Effects of Standard Fish Processing Practices on Livelihood Status of Fish Processors in Lagos and Osun States

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Notwithstanding the advantages that go with utilization of improved fish processing technologies and practices, many fish processors still do not use the improved technologies optimally. The aim of this study was to investigate the effects of Standard Fish Processing Practices (SFPP) on the livelihood status of fish processors in Lagos and Osun States. Users and non-users of SFPP were sampled in Lagos and Osun States. Sampling of users involved a random selection of 70% from the trained 150 fish processors per state to give a sample size of 105 respondents per state and 210 users for the two states, while snowballing technique was employed to select 150 non-users per state and 300 non-users for the two states to give a total sample size of 510 respondents for the study. Data used for this study were collected through an interview schedule and analysed using frequency, percentage, mean, and T-test. The findings of the study revealed that; higher proportion of SFPP users and non-users were female (67.1%) and (68.3%) respectively. Majority (74.3%) of SFPP users had a high livelihood status whereas above average (56%) of non-users revealed a low livelihood status. There was a positive significant difference ($p<0.05$) in the livelihoods of users and non-users of SFPP. The study concluded that the usage of SFPP has significantly improved the livelihood status of fish processors in Lagos and Osun states, Nigeria. The study therefore recommended that efforts should be intensified by agricultural extension organizations to increase dissemination of SFPP among non-users in Nigeria.

Keywords: Livelihood activities, fish processing, SFPP, Livelihood status, NSPRI

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Introduction

Fish consumption made up 7% of all proteins consumed and 17% of the animal protein intake of the world's population, it is also the most important single source of high-quality protein for humans and a crucial source of food (FA0, 2020), and however, in Nigeria it makes up as much as 40% of the required animal protein (WorldFish 2022). When compared to sources like beef, mutton, and chicken, it offers a cheap supply of animal protein (Olaleye *et al*., 2019). Through its contribution to agriculture's part of Nigeria's Gross Domestic Products (GDP), fish continues to have a crucial role in the country. The fisheries sector contributed 1.09% GDP of the country's total GDP in the year 2020 and 0.9% in the Q3 of 2021 (Odioko & Becer, 2022).

In order to support healthy lifestyles, sustainable economic growth, full and productive employment, and decent work for all as enshrined in the Sustainable Development Goals, SDGs 3, 8, and 16, Nigeria is faced with the challenge of meeting the protein demands of its constantly growing human population (Oladimeji *et al*., 2019). The Fish value chain contributes to the livelihoods of many communities in Nigeria especially in the coastal and riverine areas. According to WorldFish (2022), over 1,477,651 people were reported to be engaged in the fisheries sector in Nigeria.

Within the aquaculture sector, the processing and marketing activities offer the most employment prospects (Okoronkwo, 2016). Since fish is highly perishable and needs to be handled carefully to prevent spoilage, this has necessitated the introduction of a number of improved processing technologies (Kamaldeen *et al*., 2016).

In particular, the Nigerian Stored Products Research Institute (NSPRI) has designed and delivered some effective post-harvest technologies in reducing post-harvest losses in Nigeria (Adegbola *et al*., 2020), chiefly among these is the Standard Fish Processing Practices (SFPP) which included the improved NSPRI fish smoking kiln®. This is a technology for drying fish efficiently; it consists of a drying chamber with drying trays, a combustion chamber and an oil collector. The smoking kiln can be classified based on heat source (charcoal, gas and electricity). There are different sizes to choose from 25kg, 50kg, etc. The use of NSPRI smoking kiln ensures high quality fish (golden brown appearance) with internationally acceptable poly-cyclic aromatic hydrocarbons level,

the oil collected during drying is helpful in many ways, especially in the pharmaceutical industries (NSPRI, 2021).

The cost, waste, and outright losses associated with processing fish are reduced, its shelf life is increased, and its economic viability is improved when using improved processing technologies (Akinbami *et al*., 2012). In contrast, traditional or conventional processing methods require a lot of labour and are not cost-effective. According to Nkeme *et al*. (2013), traditional methods have not been effective and efficient in preventing microbial spoilage of harvested fish.

In addition, fish processors handle small quantity of fish daily, hence, earned low income due to lack of accessibility to productive resources such as capital, modern technologies, extension services and training, and other constraints (Ike-Obasi & Ogubunka, 2019). Also, traditional dryers emit heat and smoke, which can cause respiratory issues. The skin, eyes, and some processors' fingerprints are also impacted (FAO, 2020). This results in a decrease in the fish's commercial worth and the money that would have been earned by the processors in both domestic and foreign markets. In the light of the above, it is expected that this study will unfold the effects of Standard Fish Processing Practices on livelihoods of users and non-users in the study area with the specific objectives of (i) describe the demographic characteristics of the users and non-users of SFPP; (ii) examine the livelihood activities of the users and non-users of SFPP; and (iii) determine the livelihood status of users and non-users of SFPP.

Research Methodology

Study area

Lagos State

Lagos State lies approximately on longitude 2°42" and 3° 22" E of the Greenwich Meridian and between the latitude 6° 22" and 6° 42" N of the Equator. It has a projected population of 17,552,940 persons (Lagos Bureau of Statistics, 2012). It is bounded in the North and East by Ogun State and in the West and South by Republic of Benin and Atlantic Ocean respectively. The state is endowed with enormous fresh water resources as well as coastline. The coastline is about 180 km bordering the Atlantic Ocean, which is 22.5% of Nigeria's coastline (Oyediran *et al*., 2016). Trading and fishing are the major livelihood activities aside white collar-jobs in the state.

Osun State

Osun State, South-Western Nigeria, lies within latitudes 6^{o} and 9^{o} N of the equator and approximately between longitudes 2^{o} and 7^{o} E of Greenwich Meridian (Anamayi *et al*., 2010). It is one of the non-coastal states of the Federal Republic of Nigeria. It covers an estimated area of 8,062 square kilometres (Ashley-Dejo *et al*., 2020). The State runs an agrarian economy with a vast majority of the populace taking to farming which included fish farming and processing (Olajide & Omonana, 2019).

Population of the study

The population for the study consisted of the users and non-users of Standard Fish Processing Practices in Lagos and Osun States. The users of Standard Fish Processing Practices are the beneficiaries of training/capacity building of SFPP by NSPRI in Lagos and Osun States while non-users of SFPP are fish processors that make use of traditional/artisanal technologies.

Sampling procedure and sample size

Users and non-users of SFPP were sampled for the study. Selection of users involved a random selection of 70% from the trained 150 fish processors per state to get a sample size of 105 respondents for each state and 210 users for the two states, while snowballing sampling technique was employed to select 150 non-users for each state to give a sample size of 300 non-users for the two states and a total sample size of 510 respondents for the study. To enhance reliability and validity of the result more non-users were sampled. Primary data for this study was obtained through the administration of interview schedule.

To achieve various objectives stated for the study, both descriptive and inferential statistics were employed to analyse the data collected. The descriptive statistical tools used are: frequency, percentage, mean, and standard deviation while the inferential statistical tool is T-test.

The sum of the standardized scores of livelihoods ability, assets and activities were the livelihood score which was later categorized as low livelihood and high livelihood status. The sum of the scores of social, human, financial, physical, and natural capitals was the livelihood assets score, measured as, **Social capital**: The strength of users and non-users' networks and connections was measured on a three-point scale of low, average, and high for social capital items/benefits like patronage, mutual relation with family members and friends, neighbourhood interaction, trust among business partners, and relationship among occupational group members, later aggregated based on obtained scores. **Human capital**: The height of human support that users and non-users have was measured on human capital within the household and human capital outside the household. Human capital items like number of labour, and educational level of labour, others are skill level of labour, physical strength of labour, experience level of labour, and accessibility level of labour, these were later aggregated based on obtained scores;

categorized as low human capital and high human capital. **Financial capital**: The weight of financial support that users and non-users have was measured on financial capital items like savings in the bank, savings in cooperatives, formal remittances, informal remittances, access to a loan from formal sources and access to a loan from informal sources. Their responses were collated and obtained scores were later categorized as low financial capital and high financial capital. **Physical capital**: The quality of physical support that users and non-users have was measured on a four-point scale of None, Poor, Average, and Good for physical capital items like, type of toilet, source of drinking water, house ownership, and type of building. **Natural capital**: The size of natural capital that users and non-users have was measured for natural capital items like river for fishing, water sources, and land ownership, obtained scores were later aggregated as low and high.

The change in revenue of livelihood activities was measured on a three-point scale of Decreasing, Unchanged, and Increasing. Mean was calculated and ranked.

Results and Discussion

Demographic information

The result on Table 1 shows that, higher proportion of SFPP users in Osun state was female (60%) while male (56%) dominated for non-users of SFPP. The result for users of SFPP is in tandem with the result by Adegbola *et al*. (2020), where female was reported as the majority users of NSPRI improved fish smoking kiln in Osun State. For non-users, it was observed that many males from the northern part of Nigeria are the gender mainly in fish processing in Osun state; they are usually in clusters using traditional methods especially mud oven and metal drums with firewood to process fish. The gender distribution in Lagos State shows female with a majority (74.3%) for users and 92.7% for non-users of SFPP. This result further showed that fish processing is a venture mostly dominated by female. This is in line with Alabi *et al*. (2020) who reported a female dominated fish processing venture. While it is slightly different from Adetomiwa and Yesufu (2020), who found out that male dominated improved fish processing technology in southwestern Nigeria.

The age distribution shows that 45.3 years is the mean age among users and a mean of 45.2 years was recorded for non-users of SFPP in the study area. While the age ranges between 28 years and 67 years for users, it is between 23 years to 62 years for non-users of SFPP. It shows that the processors cut across both the young and elderly people. The young are known to be more inquisitive and are more likely to adopt new innovation. While the elderly are more likely to possess wisdom and experience that will assist them in their vocation. This is similar to the result obtained by (Omitoyin *et al*., 2020) in their research, titled "Gender participation in aquaculture in Lagos state, Nigeria which reported that, majority of fish handlers in Lagos state had age range of 31-60 years.

The Findings also shows that, 89% and 95% of the processors are married among users and non-users of SFPP respectively. Marriage is known to bring about a need to seek for more funds to take care of the family expenses. Hence, people may be into fish processing as a major or secondary source of income to augment finance for family up keep. This is in line with the findings by Odebode and Adetunji (2013) where it was stated that majority of the respondents were married.

The household size distribution revealed that majority (52.4%) of users has $\leq$ 5 members, while majority (62%) of non-users has 6-10 household members in the study area. Household members could be assets to the processors in their vocation; cost of production could be reduced, and marketing of processed fish also enhanced since family members can serve as source of labour. A large family size on the other hand can be a burden to the family in trying to provide sustenance to the family members; processors may reduce their investment in the vocation, thereby reducing their level of production and amount of revenue accruable from fish processing value chain. The result is similar to the of Odediran and Ojebiyi (2017) who stated that fish processors in Lagos State have an average of six household members.

Table1: Demographic Characteristics of the respondents

	Osun (n=105) Users (f(%))	(n=150) Non-users (f(%))	Lagos (n=105) Users (f(%))	(n=150) Non-users (f(%))	Pooled (n=210) Users (f(%))	(n=300) Non-users (f(%))
Age						
≤ 30	3 (2.9)	8 (5.3)	4 (3.8)	2(1.3)	7 (3.3)	10 (3.3)
31-40	40 (38.1)	31 (20.7)	16 (15.2)	34 (22.7)	56 (26.7)	65(21.7)
41-50	45 (42.9)	69 (46.0)	54 (51.4)	78 (52.0)	99 (47.1)	147(49.0)
≥51	17 (16.2)	42 (28.0)	31 (29.5)	36 (24.0)	48 (22.9)	78 (26.0)
Mean (SD)	44.2±8.28	45.4±8.08	46.4±7.72	45.1±5.99	45.3±8.06	45.2±7.10
Range	28.0-67.0	23.0-62.0	30.0-62.0	29.0-62.0	28.0-67.0	23.0-62.0
Gender						
Male	42(40)	84(56.0)	27(25.7)	11 (7.3)	69 (32.9)	95 (31.7)
Female	63(60)	66 (44.0)	78(74.3)	139 (92.7)	141 (67.1)	205 (68.3)
Marital Status						
Single	3 (2.9)	10 (6.7)	4 (3.8)	0	7 (3.3)	10 (3.3)
Married	90 (85.7)	138 (92.0)	97 (92.4)	148 (98.7)	187 (89.0)	286 (95.3)
Divorced	4 (3.8)	0	0	2 (1.3)	4 (1.9)	2 (0.7)
Widowed	8 (7.6)	2 (1.3)	4 (3.8)	0	12 (5.7)	2 (0.7)
Household size						
≤ 5	75(71.4)	70(46.7)	35(33.3)	39(26.0)	110(52.4)	109(36.3)
6-10	29(27.6)	78(52.0)	70(66.7)	108(72.0)	99(47.1)	186(62.0)
≥ 11	1(1.0)	2(1.3)	0	3(2.0)	1(0.5)	5(1.7)
Mean (SD)	4.4±1.96	5.8±1.99	5.9±1.48	6.5±1.84	5.2±1.88	6.1±1.95
Range	2.0-12.0	1.0-13.0	3.0-10.0	3.0-15.0	2.0-12.0	1.0-15.0

Livelihood status of the respondents

According to Table 2, the level of household human capital is high for users of SFPP with percentage of 78.6% and mean of 16.85±4.00 and while non-users of SFPP have a low level of household human capital with mean of 7.00±7.32 and 98% of the respondents. House-hold human capital is expected to provide most times unpaid labour from the family members of the owner of a business enterprise. A high level of this particular asset may lead to an improved livelihood status for the business owner.

Table 2: Distribution of respondents according to level of household human capital

Obtained score	Level	Users		Non-Users	
		Frequency	Percentage	Frequency	Percentage
7 – 21	Low	45	21.4.	294	98.0
22 – 35	High	165	78.6	6	2.0
Total		210	100.0	300	100.0
Mean±SD		16.85±4.00		7.00±7.32	

The result in Table 3 shows low levels of percentage and mean of non-household human capital (95.2%, 9.85±7.16), (99.3%, 1.40±3.93) for users and non-users of SFPP respectively. The result indicated that non-household human capital has low contribution to the livelihood status of the processors. The result for household human capital differs from this, where the users of SFPP have a high level of household human capital compared to non-users that still reported a low level. Weiss (2015) emphasised the value of human capital as a resource that gives those who have access to it benefits in pursuing gainful employment, off-farm pursuits, and other forms of engagements that pay and promote livelihood success that contribute to poverty reduction.

Table 3: Distribution of respondents according to level of non-household human capital

Obtained score	Level	Users		Non-Users	
		Frequency	Percentage	Frequency	Percentage
7 – 21	Low	200	95.2	298	99.3
22 – 35	High	10	4.8	2	0.7
Total		210	100.0	300	100.0
Mean±SD		9.85±7.16		1.40±3.93	

Table 4 shows that majority (90.5%) of SFPP users possess a high level of physical capital compared to non-users where above average (66.0%) have a low level of physical capital. Physical capitals which are the infrastructures in the environment of the processors can play a significant role in the enhancement of livelihood of the respondents. The high level of physical capital reported for users of SFPP maybe as a result of increased livelihood activities leading to the possession of more physical assets. While non-users with low livelihood activities may likely experience limited possession of physical infrastructures, like type of toilet, house ownership, source of drinking water, etc. Kataria *et al*. (2012) reiterated that physical capital support sustainable livelihood outcomes.

Table 4: Distribution of respondents according to level of physical capital

Obtained score	**Level**	**Users**		**Non-Users**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
7 – 21	**Low**	20	9.5	198	66.0
22 – 36	**High**	190	90.5	102	34.0
Total		210	100.0	300	100.0
Mean±SD		26.36±2.22		18.14±3.13	

Table 5 shows that slightly above average (56.7%) of SFPP users have high levels of natural capital but higher proportion (69.3%) of non-users showed a low level of natural capital. The result shows a high distribution of natural assets among users, which can be a contribution to the well-being and livelihood of people in the study area. This is consistent with the definition provided by Guerry *et al*. (2015) who described natural capital as the living and non-living ecosystem components that, in addition to people and the products they produce, contribute to the production of goods and services that are crucial for people's well-being.

Table 5: Distribution of respondents according to level of natural capital

Obtained score	**Level**	**Users**		**Non-Users**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
5 – 15	**Low**	91	43.3	208	69.3
16 – 25	**High**	119	56.7	92	30.7
Total		210	100.0	300	100.0
Mean±SD		19.60±4.12		11.21±2.03	

Table 6 shows that above average (55.2%) of SFPP users has high level of social capital, which may be attributed to the reported high membership of social groups and benefits experienced. While higher proportion (60.0%) of non-users has low social capital, this could be as a result of limited membership of social groups and benefits. This is supported by Akinnagbe and Ipinmoye (2022) who emphasised that social group widens the social circle and allows social benefits to get to members of the group.

Table 6: Distribution of respondents according to level of social capital

Obtained score	**Level**	**Users**		**Non-Users**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
8 – 23	**Low**	104	49.5	180	60.0
24 – 38	**High**	116	55.2	120	40.0
Total		210	100.0	300	100.0
Mean±SD		21.10±3.02		14.52±4.14	

The financial capital level on Table 7 shows a high level of financial capital among the users of SFPP with about 64.3% and a mean of 37.85±4.60 while non-users with 98% on low financial capital with a mean of 19.56±3.44. This result is congruent with Hassan *et al*. (2020) who observed that adoption of improved fish technology may provide better economic gains in increase in income, improve standard of living and food security.

Table 7: Distribution of respondents by level of financial capital

Obtainable score	Status	Users		Non-Users	
		Frequency	Percentage	Frequency	Percentage
12 – 36	Low	75	35.7	294	98.0
37 – 60	High	135	64.3	6	2.0
Total		210	100.0	300	100.0
Mean±SD		37.85±4.60		19.56±3.44	

Respondents' livelihood activities

Mean of livelihood activities in Table 8 shows users of SFPP engage in the following occupations; fish processing with a mean of 2.924, trading/business (2.781) and fish farming (1.395) with majority of the respondents indicating an increase in income. Whereas non-users of SFPP engage in fish processing (1.933) and trading/business (1.257) with a reported decrease in income by higher proportion of the respondents. This is comparable to Ike-Obasi and Ogubunka, (2019) which reported that women engage in fishing, fish processing and trading to enhance their food security and income.

Table 8: Distribution of respondents according to livelihood activities

Occupations	No	Yes					Rank
		Decreasing	Unchanged	Increasing	Mean	SD	
Users							
Fish processing	0	3(1.4)	10(4.8)	197(93.8)	2.924	.3153	1st
Trading/Business	5(2.4)	11(5.2)	9(4.3)	185(88.1)	2.781	.6486	2nd
Fish farming	91 (43.3)	4(1.9)	8(3.8)	107(51.0)	1.395	1.461	3rd
Livestock rearing	151(71.9)	8(3.8)	8(3.8)	43(20.5)	.729	1.228	4th
Salary job	160(76.2)	0	2(1.0)	48(22.9)	.705	1.267	5th
Artisan/Handicraft	201(95.7)	4(1.9)	2(1.0)	3(1.4)	.081	.4243	6th
Unskilled daily-waged labour	208(99.0)	1(0.5)	1(0.5)	0	.014	.1540	7th
Non-Users							
Fish processing	0	159(53.0)	2(0.7)	139(46.3)	1.933	.9961	1st
Trading/Business	69(23.0)	156(52.0)	4(1.3)	71(23.7)	1.257	1.062	2nd
Livestock rearing	265(88.3)	4(1.3)	0	31(10.3)	.323	.9174	3rd
Unskilled daily-waged labour	285(95.0)	0	2(0.7)	13(4.3)	.143	.6304	4th
Fish farming	287(95.7)	7(2.3)	6(2.0)	0	.083	.4439	5th
Artisan/Handicraft	294(98.0)	0	2(0.7)	4(1.3)	.053	.3799	6th
Salary job	298(99.3)	0	2(0.7)	0	.020	.2445	7th

The result of the aggregate livelihood status on Table 9 shows that majority (74.3%) of users of SFPP with a mean of 198.7±17.38 has a high livelihood status whereas majority (56%) of non-users with a mean of 185.30±14.45 has a low livelihood status. The implication of the result is that the usage of SFPP has been shown to increase the livelihood status of the respondents positively compared with the non-users of SFPP. This result is similar to Nkeme and Frank (2022) who stated that the usage of improved processing technologies enhanced economic stability and increases cash flow. While Karki (2021) established that livelihood comprises the capabilities, assets and activities required for a means of living.

Table 9: Summary of respondents' aggregate livelihood status

Obtained score	Level	Users		Non-Users	
		Frequency	Percentage	Frequency	Percentage
75 – 185	Low	54	25.7	168	56.0
186 – 295	High	156	74.3	132	44.0
Total		210	100.0	300	100.0
Mean±SD		198.7±17.38		185.30±14.45	

Table 10 shows a significant difference in the livelihood status of users and non-users of SFPP (p = 0.000) with a mean difference of 13.36333. The implication of this is that SFPP was able to significantly improve the livelihood status of users compared to non-users. Hence, the hypothesis that there is no significant difference in the livelihood status of users and non-users of SFPP was rejected. The result demonstrates that the usage of SFPP significantly improved the livelihood of users in the study area. This is corroborated by Hassan *et al*. (2020) who asserted that there was statistical significant difference between the level of living of the fish processors that adopted Modified Drum-Oven Technology and non-adopters.

Table 10: T-test analysis showing the difference in the livelihood status of users and non-users of SFPP

				t-test for Equality of Means				
	Mean	Std. Dev.	Std. Error	t-stat	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Users	198.70	17.38	3.710	9.446	508	0.000*	13.36333	1.41471
Non-users	185.30	14.45	2.296					

Equal variance assumed
*Differs significantly at 0.01 level

Conclusion

The usage of SFPP has significant effect on the livelihood status of fish processors in Lagos and Osun States. This means that the technologies have significantly improved the livelihood status of users in the study area. The study therefore recommended that efforts should be intensified by agricultural extension organizations to increase information dissemination on SFPP to non-users of SFPP technologies among fish processors in Nigeria.

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