TFPMs and IFPMs respectively.

About half (50.5%) of fish processors using TFPMs had household size of 1-5 persons while 46.0% had 6-10 persons per households. In contrast, majority (71.7%) of the fish processors using IFPMs had 1-5 persons per household. The mean household sizes were 6±3.06 and

5±1.64 for fish processors using TFPMs and IFPMs respectively. Results further reveals that 62.1% of fish processors using TFPMs and 23.3% of fish processors using IFPMs had no other occupation. Other occupations for some of the fish processors using TFPMs were crop farming (16.2%) and trading (16.2%). The other occupations for those using IFPMs were crop farming (13.3%), livestock rearing (28.3%), fish farming (53.3%), and civil service (15.0%). While 82.3% of fish processors using TFPMs were residents of their respective fishing communities, only 58.3% of those using IFPMs were residents of their respective fishing communities.

3.2 Processing characteristics of fish processors using traditional and improved fish processing methods

Table 3.2 presents key findings on fish processing characteristics among processors using traditional fish processing methods (TFPMs) and improved fish processing methods (IFPMs). Fish processors using TFPMs typically have more years of experience, with 46.5% having 1-10 years and 31.8% having 11-20 years, compared to 73.3% and 26.7% for IFPMs, respectively. The mean years of experience were approximately 15 years for TFPM users and 9 years for IFPM users. A significant difference is noted in formal training: 69.7% of TFPM users lacked formal training, while 90.0% of IFPM users had received formal training. Regarding processing frequency, 33.3% of TFPM users processed fish 7 times a week, and 57.1% processed 4-6 times a week, whereas 41.7% of IFPM users processed 4-6 times and 41.7% processed 1-3 times a week. Smoking durations also varied, with 36.9% of TFPM users smoking for 1-6 hours and 56.7% for 7-12 hours per day. In contrast, 75.0% of IFPM users had a smoking duration of 7-12 hours per day.

Labor utilization and fuel sources showed distinct patterns: 65.7% of TFPM users employed family labor, 97.0% used self-labor, and 31.3% used hired labor. Conversely, 86.7% of IFPM users employed hired labor and 98.3% used self-labor, with only 16.7% using family labor. Fuel sources differed, with 97.5% of TFPM users using firewood and 98.3% of IFPM users using charcoal. Both TFPM and IFPM users predominantly used smoking as their primary processing method, with TFPM users primarily using smoking drums (91.4%), smoking mud (37.4%), and box ovens (41.4%), while 95.0% of IFPM users used the NIOMR smoking kiln.

3.3 Injuries Experienced by Fish Processors using Traditional and Improved Fish Processing Methods

Table 3.3 shows that a high percentage of fish processors experienced injuries: 97.0% of those using traditional fish processing methods (TFPMs) and 96.7% of those using improved fish processing methods (IFPMs) reported such incidents. Among TFPM users, injuries were most commonly reported in the hands (95.5%) and eyes (86.9%), whereas IFPM users primarily reported hand injuries (96.7%). Regarding injury treatment, 69.7% of TFPM users relied on first aid, 64.1% used local medications, and 28.8% sought hospital treatment. In contrast, 78.3% of IFPM users treated their injuries with first aid, while a smaller percentage used hospital treatment (18.3%) or local medications (13.3%).

Table 3.1: Distribution of fish processors using TFPMs and IFPMs by socio-economic characteristics

Socio-economic characteristics	Traditional (198)		Improved (n =60)	
	Frequency	Percentage	Frequency	Percentage
Sex				
Female	187	94.4	27	45.0
Male	11	5.6	33	55.0
Marital status				
Married	185	93.4	60	100.0
Divorced	2	1.0	0	0.0
Single	2	1.0	0	0.0
Separated	9	4.5	0	0.0
Level of education				
No formal education	55	27.8	0	0.0
Primary education	110	55.6	0	0.0
Secondary education	33	16.7	8	13.3
Tertiary education (First degree)	0	0.0	50	83.3
Post graduate	0	0.0	2	3.3
Religious affiliation				
Islam	91	46.0	33	55.0
Christianity	107	54.0	27	45.0
Age categories (years)				
≤30	12	6.1	1	1.7
31-40	48	24.2	36	60.0
41-50	83	41.9	15	25.0
51-60	49	24.7	8	13.3
61-70	6	3.0	0	0.0
Mean±Stdev	45.79±9.18		40.47±5.92	
Household size (persons)				
1-5	100	50.5	43	71.7
6-10	91	46.0	16	26.7
>10	7	3.5	1	1.7
Mean±Stdev	6±3.06		5±1.64	
Other occupations*				
Crop farming	32	16.2	8	13.3
Livestock rearing	2	1.0	17	28.3
Artisanal/vocational	5	2.5	0	0.0
Trading	32	16.2	2	3.3
Fishing	1	0.5	4	6.7
Fish farming	12	6.1	32	53.3
Civil service	0	0.0	9	15.0
None	123	62.1	14	23.3
Residence in community				
Residents	163	82.3	35	58.3
Non-residents	35	17.7	25	41.7

*Multiple responses; Stdev = Standard deviation

Table 3.2: Distribution of fish processors using TFPMs and IFPMs by processing characteristics

Processing characteristics	Traditional (n = 198)		Modern (n = 60)	
	Frequency	Percentage	Frequency	Percentage
Processing experience (years)				
1-10	92	46.5	44	73.3
11-20	63	31.8	16	26.7
21-30	33	16.7	0	0.0
>30	10	5.1	0	0.0
Mean±Stdev	14.58±9.67		9.1±3.88	
Fish processing training				
Had formal training	60	30.3	54	90.0
No formal training	138	69.7	6	10.0
Mode of processing				
Part time	56	28.3	12	20.0
Full time	141	71.2	47	78.3
Occasional	1	0.5	1	1.7
Frequency of processing/week				
7 times	66	33.3	10	16.7
4-6 times	113	57.1	25	41.7
1-3 times	19	9.6	25	41.7
Smoking duration per day (hours)				
1-6				
7-12	73	36.9	8	13.3
>12	112	56.7	45	75.0
Mean±Stdev	13	6.6	7	11.7
	7.85±3.45		9.58±3.06	
Type of labour*				
Family	130	65.7	10	16.7
Hired	62	31.3	52	86.7
Self	192	97.0	59	98.3
Fuel used*				
Fire wood	193	97.5	1	1.7
Charcoal	17	8.6	59	98.3
Saw dust	26	13.1	0	0.0
Coconut husk	45	22.7	0	0.0
Slaughtering methods*				
Salting	195	98.5	59	98.3
Cutting	111	56.1	47	78.3
Stunning	2	1.0	1	1.7
Processing methods*				
Frying	29	14.6	0	0.0
Smoking	196	99.0	60	100.0
Freezing	4	2.0	0	0.0
Smoking equipment*				
Smoking drum	181	91.4	0	0.0
Smoking mud	74	37.4	1	1.7
Pot oven	5	2.5	0	0.0
NIOMR Smoking kiln	0	0.0	57	95.0
Chorkor Smoking kiln	2	1.0	0	0.0
Box oven	82	41.4	0	0.0
SMA Smoking kiln	0	0.0	3	5.0

*Multiple responses; Stdev = Standard deviation

Table 3.3: Injuries experienced, parts affected and treatments

Variables	Traditional (n = 198)		Modern (n = 60)	
	Frequency	Percentage	Frequency	Percentage
Injuries experienced by fish processors				
Had experienced injuries	192	97.0	58	96.7
Never experienced injuries	6	3.0	2	3.3
Parts affected by injuries				
Hands	189	95.5	58	96.7
Legs	61	30.8	7	11.7
Head	20	10.1	2	3.3
Eyes	172	86.9	8	13.3
Treatments administered*				
First aid	138	69.7	47	78.3
Hospital	57	28.8	11	18.3
Local medications	127	64.1	8	13.3
None	8	4.0	0	0.0

*Multiple responses

3.4 Working Condition of Fish Processors using Traditional and Modern Methods

Results on the working condition of fish processors using TFPMs and IFPMs are presented in Table 3.4. The mean values in Table 3.4 were higher than the cut-off point (1.50) for fish processors using TFPMs with respect to poor lifting techniques ($\bar{x}$ = 2.32±0.76), poorly constructed/designed equipment ($\bar{x}$ = 1.65±1.02), and working under high temperature ($\bar{x}$ = 2.07±1.10). However, all the fish processors using IFPMs had mean values lower than 1.50 in all the listed conditions. Figure 3.1 shows a summary of the categories of fish processors by working conditions. While almost all (96.7%) of the fish processors using IFPMs were working under good/safe conditions, only 59.6% of those using TFPMs worked under good conditions and 40.4% were working under poor conditions.

3.5 Occupational hazards associated with fish processing

Results on the severity of occupational hazards experienced by fish processors using TFPMs and IFPMs are presented in Table 3.5. The mean values show that smoke (2.85±0.97) was the most severe hazard associated with fish processing using traditional methods. This was followed by stings from fish spines ($\bar{x}$ = 2.82±0.82), aggression from customers ($\bar{x}$ = 2.66±0.86), minor cuts and scrapes ($\bar{x}$ = 2.64±1.10), redness of the eyes ($\bar{x}$ = 2.58±0.83), and back strain and sprain ($\bar{x}$ = 2.41±0.93). With mean values of less than the cutoff point of 2.50, none of the items in Table 3.5 was considered as severe hazards for fish processors using improved methods. The mean values further reveal that physical hazards ranked first among fish processors using TFPMs ($\bar{x}$ = 2.09) and IFPMs ($\bar{x}$ = 1.43). This was followed by ergonomic hazards (TFPMs - 1.47 and IFPMs - 1.10), chemical hazards (TFPMs - 1.41 and IFPMs - 1.05), and biological hazards (TFPMs - 1.10 and IFPMs - 1.02). Figure 3.2 also summarizes that all (100.0%) of the fish processors using IFPMs and almost all (98.0%) of fish processors using IFPMs indicated that their processing activities was associated with less severe hazards.

Table 3.4: Working conditions of fish processors using TFPMs and IFPMs

Working condition	Traditional	Modern
Poor lifting techniques	2.32±0.76	0.85±0.82
Poorly constructed/designed equipment	1.65±1.02	0.75±0.79
Working under high temperature	2.07±1.10	0.93±0.71
Long sitting duration	1.33±0.84	1.38±0.80
Under direct sunlight	0.87±1.06	0.55±0.83
Wet or slippery floor	0.53±0.85	0.82±0.91
Poor hand tools	1.18±0.96	0.57±0.65
Constrained neck posture	0.51±0.84	0.52±0.60

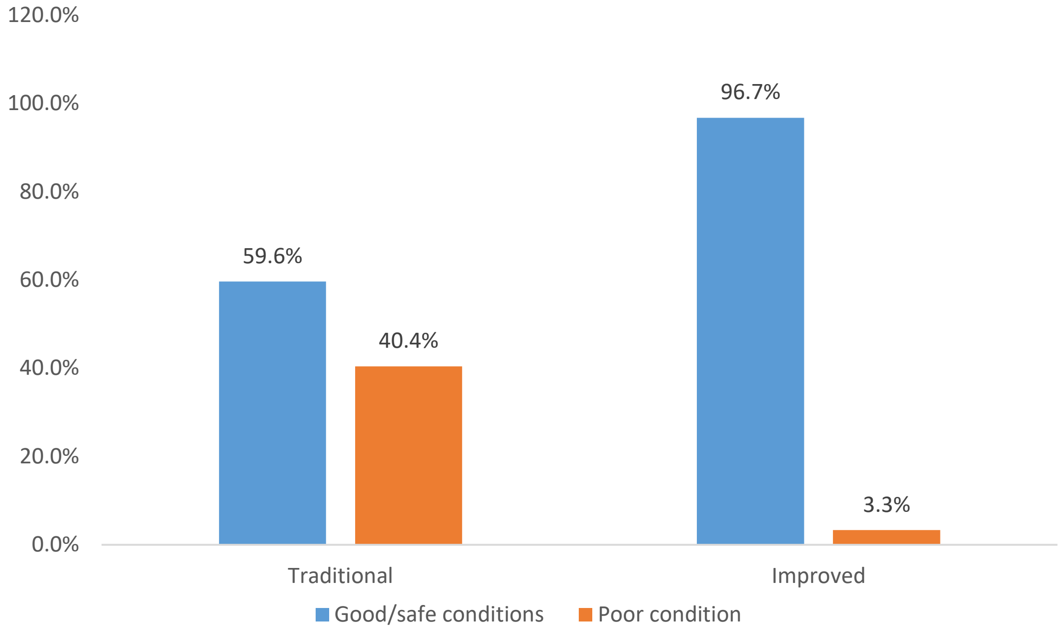

Figure 3.1: Categorization of fish processors by working condition

Table 3.5: Mean and standard deviation of severity of occupational hazards associated with fish processing

Hazards	Traditional	Modern
Physical hazards	2.09	1.43
Minor cuts and Scrapes	2.64±1.10	1.95±1.08
Falls Injury	1.49±0.88	1.08±0.38
Sting from fish spines	2.82±0.82	1.93±0.95
Redness of the eyes	2.58±0.83	1.03±0.26
Burns injury	1.70±0.96	1.72±1.03
Head injury from loads	1.42±0.79	1.07±0.31
Bruising	1.44±0.84	1.22±0.52
Aggression from customers	2.66±0.86	1.42±0.74
Chemical Hazards	1.41	1.05
Smoke	2.85±0.97	1.20±0.68
Disinfectant	1.25±0.63	1.02±0.13
Gases	1.20±0.55	1.02±0.13
Vapour	1.16±0.51	1.02±0.13
Dust	1.23±0.62	1.08±0.38
Fumes	1.08±0.31	1.02±0.13
Mist	1.09±0.35	1.02±0.13
Ergonomic Hazards	1.47	1.10
Internal Injuries	1.62±0.94	1.08±0.28
Broken bones	1.27±0.70	1.05±0.29
Dislocation	1.25±0.63	1.02±0.13
Back strain and sprain	2.41±0.93	1.48±0.81
Swelling of legs	1.43±0.81	1.03±0.26
Whitlow	1.73±0.95	1.23±0.72
Depression	1.20±0.57	1.02±0.13
Mental stress	1.18±0.53	1.00±0.00
Skin irritation	1.15±0.53	1.00±0.00
Biological Hazards	1.10	1.02
Pathogenic infestation	1.11±0.42	1.02±0.13
Parasitic infestation	1.08±0.40	1.02±0.13

Cut-off point = 2.50

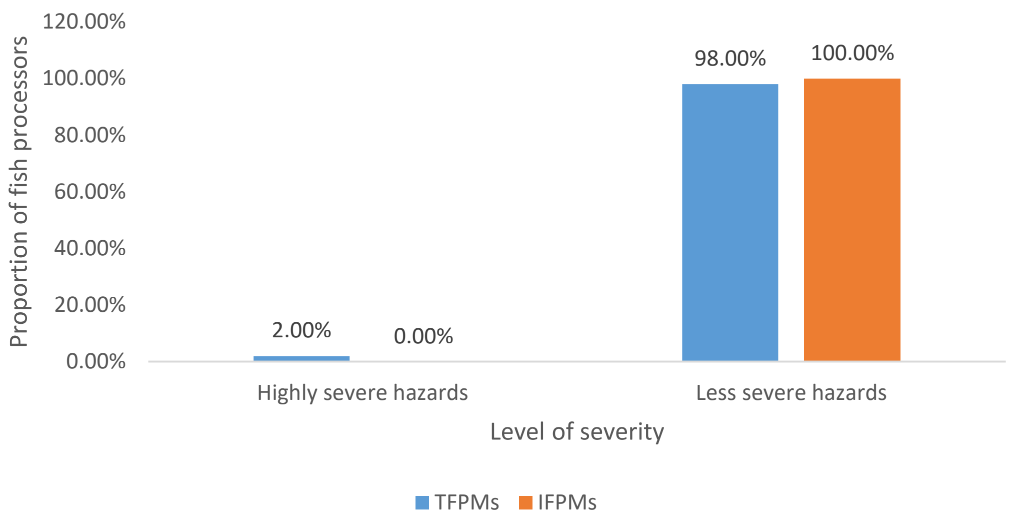

Figure 3.2: Distribution of fish processors by severity of occupational hazards

3.6 Differences in Working Condition Quality of Fish Processors using TFPMs and IFPMs

Results in Table 3.6 reveal that fish processors using TFPMs had significantly ($p<0.01$) higher working condition quality score ($\bar{x}$ = 10.46±4.531) than those using IFPMs ($\bar{x}$ = 6.2667±3.304) with mean difference of 4.0929 and t-value of 6.4894.

Table 3.6: Test of difference in quality of working condition of fish processors using TFPMs and IFPMs

Fish processors	Mean	Standard deviation	Mean difference	t-value	p-value
TFPMs	10.46	4.531	4.0929	6.4894	0.001
IFPMs	6.2667	3.304			

3.7 Differences in Severity of Occupational Hazards Experienced by Fish Processors using TFPMs and IFPMs

Table 3.7 shows that fish processors using TFPMs had significantly ($p<0.01$) higher severity score ($\bar{x}$ = 42.005±8.422) than those using IFPMs ($\bar{x}$ = 30.717±4.514) with mean difference and t-value of 11.288 and 9.9491 respectively.

Table 3.7: Test of difference in severity of occupational hazards experienced by fish processors using TFPMs and IFPMs

Fish processors	Mean	Standard deviation	Mean difference	t-value	p-value
TFPMs	42.005	8.422	11.288	9.9491	0.001
IFPMs	30.717	4.514			

4.0 Discussion

The study highlights several factors influencing the use of fish processing methods in Ogun State. One key observation is that the majority of fish processing workers are married, reflecting social and cultural influences on industry participation. Gender norms play a significant role, with women predominantly engaged in traditional fish processing methods (TFPMs) and men more often using improved fish processing methods (IFPMs). This distribution underscores the impact of cultural expectations and access to resources, such as advanced technology and training, on occupational choices. Research by Parker and Song (2017) and World Bank (2019) indicates that gender roles and resource access shape employment patterns, which is evident in the different hazard profiles associated with TFPMs and IFPMs. Educational background and age also appear to influence the adoption of processing techniques. Fish processors using IFPMs generally have higher educational attainment compared to those using TFPMs, suggesting that access to formal education and training plays a crucial role in technology adoption (Akande et al., 2018). Additionally, older processors are more likely to use traditional methods, possibly due to resistance to change or lack of resources and training for new technologies. Younger individuals, being more adaptable and better educated, are more inclined to embrace technological advancements (Nguyen et al., 2020). This age-related disparity highlights the broader challenges of technology adoption in the fish processing industry.

Household size and occupational diversification further differentiate the use of TFPMs and IFPMs. Fish processors employing TFPMs tend to have larger households but fewer additional occupations, indicating that fish processing is their primary source of income. In contrast, those using IFPMs show greater livelihood diversification, engaging in supplementary activities such as fish farming and animal husbandry. This diversification is often facilitated by technological advancements and better access to resources (Akande et al., 2018). Furthermore, the prevalence of TFPMs in fishing communities may be attributed to traditional practices and limited access to alternative technologies, as noted by FAO (2020) and Kura et al. (2019). The challenges faced by fishing communities in adopting IFPMs underscore the need for improved infrastructure and support in these areas (FAO, 2018).

The study highlights several key factors influencing the adoption and use of fish processing methods in Ogun State. Fish processors using traditional fish processing methods (TFPMs) tend to have more years of experience compared to those using improved fish processing methods (IFPMs). This experience, combined with entrenched habits and resistance to change, can make the transition to new technologies challenging (World Bank, 2019). The relatively newer use of IFPMs is reflected in the higher percentage of processors with formal training in modern techniques. Formal education equips processors with essential knowledge and skills for adopting advanced methods, whereas those with traditional practices often lack formal training, leading to inadequate safety awareness and increased risk (Olufayo et al., 2018; Hobbs et al., 2016; Antia-Obong et al, 2021). Additionally, fish processors using IFPMs typically work full-time and engage in multiple jobs, while those using TFPMs primarily rely on fish processing as their main income source, indicating a greater livelihood reliance on traditional methods (Akande et al., 2018; FAO, 2019).

The study also notes differences in processing practices and labor utilization between TFPM and IFPM users. Fish processors using IFPMs tend to spend more time smoking fish daily, thanks to larger processing capacities of modern kilns, which may lead to higher production volumes compared to those using TFPMs. Traditional processors often use family labor for processing, while IFPM users employ hired labor to manage increased scale and mechanization (FAO, 2018; World Bank, 2019). Fuel sources differ as well, with TFPM users relying on readily available firewood and IFPM users opting for charcoal for its higher energy density and consistent heat (FAO, 2020; Olufayo et al., 2018). Smoking remains the predominant processing method due to its effectiveness in flavor enhancement and shelf-life extension, with TFPMs using traditional equipment and IFPMs employing more sophisticated tools like the NIOMR smoking kiln (NIOMR, 2018; FAO, 2020)

It was shown that almost all fish processors using TFPMs and IFPMs had experienced some sort of injuries during fish processing. This is because handling equipment, chopping, filleting, and other operations involved in fish processing can result in cuts, lacerations, punctures, and strains (Kura *et al*. 2019). This implies that whether or not new technology is employed, fish processing is associated with injuries. According to Olufayo *et al*. (2018), the likelihood of accidents and injuries among fish processors is further elevated by the repetitive nature of processing jobs, exposure to sharp machinery, and slick working conditions. Furthermore, fish processors using TFPMs suffered injury to both hands and eyes, while those using IFPMs only had hand injuries. The reason for this is probably because pre-processing activities related to fish processing usually need the use of sharp tools, such as knives. Moreover, the employment of conventional techniques subjects fish processors to airborne particles, smoke, ash, and fumes, increasing the risk of eye damage (Kura *et al*. 2019).

Additionally, using IFPMs, such as the NIOMR smoking kiln, might cause hand injuries for processors who handle equipment, operate machinery, and conduct physical labor linked to processing activities (NIOMR, 2018). While all fish processors in the sample operated in a good and safe manner, a greater proportion of those using IFPMs than TFPMs did so because traditional methods involved improper lifting technique, shoddy equipment design, and high temperatures. This could be explained by the fact that modern equipment, such as the NIOMR and Chorkor smoking kilns, is designed for productivity, efficiency, and safety, and may provide better working conditions for fish processors (NIOMR, 2018). According to FAO (2019), using IFPMs tends to reduce exposure to hazardous materials, reduce labour costs associated with physical labour, and enhance control over processing parameters. Olaoye *et al*. (2017) found that fish processors in Ogun Waterside Local Government Area worked in extremely dangerous conditions; this conclusion, however, contradicts their findings.

The outcomes also demonstrated that employing antiquated methods of fish processing was riskier than using contemporary methods. This implies that ergonomic stresses, heat-related illnesses, and other workplace dangers are more common among workers who employ traditional methods. This is probably because using traditional methods requires labor-intensive manual labour, lifting large materials, handling sharp objects, and working in stuffy, hot conditions with insufficient ventilation (Olufayo *et al*. 2018; Kura *et al*. 2019). FAO (2020) states that incorporating cutting-edge technologies can help lower labor hazards, increase productivity, and enhance the welfare of fish processors.

Subsequent analysis showed that smoke, small cuts and scrapes, eye redness, fish spine stings, and other respiratory problems were the most dangerous work-related risks associated with fish processing. The results of Olufayo *et al*. (2018), who said that small cuts and scrapes are common work-related injuries, especially for fish processors who use rough instruments, are in line with this. These wounds may appear small, but they can result in severe pain, infection, and discomfort that could limit productivity. Additionally, these risks are greater for fish processors using TFPMs as opposed to IFPMs, suggesting that technological advancements and modernization contribute to a decrease in occupational hazards.

Diverse levels of occupational dangers and poor working conditions have a substantial influence on the health, safety, and overall well-being of fish processors. It was shown that the levels of occupational hazards and working conditions experienced by fish processors utilizing TFPMs and those employing IFPMs were significantly different. This is so that the implementation of IFPMs, which frequently involve mechanized processes, regulated surroundings, and standard procedures, can result in improved working conditions, such as less physical strain, better ergonomics, and increased safety precautions (FAO, 2019). Processors utilizing IFPMs often have better working conditions than those using TFPMs due to the deployment of more modern equipment, better facilities, and advanced processing technologies (NIOMR, 2018). According to the data, fish processors employing IFPMs worked in better conditions and faced fewer major hazards than their counterparts using TFPMs. This could imply that safer working environments and the adoption of improved technologies are related. Kura *et al*. (2019) state that although the level of occupational hazards faced by fish processors varies between IFPMs and TFPMs, TFPM users often face more serious concerns due to the nature of traditional processing procedures.

5.0 Conclusion and recommendations

Fish processors generally experienced occupational hazards in their hands, worked in safe conditions and experienced less severe hazards. The study also deduces that fish processors using IFPMs worked in safer conditions and experienced lesser severe hazards than those using TFPMs. The study concludes that the quality of working condition and occupational hazards experienced by fish processors are influenced by the fish processing methods. All fish processors should be sensitized on the importance of working in safe and hygienic environments, fish processors should be trained on the use of personal protective equipment, and fish processors should be availed credit facilities at low interest rates.

Acknowledgement

The authors hereby acknowledge the financial contribution from TETFUND through the Institutional-Based Research Grant.

References

Akande, T. M; Owolabi, O. A; and Oke, E. A. (2018). Gender disparity in access to education in Nigeria: Causes and implications. African Educational Research Journal, 6(4), 223-231.

Antia-Obong, E.A., Hubbard, C. and Garrod, G. (2021). Influence of transaction costs on smallholder poultry market participation in Nigeria: A mixed methods analysis. *World Food Policy*, 7(2): 96-110.

Bello, R. M; Otubusin, S. O; and Akinnawo, B. O. (2018). Post-harvest fish losses in Nigeria: A synoptic review. Journal of Aquatic Sciences, 33(1), 35-44.

Food and Agriculture Organization (FAO). (2018). Gender dimensions of agricultural and

rural employment: differentiated pathways out of poverty. Rome: FAO.
Food and Agriculture Organization (FAO). (2019). The state of world fisheries and aquaculture 2018 - Meeting the Sustainable Development Goals. Rome: FAO.
Food and Agriculture Organization (FAO). (2020). The state of world fisheries and aquaculture 2020. Available at: http://www.fao.org/state-of-fisheries-aquaculture.
Gonçalves, P; and Ribeiro, A. (2022). Ergonomic risks in fish processing industries: A comprehensive review. Journal of Occupational Health and Safety, 15(3), 195-210.
Hobbs, G. R; Torgerson, C. J; and Plant, R. W. (2016). Safe conduct? A review of safety climate and culture construction industry research. Construction Management and Economics, 34, 764-778.
Khan, M; and Khan, S. (2021). Ergonomic risk assessment in the seafood processing sector: Case studies from South Asia. International Journal of Industrial Ergonomics, 29(2), 142-153.
Kura, Y; Ijaola, T. O; and Sogbesan, A. O. (2019). Occupational health hazards among women engaged in traditional fish smoking in Northern Nigeria. European Journal of Preventive Medicine, 7(2), 25-31.
Lee, J; and Cho, H. (2023). Exposure to hazardous materials in the fish processing industry: Health implications and safety measures. Environmental Health Perspectives, 131(4), 403-417.
Macrotrends (2024a). World population 1950-2024. Available at: https://www.macrotrends.net/global-metrics/countries/WLD/world/population (Accessed: 6 May 2024).
Macrotrends (2024b). Nigeria population 1950-2024. Available at: https://www.macrotrends.net/global-metrics/countries/NGA/nigeria/population (Accessed: 6 May 2024).
National Institute of Oceanography and Marine Research (NIOMR). (2018). NIOMR smoking kiln. National Institute of Oceanography and Marine Research. Lagos: NIOMR
Nguyen, Q. T; Le, T. T. H; and Phan, T. D. (2020). Age and employment: Evidence from Vietnam. Journal of Population and Social Studies, 28(4), 324-337.
Nwankwo, O. C; Onwughalu, J. T; and Nnabuife, C. (2019). Postharvest fish losses and handling practices among fish processors in Anambra State, Nigeria. Journal of Fisheries and Aquatic Science, 14(4), 273-280.
Odioko, E; and Becer, Z. A. (2022). The economic analysis of the Nigerian fisheries sector: A review. Journal of Anatolian Environmental and Animal Sciences, 7(2), 216-226.
Olaoye, O. J; Ojebiyi, W. G., Ogunremi, J. B; Oose, M. O; Ojeikhoa, O. R and Opele, A. I. (2017). Some hazardous practices associated with artisanal fish processing in Ogun Waterside Local Government Area of Ogun State, Nigeria. Applied Tropical Agriculture, 22(1), 68-77.
Olufayo, M. O; Omolade, O. O; and Ajani, E. K. (2018). Assessment of occupational health and safety practices among fish processors in Lagos, Nigeria. International Journal of Environmental Health and Public Health, 1(1), 12-21.
Omoruwou, W. P; Lawal, F. I; and Aderolu, A. Z. (2017). Fish processing and preservation methods adopted by fish processors in Ilaje Local Government Area, Ondo State, Nigeria. International Journal of Fisheries and Aquatic Studies, 5(3), 134-139.
Organisation for Economic Cooperation and Development (OECD). (2020). Sustainable fisheries and aquaculture policies for the future. Available at: https://www.oecd.org/agriculture/topics/fisheries -and-aquaculture/ 10.06.2021
Parker, L.; and Song, M. (2017). Gender, occupation, and the cultural context of domestic and industrial foodwork in Canada. Gender, Place & Culture, 24(9), 1343-1359.

Reddy, S; and Kumar, N. (2022). Injury rates and occupational hazards in fish processing: A cross-sectional study. Journal of Safety Research, 54(2), 162-175.

World Bank. (2019). World Development Report 2019: The changing nature of work. Washington, DC: World Bank.