
**ASSESSMENT OF FISH HANDLING PRACTICES IN IGANGA FISH MARKET AND
THEIR PERCEIVED IMPACTS ON FRESH FISH QUALITY.**

BY

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**A RESEARCH PROPOSAL SUBMITTED TO THE FACULTY OF NATURAL
RESOURCES AND ENVIRONMENTAL SCIENCES IN PARTIAL
FULFILLMENT FOR THE AWARD OF BACHELOR'S DEGREE IN FISHERIES
AND WATER RESOURCE MANAGEMENT OF BUSITEMA UNIVERSITY**

DECLARATION

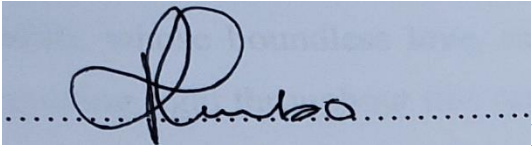
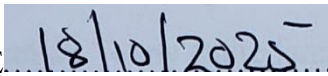
I, **Mukisa Araphat**, hereby certify that this research project is wholly my original work, except where properly acknowledged through citations and references. It has not been submitted, in part or in full, to any university or academic institution for the award of a Bachelor's Degree in Fisheries and Water Resource Management or any other qualification. I attest that all sources utilized have been appropriately credited, and this work reflects my independent scholarly effort.

SIGNATURE.....  DATE..... 05/10/2025

MUKISA ARAPHAT.

APPROVAL

This is to certify that this research has been submitted with my approval as supervisor.

SIGNATURE  DATE 

Dr. GIMBO REBECCA

DEDICATION

This research is lovingly dedicated to my cherished parents, Mr. **Mukama Sulait** and Ms. **Kagoya Hamidah**, whose boundless love, sacrifices, and unwavering encouragement have been my guiding light throughout this academic journey. To my entire family, your steadfast support and belief in my dreams have fueled my determination. I also extend this dedication to my course mates and esteemed lecturers at Busitema University, whose relentless guidance, inspiration, and tireless support have shaped this work and my growth as a scholar. Your collective presence has made this achievement possible.

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ABSTRACT

This study assessed fish handling practices and their impacts on fish quality in Iganga fish market, Uganda, with the general objective of evaluating past practices and their effects on fish quality and safety. Specific objectives included identifying fish handling practices employed, evaluating their impact on fish quality and freshness with a focus on spoilage rates and hygiene risks, and assessing vendors' knowledge and awareness of proper handling, storage, and hygiene practices. A cross-sectional descriptive design was used. Data was collected through questionnaires and observations using 100 fish vendors in Iganga fish market. Fish preservation primarily involved salting (46%) or insulated containers with ice (37%). Storage of fresh fish was predominantly under ice (48%) or refrigeration (26%). 84% display fish on tables. 72% practice fish scaling before sales; use of clean tap water (52%) is commonly used. However, 80% reported frequent spoilage, primarily attributed to high temperatures (36%) and inadequate facilities (31%), with bad odor (64%) as the dominant spoilage indicator. Hygiene practices focused on facility cleaning (75%), but only 69% of vendors had received training, mostly from government agencies (56%). Key challenges included limited refrigeration (36%) and lack of training (32%). Respondents (52%) suggested improved hygiene to enhance fish quality, with 89% expressing willingness to participate in training programs. The study recommended targeted training, improved infrastructure, and stricter hygiene regulations to reduce spoilage and ensure consumer safety.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

In developing countries like Uganda, fish markets play a critical role in providing access to affordable protein to the population. Despite this, fish is a highly perishable commodity that requires proper practices in handling, transportation, and storage to maintain its quality and safety for human consumption. Improper fish handling practices are a common problem that compromises the quality of fish, leading to spoilage, contamination, and economic losses (oparaku, 2012). The Iganga fish market, like many local markets in Uganda, faces challenges related to hygiene, handling, and storage, which are exacerbated by limited infrastructure and knowledge gaps among vendors and suppliers. This study seeks to address these issues by focusing on current practices, their impacts on fish quality, and the knowledge level of vendors regarding proper fish handling.

Fish handling practices typically involve the processes along the value chain of harvesting, transportation, storage, and display for sale. Poor handling practices, such as the use of dirty containers, lack of ice or refrigeration during transport, and improper storage at the market, can lead to rapid spoilage. Studies have shown that unhygienic practices in handling and storage increases the risk of microbial contamination, which has a direct impact on fish quality and shelf life (Gram, 1996). For example, the use of non-food-grade containers or exposure to high ambient temperatures accelerates bacterial growth, leading to higher spoilage rates and potential health risks for consumers (FAO, Fishery and aquaculture country profiles, 2016).

In Iganga fish market, anecdotal evidence suggests that fish is often displayed in open stalls without adequate cooling systems, making it susceptible to contamination from dust, flies, and human contact. These practices indicate a need to systematically assess the current handling methods and determine the specific factors contributing to fish spoilage and contamination risks.

The quality and freshness of fish are directly influenced by post-harvest handling practices. Spoilage in fish begins immediately after death due to enzymatic activity, microbial growth, and chemical oxidation (Huss, 1995). The rate of spoilage is further accelerated by improper storage conditions, such as a lack of refrigeration or ice, resulting in the loss of sensory quality attributes like texture, color, and smell. Studies conducted in similar markets have found that poor fish handling practices not only lead to a high rate of spoilage but also contribute to economic losses for vendors and reduced nutritional value for consumers (Adebayo-Tayo, 2012).

In addition, contamination risks are heightened by poor hygiene practices, such as the use of unclean utensils, inadequate handwashing by vendors, and exposure to unsanitary market environments. These practices increase the likelihood of pathogenic contamination, including *Escherichia coli*, *Salmonella* spp., and *Listeria monocytogenes*, which pose serious public health risks (Olafsdottir, 1997). Evaluating the specific contamination risks in Iganga fish market is critical to identifying the gaps in hygiene and proposing practical remedies.

Another key factor influencing fish quality is the level of knowledge and awareness among vendors regarding proper handling, storage, and hygiene practices. Studies have shown that many small-scale fish vendors lack formal training in fish preservation techniques and are unaware of the importance of maintaining cold chain systems (Omojowo, 2014). In Uganda, limited access to training programs and extension services for fish vendors has been identified as a major gap in ensuring food safety in local markets (Assefa, 2017).

Preliminary observations in Iganga suggest that vendors may have limited knowledge of best practices, such as the use of ice, proper cleaning of display areas, and personal hygiene. A systematic assessment of their awareness and practices is necessary to design targeted interventions aimed at improving fish handling and reducing spoilage rates.

While several studies have examined fish handling practices and their impacts on quality, most focus on large-scale fisheries or urban markets with better access to infrastructure (Adebowale, 2008). There is limited research on rural and semi-urban markets like Iganga Fish Market, where infrastructure is often inadequate, and traditional handling methods are predominant. Furthermore, existing studies rarely combine an assessment of handling practices, their direct impacts on fish quality, and the knowledge level of vendors in a single framework.

This study fills these gaps by adopting an integrated approach to assess fish handling practices, evaluate their effects on spoilage and contamination, and examine the knowledge and awareness of vendors. The findings will provide evidence-based recommendations for improving fish handling practices and ensuring better fish quality and safety in Iganga fish market.

1.2 Problem statement:

The Iganga fish market, a vital node in Uganda's fish supply chain, faces significant challenges due to inadequate fish handling practices, leading to detrimental impacts on fish quality and consumer safety. Currently, practices such as insufficient icing, lack of proper sanitation, and inconsistent temperature control have resulted in high post-harvest losses, with studies indicating that up to 30% of fish are lost due to spoilage before reaching consumers (Ayinia, 2020). These issues not only compromise the freshness and safety of fish products but also pose serious public health risks, as contaminated fish can lead to foodborne illnesses that disproportionately affect vulnerable populations (Mugisha, 2019).

The ideal situation would involve standardized, best-practice fish handling techniques throughout the supply chain, ensuring that fish remains safe, fresh, and of high quality from the point of capture to the consumer's table. This includes maintaining optimal temperatures during storage and transport, implementing rigorous sanitation protocols, and providing comprehensive training for all fish handlers to enhance their knowledge and skills in effective handling practices (Ngutadayo, 2021). In such an environment, both

the economic viability of fish traders and the health of consumers would be significantly improved, contributing to enhanced food security and sustainable livelihoods.

To bridge the gap between the current state and the ideal situation, targeted interventions are necessary. These may include the development of training programs for fish handlers focused on best practices in fish preservation, the establishment of quality control measures to monitor fish handling throughout the supply chain, establishment of the fish handling facilities and infrastructures in the market and the implementation of community awareness campaigns to educate consumers about the importance of fish quality and safety. Furthermore, collaboration among stakeholders including fish traders, local government, and health authorities will be essential to create a supportive framework that encourages adherence to improved handling practices.

By assessing the deficiencies in current fish handling practices, this assessment aims to identify the current fish handling practices used by vendors and suppliers in Iganga fish market, evaluate the impact of these practices on fish quality and freshness focusing on spoilage rates, hygiene contamination risks and suggest remedies and assess the knowledge and awareness of vendors about proper fish handling, storage and hygiene practices.

1.3 Research Objectives and Research questions

1.3.1 General objective

To assess fish handling practices and their impacts on the quality of fresh fish in the Iganga fish market.

1.3.2 Specific objectives.

1. To identify the current fish handling practices used by vendors and suppliers in Iganga fish market.
2. To evaluate the impact of these practices on fish quality and freshness focusing on spoilage rates, hygiene contamination risks and suggest remedies.
3. To assess the knowledge and awareness of vendors about proper fish handling, storage and hygiene practices.

1.3.3 Research questions

1. What are the current fish handling practices employed by vendors and suppliers in the Iganga fish market?
2. How knowledgeable are fish vendors in the Iganga fish market about proper handling, storage, and hygiene practices, and what factors influence their level of awareness?

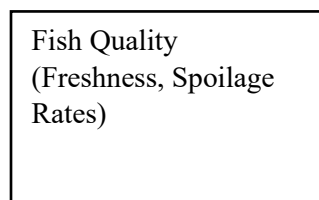
What can be done to improve on fish quality in Iganga fish market?

1.3.4 Hypothesis

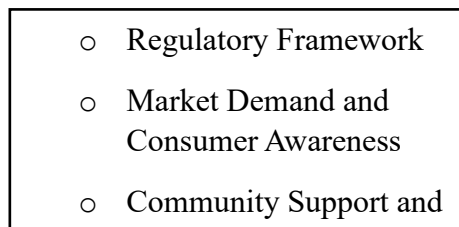
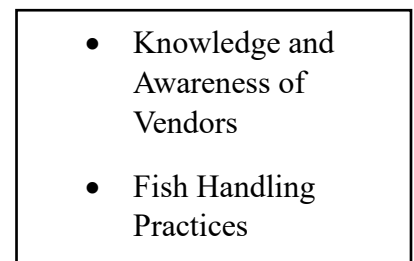
Improper fish handling practices in the Iganga fish market significantly contribute to decreased fish quality and increased spoilage rates.

1.4 Conceptual framework

Dependent Variables



Independent Variables



Intervening Variables

Figure 1. 1 Conceptual frame work.

1.5 Justification of the study

Understanding and improving fish handling practices is essential to mitigate health risks associated with fish consumption. Poor handling can lead to contamination and foodborne

illnesses, which can have severe consequences for consumer health. Fish is a significant source of income and nutrition for many communities in Uganda. By identifying and addressing inadequate handling practices, this assessment can help reduce post-harvest losses, thereby enhancing the economic viability of fish traders and supporting local livelihoods. Also, given that fish is a primary protein source for many households, improving handling practices directly contributes to food security. Ensuring that fish reaches consumers in optimal condition helps maintain its nutritional value.

Last but not least, enhancing fish quality through better handling practices can improve marketability and consumer trust. This, in turn, encourages sustainable practices within the fish trade, benefiting both the economy and the environment.

1.6 Significance of the study.

The assessment of fish handling practices and their impacts on quality in the Iganga fish market holds significant importance for various stakeholders, including consumers, fish traders, policymakers, and public health officials. The key aspects of its significance include:

By identifying inadequate handling practices that lead to contamination and spoilage, the study aims to improve the safety and quality of fish products. This is crucial for protecting public health and reducing the risk of foodborne illnesses associated with poor fish handling.

The study provides insights into the relationship between handling practices and fish quality. By promoting best practices, it can help maintain the freshness and nutritional value of fish, benefiting consumers and contributing to overall food security.

Furthermore, Understanding the impact of handling practices on fish quality can lead to reduced post-harvest losses. This, in turn, can enhance the profitability of fish vendors and suppliers in the Iganga market, fostering economic stability and growth within the community.

Also, the findings can guide the development of targeted training programs for fish handlers, equipping them with essential knowledge and skills in proper handling, storage, and hygiene practices, thereby elevating industry standards. Lastly, by improving fish handling and reducing waste, the study supports sustainable fisheries management. This is essential for the long-term viability of fish resources and the livelihoods dependent on them.

1.7 Scope of the study

1.7.1 Geographical scope

The area of study is Iganga fish Market is found in Iganga Municipality, Iganga District which is approximately 120 kms east of Kampala and is located on Plot 1–7, Saza Road, in Kasokoso Central 1 Village, Kasokoso Ward, Central Division, Iganga Municipality, Iganga District. The coordinates of Iganga district are: Latitude: 0° 37' 59.99" N Longitude: 33° 28' 59.99" E.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Fish handling practices play a perilous role in determining the quality and safety of fish sold in markets. Proper handling techniques are essential to maintain the freshness of fish, minimize spoilage, and reduce the risk of contamination. This review explores existing literature on fish handling practices, their impact on fish quality, and the knowledge levels of vendors concerning proper fish handling, storage, and hygiene, with a focus on the Iganga fish market.

2.2 Current Fish Handling Practices

Globally, fish handling practices vary depending on the level of development, infrastructure, and awareness among fish handlers. In developed countries, advanced technologies such as automated cold chains, insulated containers, and strict hygiene protocols are employed to maintain fish quality (Huss, 1995). However, in developing countries, manual handling, lack of refrigeration, and substandard hygiene are prevalent. Fish is often transported in open containers, exposing it to contamination and spoilage due to high temperatures (Gram, 1996).

In Africa, fish handling practices are heavily influenced by socio-economic challenges. A study by (Akande, 2010) highlighted poor infrastructure, lack of cold storage facilities, and inadequate transportation as key factors contributing to post-harvest losses in small-scale fisheries. Fish is often handled on dirty surfaces, and traditional methods, such as smoking and sun drying, are used to extend shelf life. These practices, while effective to some extent, compromise the sensory and nutritional quality of fish.

In East Africa, particularly in countries like Kenya, Tanzania, and Uganda, fish handling practices remain inadequate. For example, fish from Lake Victoria are commonly transported without ice or refrigeration, leading to rapid spoilage (Onyango M.-O. , 2019). Vendors at local markets often display fish on open tables, exposing it to flies, dust, and

direct sunlight. Furthermore, lack of access to clean water for washing fish and equipment exacerbates contamination risks

In Uganda, small-scale fisheries dominate the sector, with fish being an important source of livelihood and nutrition. However, studies indicate that fish handling practices at landing sites and markets are generally poor. (Kaaya, 2010) found that fish is frequently stored in unclean containers, and vendors lack proper training in hygienic handling. Transportation from landing sites to markets is another critical point where fish quality is compromised due to the absence of cold storage facilities.

While specific studies on Iganga District are limited, observations from similar districts suggest that fish handling practices in local markets are substandard. Vendors in Iganga fish market commonly display fish on open surfaces without refrigeration or protection from contamination. Additionally, the use of unclean tools and lack of personal hygiene among handlers likely contribute to quality deterioration and health risks for consumers (MUgabe, 2020).

Fish handling practices among vendors and suppliers vary widely depending on the infrastructure, level of training, and access to proper storage facilities. Studies in similar markets have shown that the majority of fish vendors rely on rudimentary handling techniques, such as using wooden slabs and unclean surfaces for fish display, which significantly increases the risk of contamination (Odeyemi, 2018). In many fish markets across Uganda, including Iganga, fish is often transported and stored in open containers without adequate temperature control, leading to accelerated spoilage (Akande, 2010). The lack of proper refrigeration and cold chain management has been identified as a major challenge in maintaining fish freshness, especially in rural markets where electricity is unreliable (Adewumi, 2014).

Moreover, the use of inappropriate packaging materials such as plastic bags and newspapers further contributes to the decline in fish quality. These materials are often not food-grade, and their reusability increases the likelihood of cross-contamination (Uddin,

2021). In Iganga, the situation is similar, where vendors lack access to proper handling equipment and are often unaware of the importance of hygienic practices (Katongole, 2018).

2.3 Impacts of Fish Handling Practices on Fish Quality

Fish is highly perishable, and poor handling practices accelerate spoilage. Globally, studies have shown that improper temperature control is the main factor influencing spoilage. Without chilling, spoilage begins within hours due to bacterial activity (Ababouch, 2005). In Africa, spoilage rates are higher due to inadequate infrastructure and reliance on traditional preservation methods such as smoking and salting (Diei-Ouadi, 2011).

In Uganda, (Kaaya, 2010) report that fish spoilage accounts for significant post-harvest losses, especially during transportation and at markets. In Iganga, anecdotal evidence suggests that spoilage is a common issue due to high ambient temperatures and lack of cold storage.

Hygiene is a critical factor in maintaining fish quality and ensuring safety for consumers. Globally, poor hygiene practices, such as using unclean tools and handling fish with bare hands, are linked to contamination with *E. coli* and *Salmonella* (Huss, 1995). In East Africa, markets often lack basic sanitation facilities, increasing the risk of microbial contamination (Onyango M.-O. , 2009).

In Uganda, studies have shown that vendors often handle fish on dirty surfaces and use contaminated water for washing, further compromising quality (MUGabe, 2020). In Iganga, similar practices are likely prevalent, posing health risks for consumers.

Poor handling practices significantly affect fish quality and freshness, leading to increased spoilage rates. Studies have demonstrated that inadequate temperature control is one of the most critical factors affecting fish spoilage, with fish beginning to deteriorate rapidly when stored above 4°C (FAO, Guidelines for improved quality and safety., 2020). In Uganda, and specifically in the Iganga fish market, the absence of cold storage facilities

has been shown to result in high spoilage rates, with an estimated 20-30% of fish becoming unsellable due to spoilage before reaching consumers (Akande, 2010).

Hygiene practices also play a significant role in determining fish quality. A study by (akinola, 2021) found that poor personal hygiene among fish vendors and inadequate sanitation in market environments contribute to microbial contamination, which accelerates fish spoilage and poses health risks to consumers. Inadequately cleaned surfaces, lack of proper waste disposal systems, and the presence of pests further exacerbate the risk of contamination (Odeyemi, 2018). In the Iganga fish market, similar issues have been observed, with vendors often handling fish with bare hands and using unclean water for washing fish, thereby increasing the likelihood of contamination (Katongole, 2018). In addition to microbial risks, improper handling practices can lead to physical and chemical spoilage of fish. Crushing, bruising, or cutting fish incorrectly during transportation and display can cause tissue damage, which accelerates spoilage (Uddin, 2021). Furthermore, exposure to high temperatures and oxygen can lead to oxidation of fish oils, producing off-flavors and odors that reduce the marketability of the product (Adewumi, 2014).

To mitigate these challenges, the use of ice during transportation and storage has been recommended as a cost-effective solution. In addition, training programs for vendors on hygiene and quality standards can significantly reduce spoilage and contamination risks (Diei-Ouadi, 2011).

2.4 Knowledge and awareness of vendors

Globally, awareness of proper fish handling practices varies widely. In developed countries, vendors are trained in quality assurance and hygiene standards, ensuring compliance with food safety regulations (Huss, 1995). However, in developing countries, lack of training and education is a major barrier to improving handling practices (Ababouch, 2005).

In Africa, vendor awareness of proper fish handling is generally low. Studies have shown that most vendors lack formal training and are unaware of the risks associated with poor hygiene and storage practices (Akande, 2010).

In Uganda, (Kaaya, 2010) report that most fish vendors have limited knowledge of quality control measures. Similarly, in Iganga, vendors are likely to prioritize short-term profits over investments in proper handling equipment, reflecting a lack of awareness and financial constraints. The level of knowledge and awareness among fish vendors concerning proper handling, storage, and hygiene practices is often limited, particularly in rural markets. Several studies have highlighted a lack of formal training for fish vendors, which results in the use of suboptimal handling techniques (Adewumi, 2014). In markets like Iganga, fish vendors typically rely on traditional knowledge passed down through generations, rather than scientific or modern best practices (Katongole, 2018). This lack of awareness is compounded by the absence of regular government inspections and enforcement of hygiene standards (Uddin, 2021).

Research has shown that when vendors receive proper training in fish handling and hygiene practices, there is a significant improvement in the quality of the fish sold and a reduction in spoilage rates (akinola, 2021). Training programs that focus on cold chain management, personal hygiene, and the use of clean and appropriate storage facilities are particularly effective in improving fish handling outcomes (FAO, Guidelines for improved quality and safety., 2020). However, such programs are often lacking in regions like Iganga, where the fish trade is largely informal and regulatory oversight is minimal (Akande, 2010). The literature suggests that fish handling practices in the Iganga fish market are likely to be suboptimal, with significant implications for fish quality and consumer safety. The lack of cold storage, poor hygiene practices, and limited knowledge among vendors all contribute to high spoilage rates and increased contamination risks. Addressing these issues through improved infrastructure, vendor training, and stricter regulatory oversight could lead to significant improvements in fish quality and safety in the Iganga fish market.

CHAPTER THREE METHODOLOGY

3.1 Introduction

This chapter presents the study design, study area and population, research approaches sampling methods, data collection methods, data analysis and limitations, ethical considerations and references.

3.2 Study area

The area of study is Iganga fish market found in Iganga municipality, Iganga District with the following coordinates: Latitude: $0^{\circ} 37' 59.99''$ N Longitude: $33^{\circ} 28' 59.99''$ E (Figure 3.1). Iganga located in Eastern Uganda, is approximately 120kms east of Kampala and is located on Plot 1–7, Saza Road, in Kasokoso Central 1 Village, Kasokoso Ward, Central Division, Iganga Municipality, Iganga District

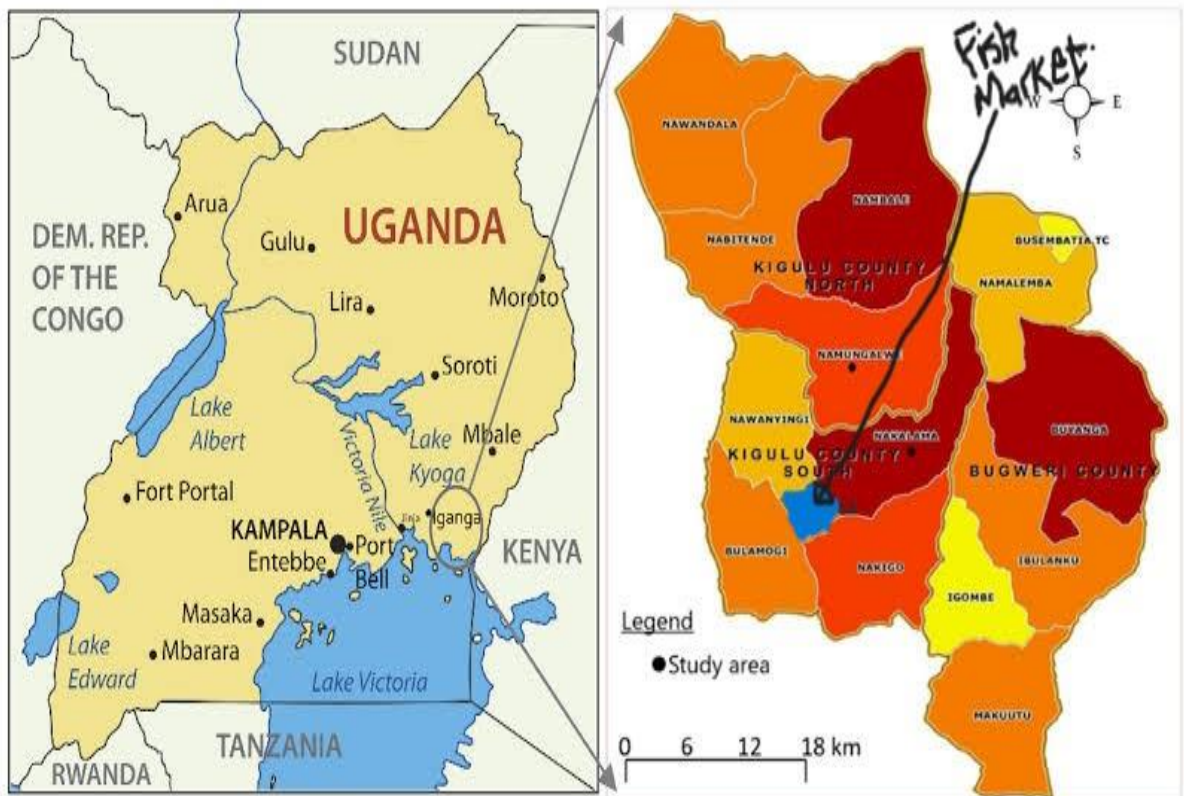


Figure 3. 1 showing the map of Iganga district.

Iganga district experiences a tropical rainforest climate. The climate is highly favorable for agriculture, which is the district's dominant economic activity. The district receives rainfall of between 1,200 mm to 1,500 mm of rainfall annually. There are two distinct rainy seasons: Long rainy season runs from March to May. Short rainy season begins in September and ends November. Rainfall is evenly distributed, making it suitable for both annual and perennial crops.

The average temperatures range between 21°C (70°F) and 30°C (86°F) throughout the year. The hottest months are typically January and February, while the rainy seasons bring cooler temperatures. High humidity characterizes the district due to its tropical climate, which influences the growth of crops like bananas, coffee, and sugarcane.

According to the 2024 National Census, Iganga District had a population of approximately 623,400 people, reflecting steady growth from the 506,388 recorded in the 2014 Census. This population growth aligns with Uganda's high national growth rate of over 3% per year. The majority of the residents belong to the Busoga ethnic group, and Lusoga is the predominant language spoken in the district.

Iganga has a youthful population, with over 50% under the age of 18, contributing to a high dependency ratio. While Iganga Town serves as an urban hub, the majority of the population (approximately 80%) lives in rural areas, relying on subsistence agriculture for their livelihoods. As one of Uganda's most densely populated districts, Iganga has a population density of over 350 people per square kilometer, putting pressure on available resources. The district's growing population has fueled demand for transport services, particularly boda bodas (motorcycle taxis) and public transport. The services sector, including education, healthcare, and retail businesses, is expanding to meet the needs of the growing population. Many residents are involved in informal economic activities such as roadside vending, small shops, and casual labor.

Iganga town serves as a growing commercial hub where agricultural produce is sold and traded. The economy of Iganga District is largely agrarian, with agriculture being the

dominant source of income and employment. Other key economic activities include trade, small-scale industries, services, and fishing. Subsistence farming is the backbone of the economy, with the majority of households engaged in crop and livestock farming. Livestock farming is also significant, with cattle, goats, pigs, and chickens being the main animals reared. Challenges in agriculture include post-harvest losses, limited access to markets, and Fishing is an important economic activity in Iganga, especially in areas near Lake Victoria and other local water bodies. It provides food, employment, and income for many households. Poor fish handling practices, however, often lead to quality deterioration and economic losses.

The district's location along the Jinja-Tororo highway, a major East African trade route, facilitates trade with neighboring districts and countries like Kenya. Local markets in Iganga are vibrant, with vendors trading in food items, clothing, and household goods. Processing of agricultural products, such as coffee drying and maize milling, is a common activity. Other small-scale industries include brickmaking, carpentry, and tailoring, which provide employment to the local population.

3.3 Study Design

The study adopted a cross-sectional descriptive design to evaluate the fish handling practices and their impacts on fish quality at a specific point in time. This design was appropriate for providing a snapshot of the current state of practices and their outcomes in the Iganga fish market.

3.4. Study Population

The target population included Fish vendors (both male and female) and suppliers who deliver fish to the market. A sample size of 100 of both fish vendors and suppliers were selected for the study to ensure a representative assessment of practices in the market.

3.5 Research Approaches.

This study employed a mixed methods research approach. This approach combined both in-depth interviews with key stakeholders, including vendors, suppliers, and market officials, provided insights into their perceptions, challenges, and experiences regarding

fish handling practices. Direct observation of fish handling processes in the market helped to capture real-time practices and environmental conditions affecting fish quality.

3.6 Data Collection Methods

The sampling method was purposive sampling, targeting fish vendors and suppliers who were actively engaged in the market for at least 6 months. This method ensured that targeted participants provide reliable information about fish handling practices.

Structured interviews were conducted with fish vendors and suppliers to assess their knowledge, attitudes, and practices related to fish handling, storage, and hygiene. I designed a questionnaire and gathered data from the target groups.

A physical assessment of fish samples was conducted to measure quality indicators such as texture, odor, color, and signs of spoilage. I clearly defined what each quality indicator means and how it was assessed.

In the coding system specific codes were assigned to each observed category. For example:

Table 1 Showing the codes assigned to each observed category of fish spoilage.

Indicator	Category	Code
Texture	Firm	T1
	Soft	T2
	Bruised muscle	T3
Odor	Mild, ocean-like smell	01
	Ammonia-like smell	02
Scales	Tightly adhered	S1
	Loose or missing scales	S2
Color of gills	Bright	C1
	Greenish or yellowish	C2

Handling practices for fresh fish directly impact quality attributes like texture, odor, color, and signs of spoilage.

3.7 Data Analysis

Data from structured interviews and fish quality assessments was analyzed using descriptive statistics (percentages, means, and frequencies) to summarize the handling practices and their impact on fish quality. Software of Excel was used for analysis.

Analyzed data was presented using the graphs and charts for visualization of the data.

3.8 Ethical Considerations

Informed Consent: All participants were informed about the purpose of the study, and verbal or written consent was obtained before data collection.

Confidentiality: The identities of the participants were kept confidential, and data was anonymized to protect their privacy.

3.9 Limitations of the Study.

During this study I faced the following limitations:

- Financial constraints: Limited resources restricted the scope of microbial testing and advanced fish quality assessments.
- Lack of objective measurements where fish assessment based on visual inspection, not laboratory testing.
- Some of the Vendors' responses were biased or inaccurate.
- Unwillingness to disclose some information by the vendors and suppliers

CHAPTER FOUR

RESULTS.

4.1 Demographic characteristics of the respondents.

Table 2 Showing the Gender, Marital status, Age group and Education level of the respondents.

Marital status		Single	Married	Divorced	Widow/widower	
	Percentage (%)	28	52	15	5	
Gender	Male (%)	56	61	58	53	20
	Female (%)	44	39	42	47	80
Age group	<18 (%)	2	7	0	0	0
	18-30(%)	37	79	27	7	0
	31-45(%)	34	14	48	27	20
	45-55(%)	23	0	23	67	20
	>55(%)	4	0	2	0	60
Education level	No formal education	7	11	6	0	20
	Primary	28	11	35	33	40
	Ordinary level	31	18	38	33	20
	Advanced level	16	21	12	20	20
	Diploma	7	14	4	7	0
	Degree	11	25	6	7	0

56% respondents were males compared to 44% who were female.52% respondents were married compared to 28%, 15% and 5% who were single, divorced and widow/widower

respectively..37% and 34% of the respondents were aged between 18-30 years and 31-45 compared to 23%,4% and 2% of the respondents were aged between, 45-55 years, >55 years and <18 years respectively 31% of the respondents had attained Ordinary Level compared to 28%, 16%, 11%, 7% and 7% of the respondents who were of primary, Advanced Level, degree, Diploma and No formal education respectively

4.1.1 Role of respondent in the Fish market.

73% of the respondents were fish market vendors compared to the 26% and 1% who were fish suppliers to the market and fisheries personal respectively. (Figure 4.1)

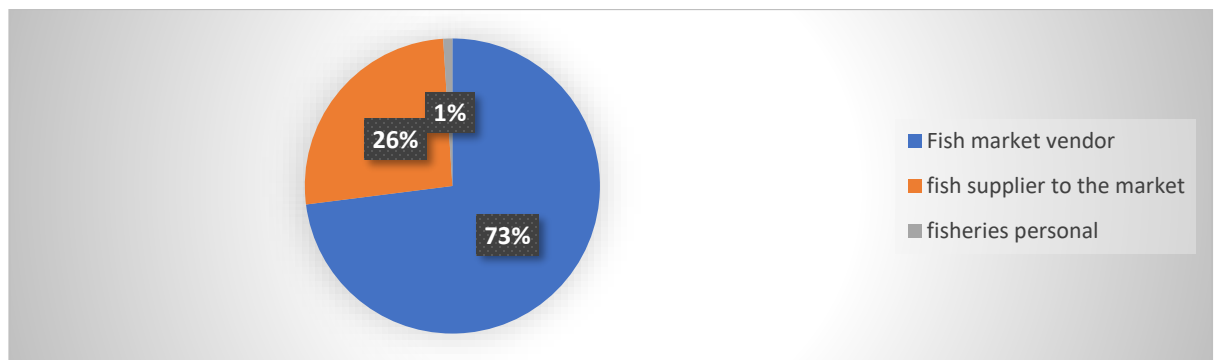


Figure 4. 1 Distribution of the respondents by role in the fish market.

4.1.2 Years of experience in the fish market business

50% of the respondents had 1-5 years of experience compared to the 27%,19% and 4% who had 6-10 years, less than 1 year and more than 10 years respectively (Figure 4.2)

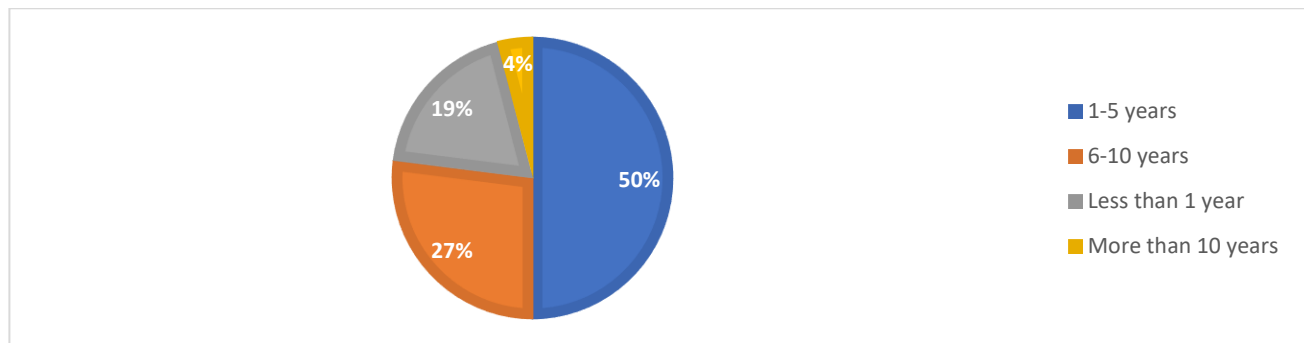


Figure 4. 2 Distribution of the respondents by the years of experience

4.2 Fish traded and form in which its received.

48% and 42% of the respondents indicated they frequently traded the Nile Tilapia and Nile Perch respectively compared to the 9% and 1% that most frequently traded in catfish and other fish respectively as shown in Figure 4.3 73% of the respondents said that they receive fish in fresh (not refrigerated) form/state compared to the 22%,4%and 1% that receive fish in fresh refrigerated, frozen and other forms/states respectively.

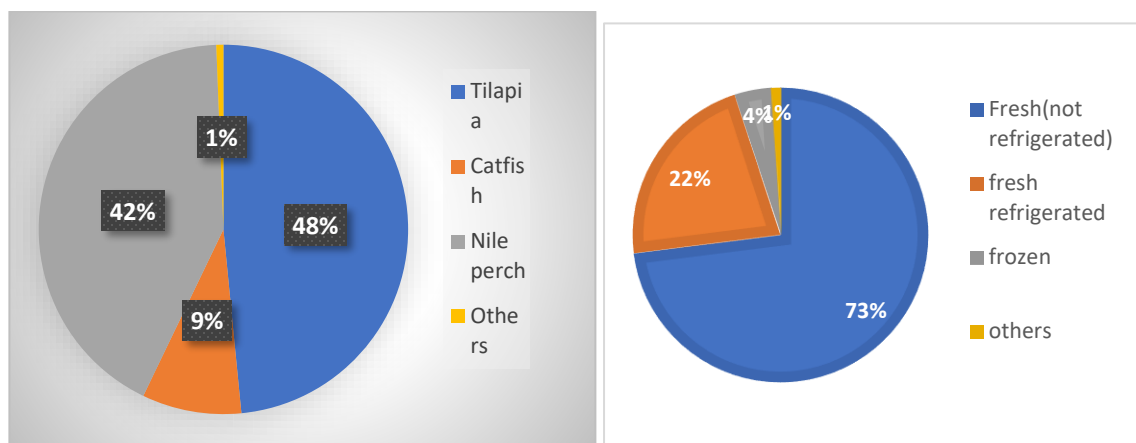


Figure 4. 3 Showing the different types of fish traded and the form in which its received.

4.3 Fish transport to the fish market

76% of the respondents said use the motorcycle as their means of transport compared to the 18% and 6% of the respondents that use trucks and bicycles as their means of transport respectively.

Table 3 Showing the fish transport to the market by their Percentage.

Transport used in marketing.	%age	Female (%)	Male (%)	Facilities for holding fish	%age	Female (%)	Male (%)
Trucks	18	27	10	Insulated containers	37	40.9	33.9
Motorcycle.	76	68	83	Open baskets	46	45.5	46.4

Bicycles.	6	1.9	6.7	Plastic bags	5	2.3	7.1
				Refrigerated vehicles	9	11.4	7.1
				Others	3	0	5.4

According to the gender, female traders using open baskets dominated with 45.5% and these use the motorcycle as their means of transport followed by those with insulated containers with ice (40.9%). Refrigerated vehicles (11.4%) and use of plastic bags (2.3%) were less common.

Contra wise, males using open baskets were reported most common, constituted 46.43%, followed by insulated containers (33.9%). Responses revealed that males utilizing refrigerated vehicles constituted only 7.1%, plastic bags (7.1%), and others (5.4%) are used minimally. This reveal both genders normally use open baskets for carrying fish for trade, but females use insulated containers more than males, while males use a broader range of methods, including "others."

Study revealed most of vendors of the divorced category were using insulated containers (73%) and the rest (27%) used open baskets. Of the married most of them indicated (50%) use open baskets for carrying fish to the markets, followed by insulated containers (28.9%) and refrigerated vehicles (11.5%). Plastic bags (3.9%) and others (5.8%) are minimal. (Figure 4.4) For the respondents under the Single category, high percentage use open baskets (42.9%) and insulated containers (35.7%); and those using plastic bags and refrigerated vehicles were each at 10.7%. Widow/Widowers were found to use open baskets (80%), insulated containers were only 20% (Figure 4.4).

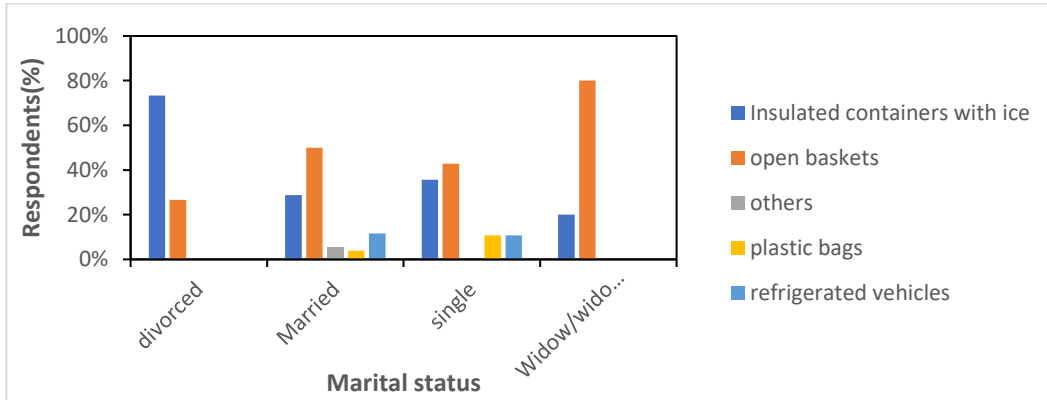


Figure 4. 4 Modes of fish transport to the fish market and marital status.

The study revealed that among vendors under 18 years of age, transportation methods are evenly divided: 50% use insulated containers, and 50% use open baskets (Figure 4.5). For vendors over 55, all (100%) exclusively use open baskets (Figure 4.5). Among those aged 18-30, the majority use open baskets (48.65%), followed by insulated containers (27.03%), refrigerated vehicles (10.81%), plastic bags (8.11%), and other methods (5.41%) (Figure 4.6). For the 31-45 age group, open baskets (44.12%) and insulated containers (41.18%) are most prevalent, with refrigerated vehicles (11.76%) and other methods (2.94%) less common; no plastic bags were used (Figure 4.5). Among vendors aged 45-55, insulated containers dominate (52.17%), followed by open baskets (34.78%), plastic bags (8.70%), and refrigerated vehicles (4.35%); no other methods were reported (Figure 4.5).

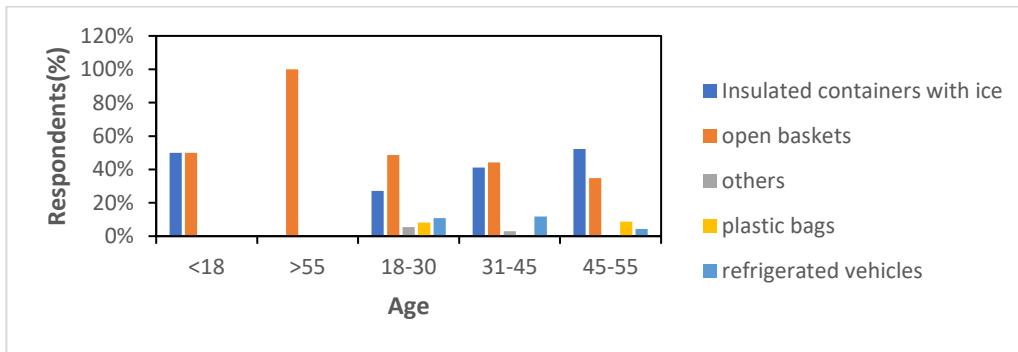


Figure 4. 5 Mode of fish transport to the fish market by the respondents according to age.

The research found out that among vendors with advanced level of education, mostly used insulated containers (50%), followed by open baskets (25%) and refrigerated vehicles (18.75%). Plastic bags are used minimally (6.25%) (Figure 4.6). Those holding a degree, insulated containers lead (54.55%), followed by open baskets (27.27%) and refrigerated vehicles (18.18%); no plastic bags or other methods were reported (Figure 4.6). Use of insulated containers and open baskets was also common for Diploma holders (42.86% each), with refrigerated vehicles at 14.3% (Figure 4.6). Use of open baskets (85.7%) was noted high for vendors with no formal education; use of insulated containers was 14.3% (Figure 4.6). For those with Ordinary level education, open baskets are most common method used (38.71%), followed by insulated containers (32.3%), with plastic bags, refrigerated vehicles, and other methods each at 9.7% (Figure 4.6). Among vendors with primary education, open baskets prevail (64.3%), followed by insulated containers (32.14%); plastic bags are used sparingly (3.6%), with no other methods or refrigerated vehicles reported (Figure 4.6).

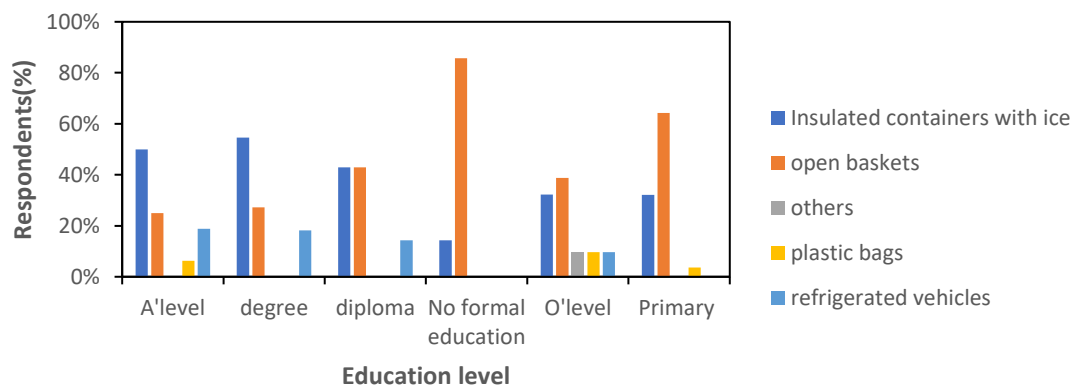


Figure 4. 6 Showing how fish is transported to the fish market by the respondents according to level of education.

The research also found that among fish market vendors, open baskets were predominant (52.05%), followed by insulated containers (35.62%). Refrigerated vehicles (5.48%), plastic bags (4.11%), and other methods (2.74%) are used sparingly (Figure 4.8). For fish suppliers to the market mostly used insulated containers (42.31%), followed by

open baskets (30.77%). Use of refrigerated vehicles was 15.38% plastic bags (7.69%), and other methods (3.85%) less common (Figure 4.7). Fisheries personnel exclusively use refrigerated vehicles (100%) (Figure 4.7).

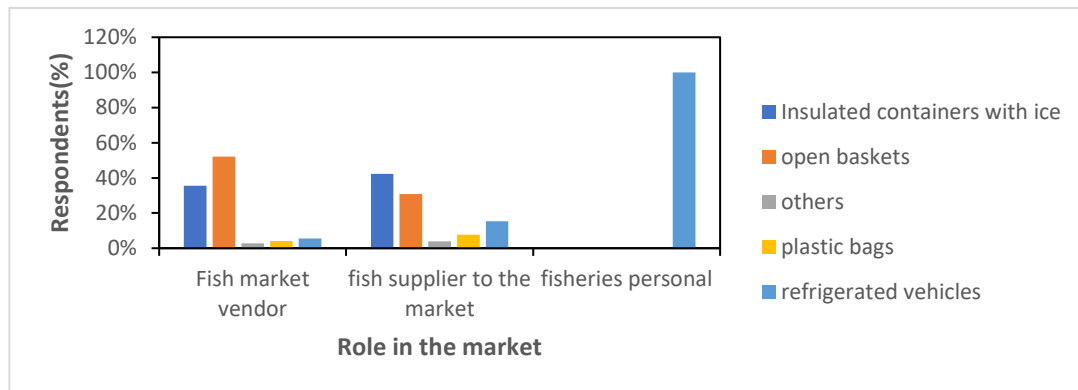


Figure 4. 7 Comparison of how fish is transported to the fish market by the respondents according to role in the fish market.

4.4 Fish storage at the market

Table 4 Showing fish storage at the market before selling aggregated by gender, age, role in the market, education level and marital status

Storage facilities		At room temperature	In refrigerator/freezer	In water tanks	On ice	Others
	Percentage (%)	17	26	8	48	1
Marital status	Single (%)	18	39	21	21	0
	Married (%)	14	21	4	59.6	1.9
	Divorced (%)	27	20	0	53.3	0
	Widow/widower	20	20	0	60	0
Education level	No formal education	14	0	43	42.9	0
	Primary	18	11	0	71	0
	Ordinary level	19	27	3	52	0
	Advanced level	13	44	0	25	0
	Diploma	0	57	14	29	0
	Degree	27	36	27	27	9

Gender	Male (%)	14	21	5	57	2
	Female (%)	21	32	11	36	0
Age group	>18(%)	0	0	50	50	0
	18-30	22	27	14	38	0
	30-45	15	38	3	41	3
	45-55	13	13	4	70	0
	>55	25	0	0	75	0
Role in the fish market	Fish market vendor (%)	16	26	8	48	1
	Fish market supplier (%)	19	27	8	46	0
	Fisheries personal	0	0	0	100	0

The data provides insights into fish storage practices among participants in the fish market, with an overall distribution showing that storage on ice is the most prevalent method at 48%, followed by refrigeration or freezing at 26%, room temperature storage at 17%, water tanks at 8%, and other methods at a negligible 1%. These preferences vary notably when segmented by demographic and occupational factors such as marital status, education level, gender, age group, and role in the fish market, revealing patterns that may reflect socioeconomic influences, access to resources, or practical constraints.

Married individuals exhibit the strongest preference for ice-based storage at nearly 60%, which is higher than the overall average, while their use of refrigeration drops to about 21% and water tanks to a low 4%. This suggests that married respondents, possibly managing larger households or commercial volumes, prioritize cost-effective and traditional methods like ice over more energy-dependent options. In contrast, singles show a more balanced but fragmented approach, with refrigeration at 39% exceeding the overall rate and equal reliance on water tanks and ice at around 21% each, indicating perhaps greater flexibility or experimentation among unmarried individuals who might have fewer family obligations. Divorced respondents lean heavily toward ice at 53%, similar to married ones, but with elevated room temperature storage at 27% and no use of water

tanks, potentially pointing to resource limitations post-divorce that favor simpler, ambient methods. Widows or widowers align closely with married patterns, favoring ice at 60% and splitting room temperature and refrigeration evenly at 20% each, with no adoption of tanks or other methods, which could imply a reliance on established habits amid life transitions.

Education level introduces clear gradients in storage choices, where higher education correlates with diversified and technology-oriented practices. Those with no formal education divide preferences almost equally between water tanks and ice at about 43% each, avoiding refrigeration entirely, which may stem from limited access to electricity or appliances in less educated, potentially rural or low-income groups. Primary education holders shift dramatically toward ice at 71%, with minimal refrigeration at 11% and no tanks, emphasizing a practical, low-maintenance approach. At the ordinary level, ice remains dominant at 52%, but refrigeration rises to 27%, close to the overall average, suggesting moderate resource availability. Advanced-level educated individuals favor refrigeration at 44% the highest among education groups while ice drops to 25%, though the data shows some inconsistency in totals, possibly indicating unreported alternatives; this pattern hints at better infrastructure access. Diploma holders push refrigeration even further to around 57%, with tanks at 14% and ice at 29%, reflecting professional training that might encourage modern preservation techniques. Degree holders display the most varied distribution, with roughly equal shares across room temperature, refrigeration, tanks, and ice at about 27% each, plus 9% in other methods the highest "others" usage implying that advanced education fosters innovation and access to diverse options beyond traditional ice.

Male fish vendors prefer ice (57%) for preserving or transporting fish, surpassing the overall average of 48%. Only 21% use refrigeration, and 5% use tanks. Ice is favored for its low cost and ease of use, ideal for keeping fish fresh during transport or market sales, where refrigeration is often unavailable. Females, however, opt for refrigeration more frequently (32%) above the average and tanks at 11%, but use of ice was only 36%, This

pattern suggests that women likely more involved in retail product handling prioritize controlled environments like refrigerators to maintain quality. However, their use of room temperature storage is also slightly higher than average at 20%, probably due to limited space in the market.

Age groups reveal evolving preferences over life stages, with those under 18 splitting evenly between tanks and ice at 50% each, the 18-30 age group preferred room temperature (22%) and refrigeration (27%), tanks (14%) and ice (38%), may reflect youthful adaptability but probably with limited resources for advanced methods. Between 30-45 years, refrigeration was highly used (38%) the highest across ages while use of ice was 41% and tanks 3%, suggesting mid-career stability enabling advanced appliance use. Use of ice was high (>70%) for the over 45 age groups, with some respondents storing fish at room temperature and refrigeration.

4.5 Fish handling

72% of the respondents reported that they remove fish scales before selling fish. 18%,7% and 3% of the respondents reported that they wash the fish with clean water, gut and wash the facilities before selling fish respectively. (figure 4.8)

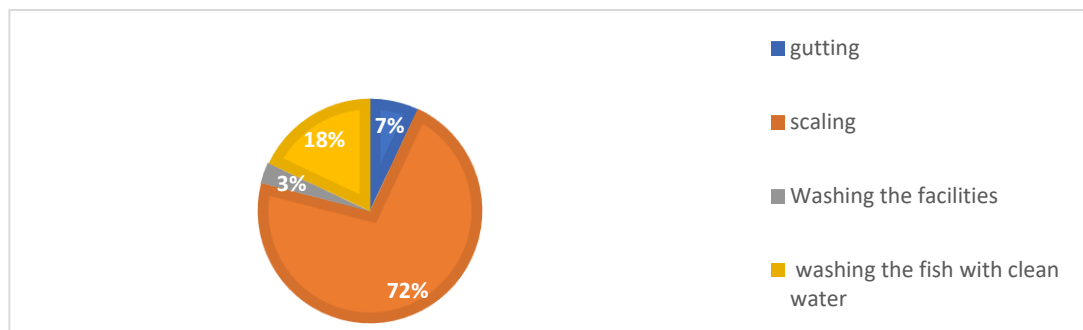


Figure 4. 8 Showing the cleaning practices followed by the respondents before selling fish.

The study revealed that scaling is the most common fish preparation method among female vendors (70.45%), followed by washing fish with clean water (18.18%) and using washing facilities (6.82%). Gutting is practiced minimally (4.55%) (Figure 4.9). Among

male vendors, scaling predominates (73.21%), followed by washing fish with clean water (17.86%) and gutting (8.93%); no use of washing facilities was observed (Figure 4.9).

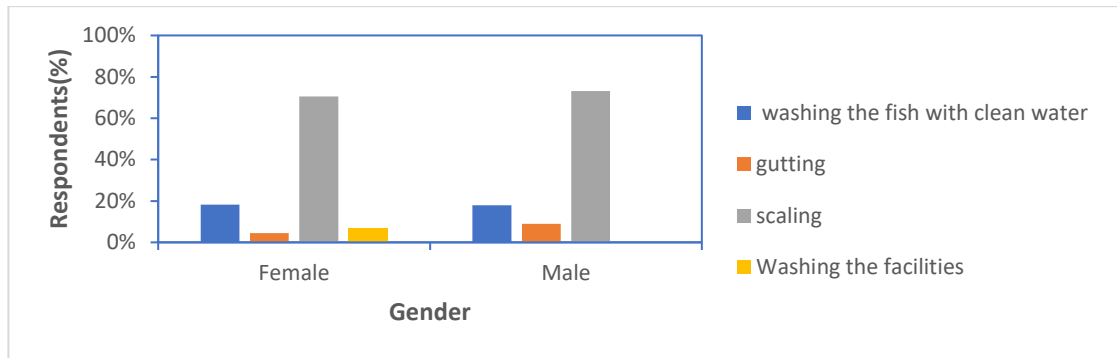


Figure 4. 9 Showing cleaning practices followed by the respondents before selling fish with Gender.

The study revealed that among vendors under 18, fish was scaled and washed with clean water (50% each); no other practices were reported (Figure 4.10). For vendors over 55, scaling is exclusively practiced (100%) (Figure 4.13). Among those aged 18-30, scaling is the most common method (64.86%), followed by washing fish with clean water (18.92%) and gutting (16.22%); no washing facilities were observed (Figure 4.10). For the 31-45 age group, scaling predominates (73.53%), followed by washing fish with clean water (23.53%) and gutting (2.94%); no washing facilities were reported (Figure 4.10). Among vendors aged 45-55, scaling dominates (78.26%), followed by using washing facilities (13.04%) and washing fish with clean water (8.7%); no gutting was practiced (Figure 4.10).

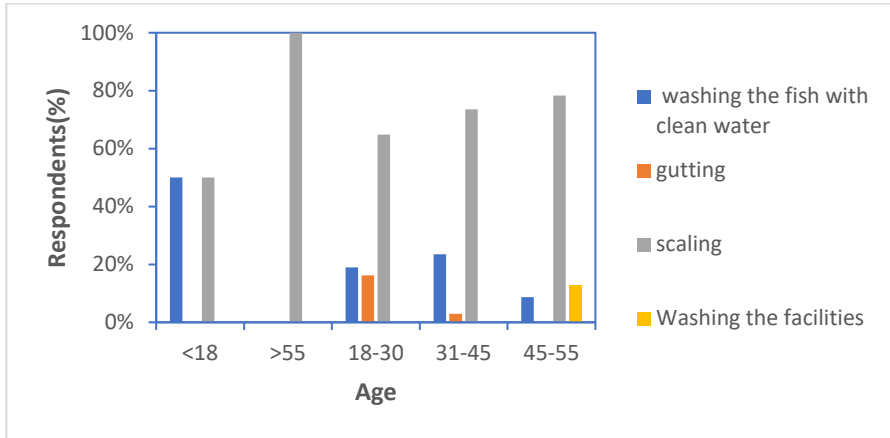


Figure 4. 10 Showing cleaning practices followed by the respondents before selling fish with Age.

The study showed that vendors with advanced level education, scaling is the primary fish preparation method (56.25%), followed by washing fish with clean water (31.25%) and gutting (12.5%) (Figure 4.11). Fishmongers with advanced levels of education (degrees and diplomas) practiced fish scaling before sales (>81 %), gutted fish and washing fish with clean water (Figure 4.11). For vendors with no formal education, scaling was most frequently used (57.14%), washed fish with clean water (42.86%); though gutting was less done and no washing facilities were recorded (Figure 4.11).

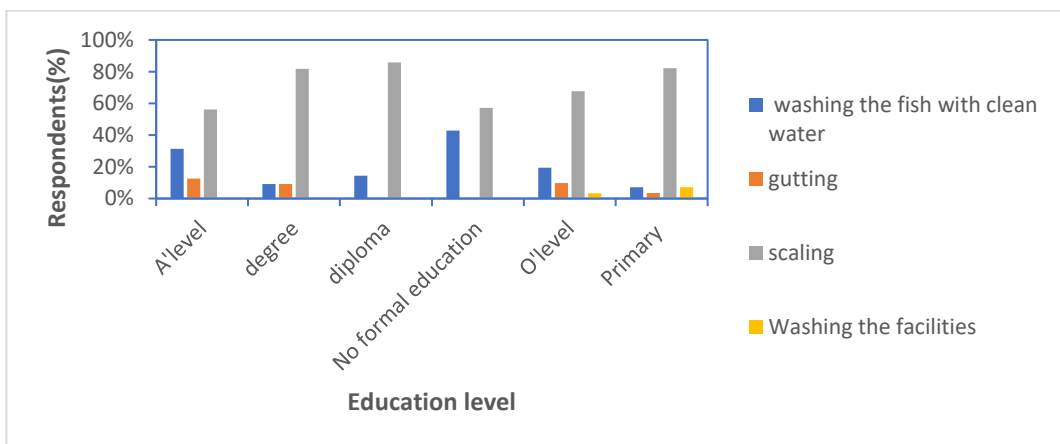


Figure 4. 11 Comparison of cleaning practices followed by the respondents before selling fish with level of education.

Fish market vendors practice scaling of fish (80.82%), wash fish with clean water (9.59%) and gut (6.85%). Washing facilities were used minimally (2.74%) (Figure 4.12). The findings indicate that for fish suppliers scaled fish before sale (46.15%), washed fish with clean water (42.31%) and gutted (7.69%), with washing facilities practiced minimally (3.85%) (Figure 4.12). The data revealed that among fisheries personnel, scaling is exclusively practiced (100%) (Figure 4.12).

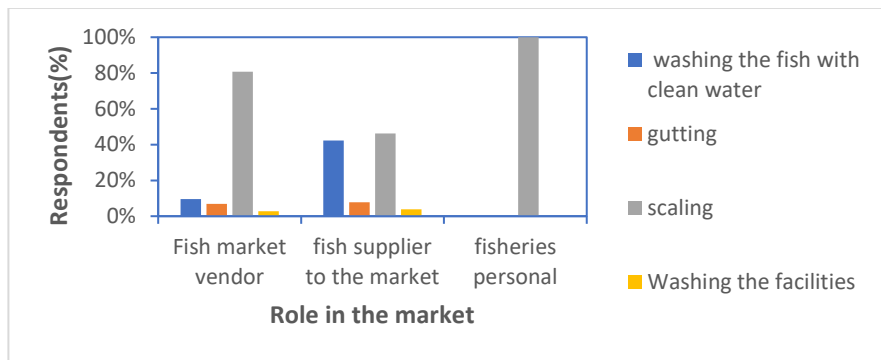


Figure 4. 12 Comparison of cleaning practices followed by the respondents before selling fish with role in the market.

The investigation showed that among vendors with 1-5 years of experience, scaling is the primary fish preparation method (70%), followed by washing fish with clean water (18%) and gutting (10%). Washing facilities are used minimally (2%) (Figure 4.13). The findings indicate that for those with 6-10 years of experience, scaling predominates (66.67%), followed by washing fish with clean water (22.22%) and washing facilities (7.41%), with gutting practiced minimally (3.7%) (Figure 4.13). The data revealed that among vendors with less than 1 year of experience, scaling leads (78.95%), followed by washing fish with clean water (15.79%) and gutting (5.26%); no washing facilities were reported (Figure 4.13). The study found that for vendors with more than 10 years of experience, scaling is exclusively practiced (100%) (Figure 4.13).

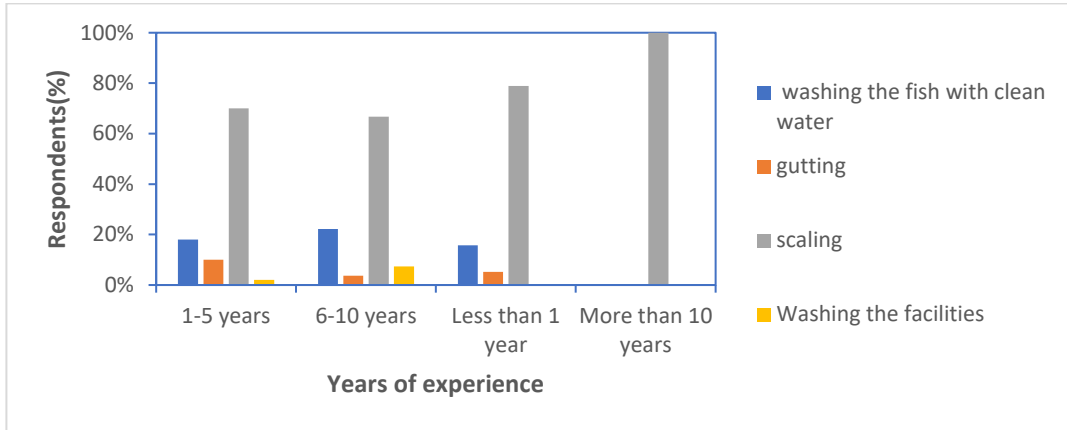


Figure 4. 13 Comparison of cleaning practices followed by the respondents before selling fish with Years of experience.

4.5.1 Fish display for sale

84% of the respondents reportedly display fish for sale on the table compared to the 8%, 6%,1% and 1% who reported that they display fish for sale in open baskets, plastic containers, sacks and shelves respectively (figure 4.14)

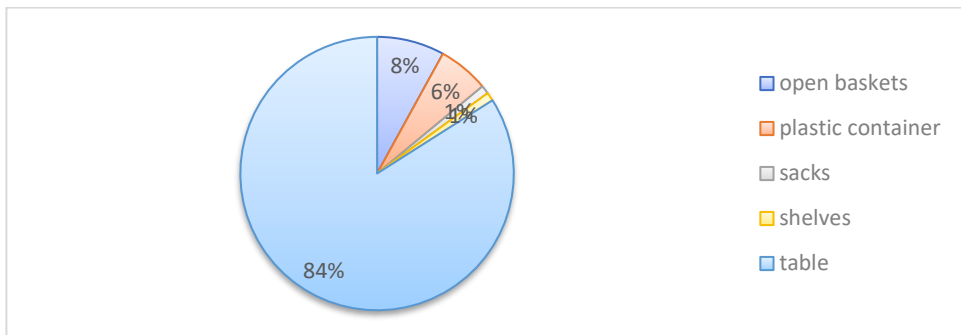


Figure 4. 14 Showing how fish is displayed for sale by the respondents.

The investigation showed that all vendors use tables as the primary method for displaying fish for sale (>80%). Use of open baskets by female vendors was low (11.36%) and plastic containers (2.27%); no sacks or shelves were reported (Figure 4.15). For male vendors, in addition to tables use plastic containers (8.93%) and open baskets (5.36%), with sacks and shelves used minimally (1.79% each) (Figure 4.15).

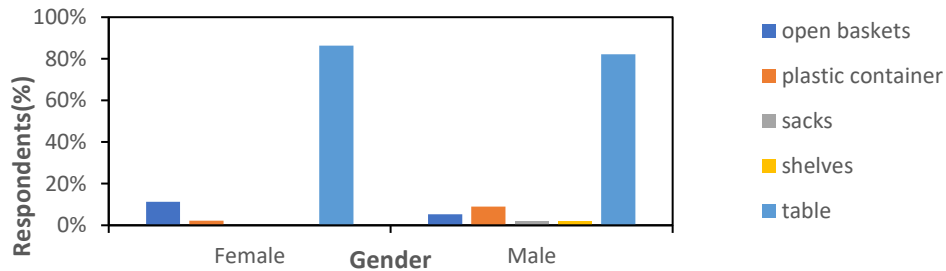


Figure 4. 15 Comparison of how fish is displayed for sale by the respondents according to Gender.

4.5.2 Type of water used for washing fish and demographics.

52% of the respondents said use clean tap water for washing fish and containers compared to the 32% and 16% who reported use borehole water and river or lake water for washing fish and containers respectively. (Figure 4.16)

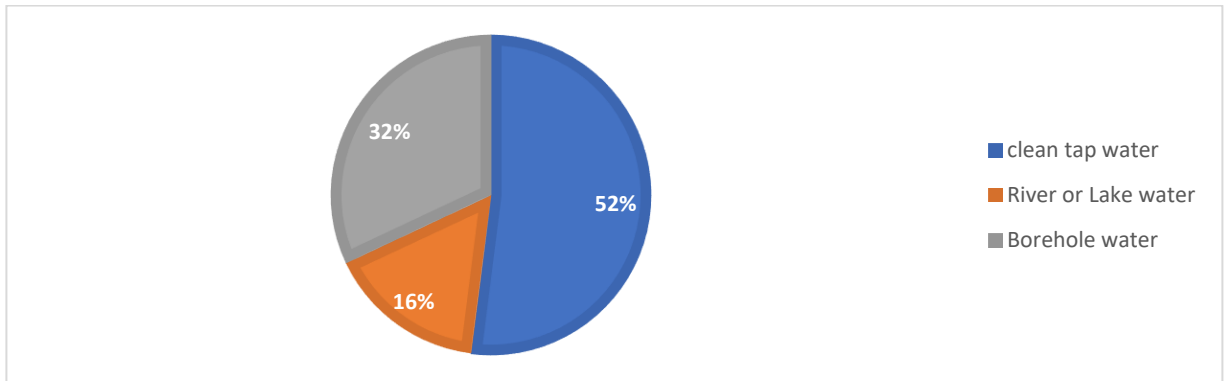


Figure 4. 16 Showing the type of water used for washing fish and containers by the respondents.

Most market vendors use clean tap water for cleaning fish; rated at >57.5%, followed by borehole water at 34.25% and river/lake water at 8.22% (Figure 4.17). Fish suppliers to the market reported use river/lake water (38.5%), followed by clean tap water (34.62%) and borehole water (26.9). Fisheries personnel exclusively use clean tap water (100%) (Figure 4.17).

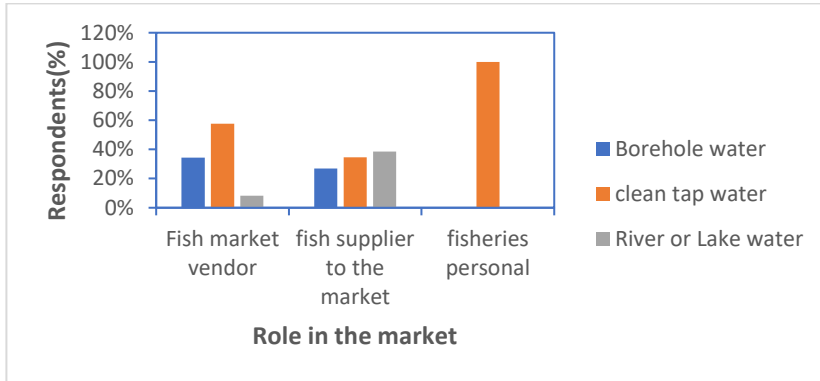


Figure 4. 17 Comparison of the type of water used for washing fish and containers by the respondents with role in the market.

Among those with 1-5 years of experience, clean tap water leads at 50%, followed by borehole water at 34% and river/lake water at 16% (Figure 4.18). Among vendors with 6–10 years of experience, borehole and clean tap water are each used by 40.74%, while river or lake water is used by 18.52% (Figure 4.18). Respondents with less than 1 year of experience show use of clean tap water (73.7%), followed by river/lake water at 15.79% and borehole water at 10.53% (Figure 4.18). Among vendors with over 10 years of experience, borehole water and clean tap water are each used by 50%, with no recorded use of river or lake water (Figure 4.18).

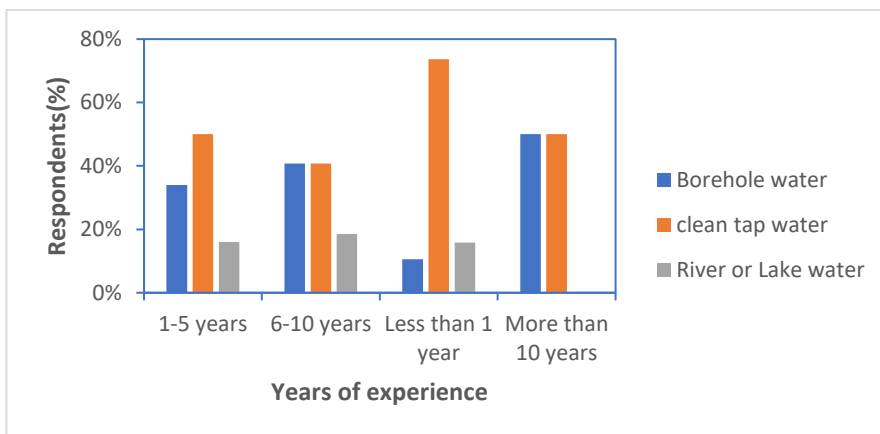


Figure 4. 18 Comparison of type of water used for washing fish and containers by the respondents with years of experience.

4.5.3 Fish preservation.

62% of the respondents who preserve fish they do it by freezing while 18% and 17% preserve by salting and smoking respectively then the 2% and 1% preserve by sun drying and canning respectively.

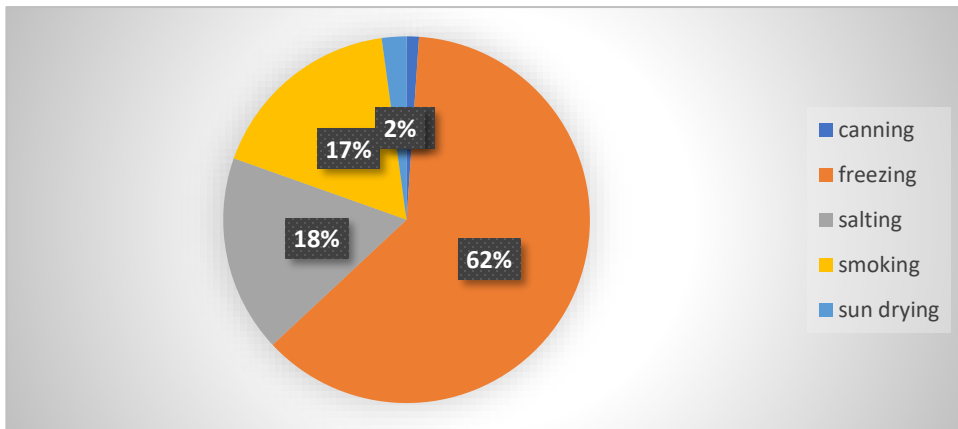


Figure 4. 19 Showing how respondents preserve their fish.

4.6 Perception of fish spoilage and demographics.

64% of the respondents reported bad odor as a sign of spoiling observed most frequently compared to the 27% and 9% who reported soft flesh and gill discoloration respectively.

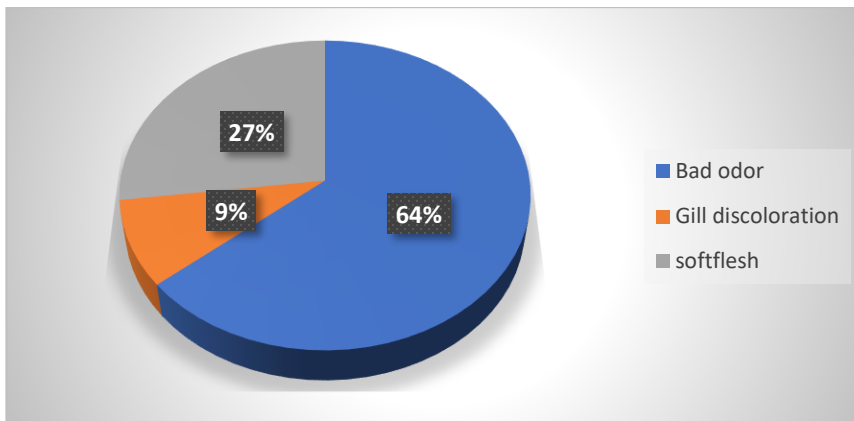


Figure 4. 20 Showing the signs of spoiling observed most frequently by the respondents.

Among advanced level holders, bad odor dominates at 87.5%, followed by gill discoloration and soft flesh at 6.25% each. For degree holders, bad odor leads at 54.55%,

followed by soft flesh at 27.27% and gill discoloration at 18.18%. Diploma holders report soft flesh and bad odor each at 42.86%, followed by gill discoloration at 14.29%. Those with no formal education report bad odor leading at 57.14%, followed by soft flesh at 28.57% and gill discoloration at 14.29%. Ordinary Level holders show bad odor leading at 58.06%, followed by soft flesh at 35.48% and gill discoloration at 6.45%. Primary education holders report bad odor leading at 67.86%, followed by soft flesh at 25% and gill discoloration at 7.14%. Higher education correlates with more reports of bad odor, while lower education includes more instances of soft flesh (Figure 4.21).

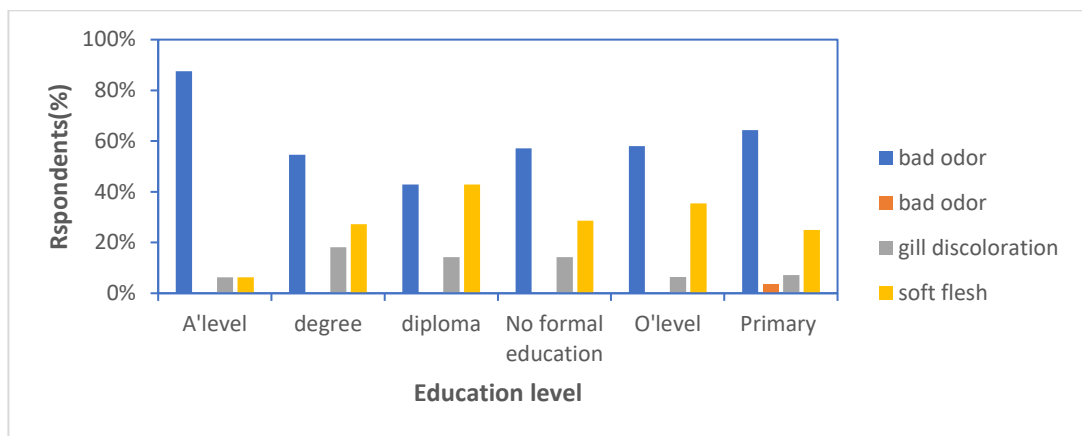


Figure 4. 21 Comparison of signs of spoiling observed most frequently by the respondents with level of education.

Fish market vendors report bad odor leading at 67.12%, followed by soft flesh at 23.29% and gill discoloration at 9.59%. Fish suppliers to the market also report bad odor leading at 57.69%, followed by soft flesh at 34.62% and gill discoloration at 7.69%. Fisheries personnel exclusively observe soft flesh (100%), indicating that fisheries personnel report only soft flesh, while vendors note bad odor (Figure 4.22).

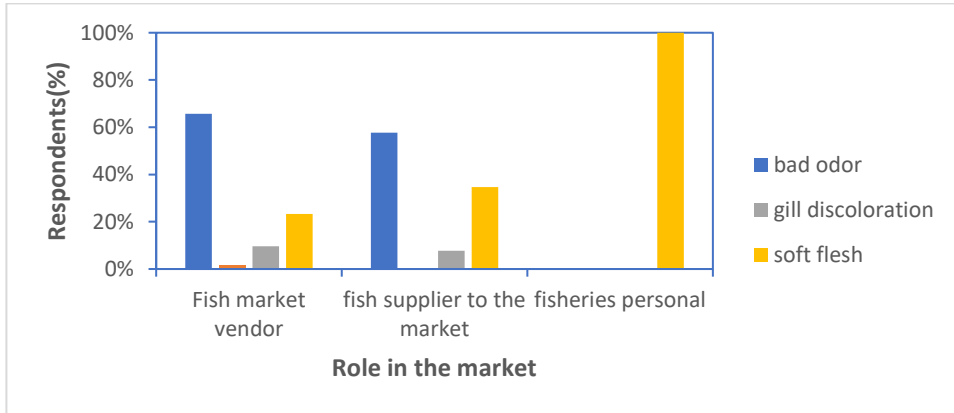


Figure 4. 22 Comparison of signs of spoiling observed most frequently by the respondents with role in the market.

Among individuals with 1-5 years of experience, bad odor leads at 60%, followed by soft flesh at 28% and gill discoloration at 12%. Those with 6-10 years of experience report bad odor leading at 70.37%, followed by soft flesh at 18.52% and gill discoloration at 11.11%. For those with less than 1 year of experience, bad odor leads at 63.16%, followed by soft flesh at 36.84%, with no gill discoloration noted. Individuals with more than 10 years of experience report bad odor leading at 75%, followed by soft flesh at 25%, with no gill discoloration (Figure 4.23).

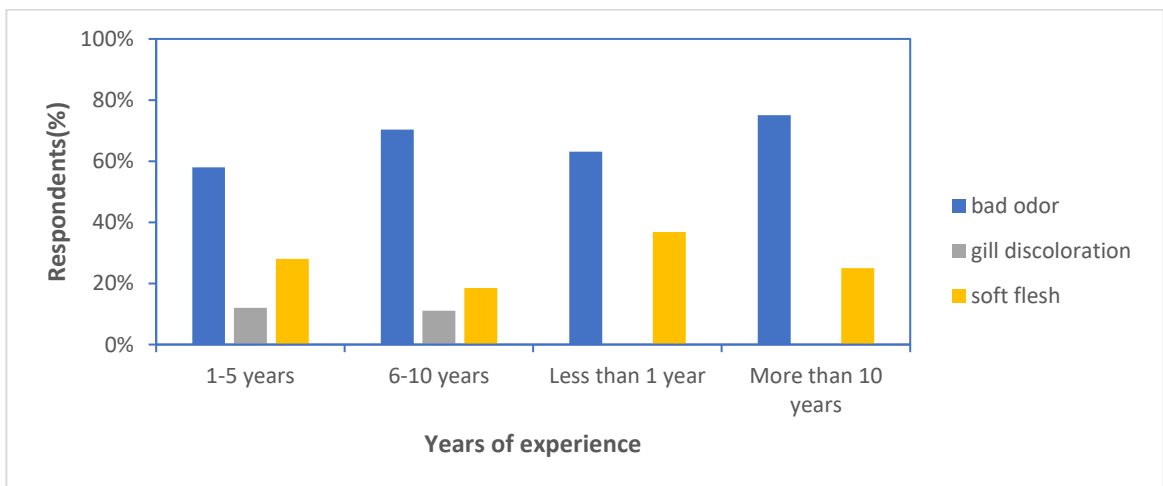


Figure 4. 23 Comparison of signs of spoiling observed most frequently by the respondents with years of experience.

For fish stored at room temperature, bad odor leads at 64.71%, followed by soft flesh at 29.41% and gill discoloration at 5.88%. In refrigerators or freezers, bad odor leads at 76.93%, followed by soft flesh at 15.38% and gill discoloration at 7.69%. In water tanks, bad odor and soft flesh lead at 62.5% and 25% respectively, with gill discoloration at 12.5%. Those storing fish on ice report bad odor leading at 56.25%, followed by soft flesh at 33.33% and gill discoloration at 10.42%. In other storage methods, respondents report exclusively bad odor (100%). Refrigeration correlates with higher reports of bad odor, while ice and water tanks include more instances of soft flesh (Figure 4.24).

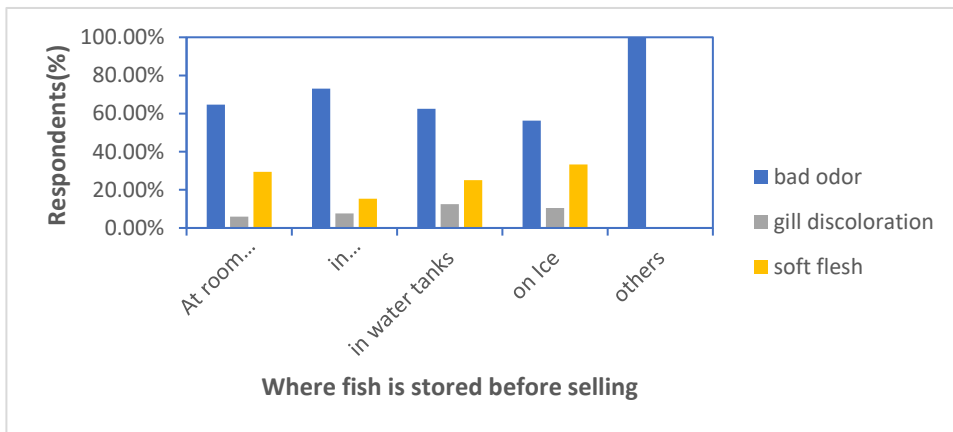


Figure 4. 24 Comparison of signs of spoiling observed most frequently by the respondents with where fish is stored before selling.

For fish stored on ice, bad odor and soft flesh are reported at 66.67% and 33.33% respectively, with no gill discoloration noted. In water tanks, there is an equal split between bad odor and soft flesh at 50% each, with no gill discoloration. Fish stored in open air report exclusively bad odor (100%). For those storing fish in refrigerators, bad odor leads at 63.77%, followed by soft flesh at 26.6% and gill discoloration at 9.57%. Open air storage reports only bad odor, while water tanks and ice storage include soft flesh (Figure 4.25).

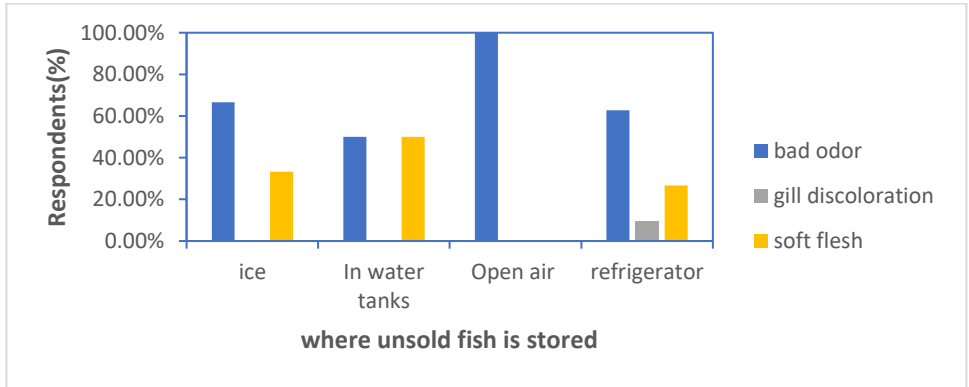


Figure 4. 25 Showing signs of spoiling observed most frequently and where unsold fish is stored.

4.6.1 Factors contributing to fish spoiling in the market and demographics

36% and 31% of the respondents reported that high temperatures and lack of the fish facilities contribute most to fish spoiling compared to the 25%,4%,2% and 2% who reported that poor hygiene in the market, delays on the road, ignorance and limited market contribute most to fish spoiling in the market respectively.

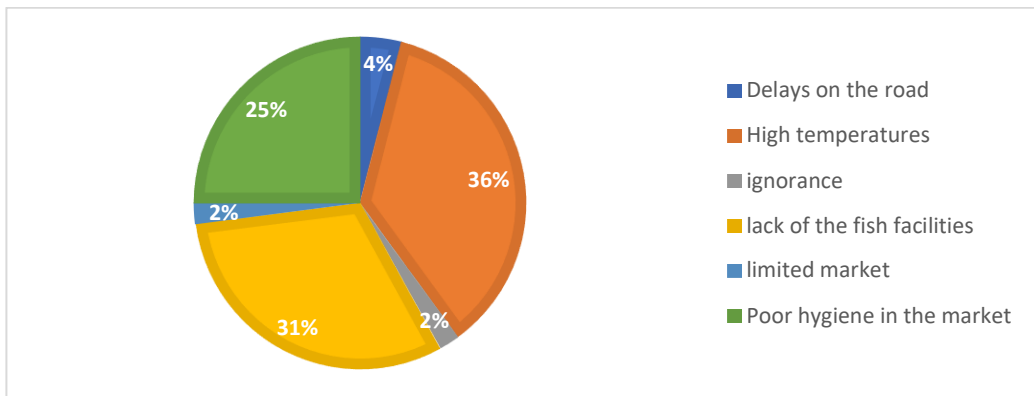


Figure 4. 26 Showing the factors contributing most to fish spoiling in the market.

Among females, high temperatures (34.09%) and lack of facilities (31.82%) dominate, followed by poor hygiene (20.45%). Delays (6.82%), ignorance (4.55%), and limited market access (2.27%) are minimal. For males, high temperatures lead at 37.5%, followed by lack of facilities at 30.36% and poor hygiene at 28.57%, with minimal delays and

limited market access (1.79% each). Both genders cite high temperatures and lack of facilities as primary causes of spoilage (Figure 4.27).

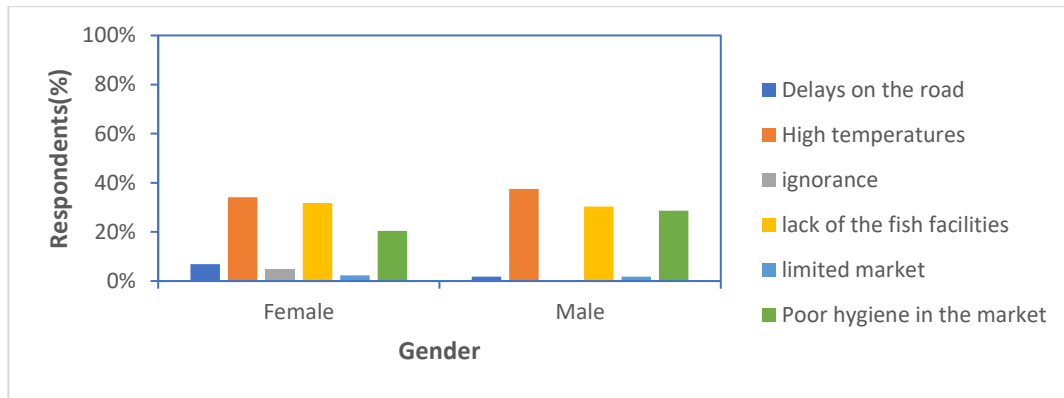


Figure 4. 27 Comparison of factors contributing most to fish spoiling in the market with gender.

Advanced Level holders report lack of facilities leading at 56.25%, followed by high temperatures at 25% and poor hygiene at 18.75%. Degree holders note lack of facilities leading at 54.55%, followed by poor hygiene at 27.27% and delays at 18.18%, with no mention of high temperatures. Diploma holders report lack of facilities leading at 57.14%, followed by poor hygiene at 28.57% and limited market access at 14.29%, with no high temperatures noted. Those with no formal education report high temperatures and poor hygiene leading at 42.86% each, followed by lack of facilities at 28.57%. Ordinary Level holders cite high temperatures leading at 45.16%, followed by lack of facilities and poor hygiene at 25.81% each, with minimal delays (3.23%). Primary education holders report high temperatures dominating at 53.57%, followed by poor hygiene at 25% and lack of facilities at 7.14%, with ignorance and limited market access minimal (7.14% and 3.57%). Higher education emphasizes facilities, while lower education highlights high temperatures (Figure 4.28).

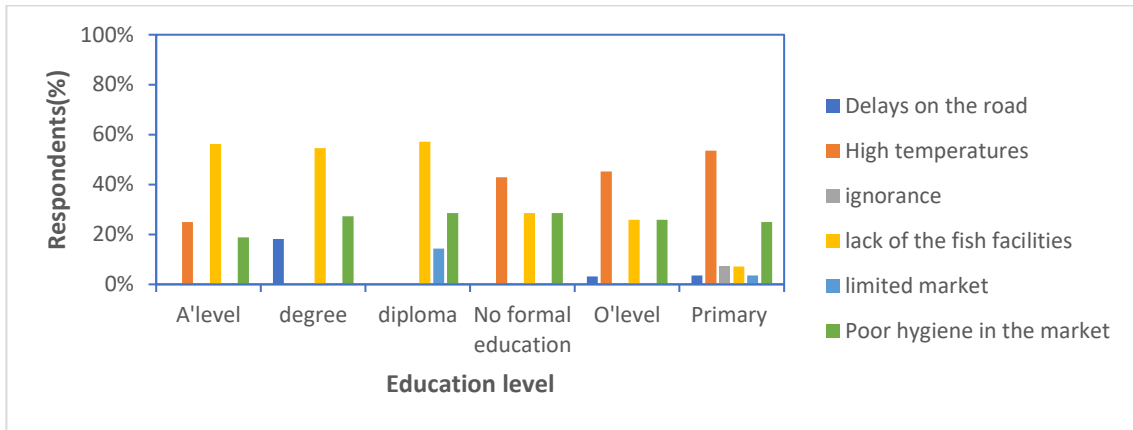


Figure 4. 28 Comparison of factors contributing most to fish spoiling in the market with level of education.

Fish market vendors report high temperatures leading at 39.73%, followed by poor hygiene at 31.51% and lack of facilities at 21.92%, with minimal mentions of delays, ignorance, and limited market access (2.74%, 2.74%, and 1.37% respectively). For fish suppliers to the market, lack of facilities leads at 53.85%, followed by high temperatures at 26.92% and poor hygiene at 7.69%, with delays and limited market access minimal (7.69% and 3.85%). Fisheries personnel report exclusively lack of facilities (100%), indicating that suppliers and personnel focus on facilities, while vendors highlight high temperatures (Figure 4.29).

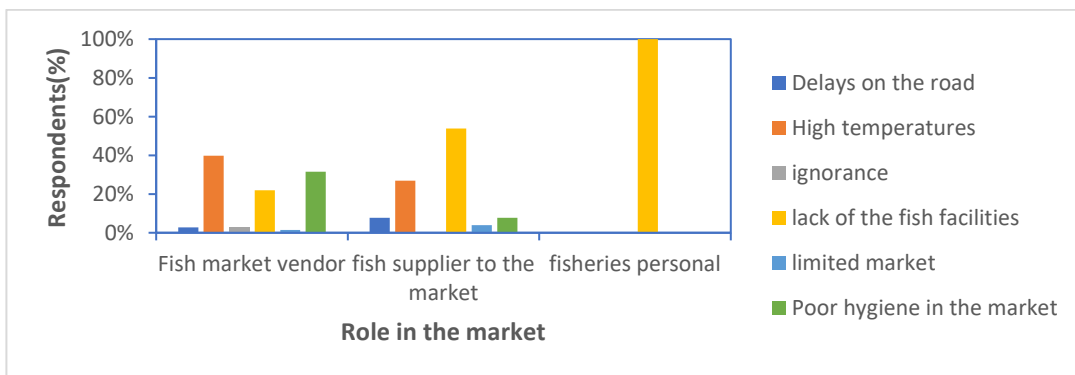


Figure 4. 29 Comparison of factors contributing most to fish spoiling in the market with role in the market.

Among those with 1-5 years of experience, high temperatures and lack of facilities lead at 36% each, followed by poor hygiene at 18%, with minimal mentions of delays and limited market access (6% and 2% respectively). For individuals with 6-10 years of experience, high temperatures and poor hygiene lead at 33.33% and 29.63% respectively, followed by lack of facilities at 29.63%, with minimal delays and limited market access (3.7% each). For those with less than 1 year of experience, poor hygiene leads at 42.11%, followed by high temperatures at 31.58% and lack of facilities at 26.32%. Individuals with more than 10 years of experience report high temperatures dominating at 75%, followed by ignorance at 25%, with no other causes noted. Less experienced individuals cite hygiene, while more experienced individuals focus on temperatures (Figure 4.30).

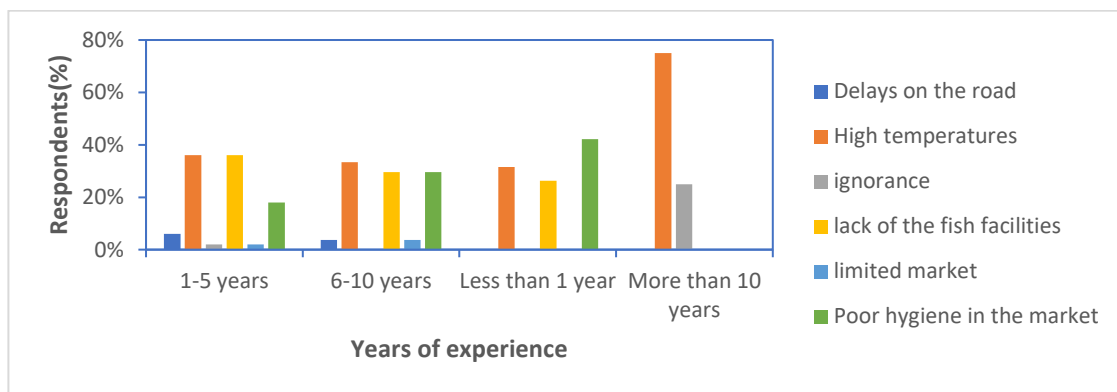


Figure 4. 30 Comparison of factors contributing most to fish spoiling in the market with years of experience.

4.7 Fish Hygienic practices and demographics.

75% of the respondents revealed that cleaning of the fish facilities is the major hygienic practice followed to prevent contamination while 16% and 9% said washing hands frequently and temperature regulation respectively are the hygiene practices they follow to prevent contamination. (figure 4.31)

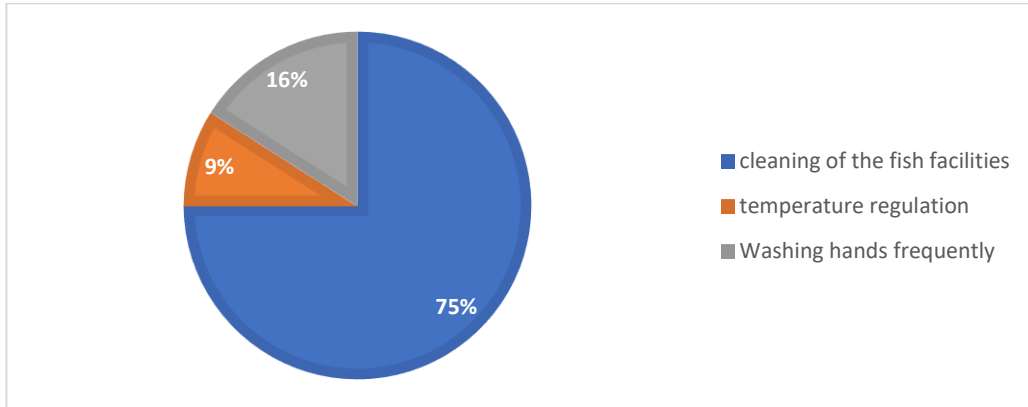


Figure 4. 31 Showing the hygiene practices followed by respondents to prevent contamination.

Among females, cleaning fish facilities dominates at 77.27%, followed by washing hands at 20.45%, with temperature regulation minimal at 2.27%. Males also prioritize cleaning fish facilities at 73.21%, followed by temperature regulation at 14.29% and washing hands at 12.5%. Both genders emphasize cleaning facilities, but males place more emphasis on temperature regulation (Figure 4.32).

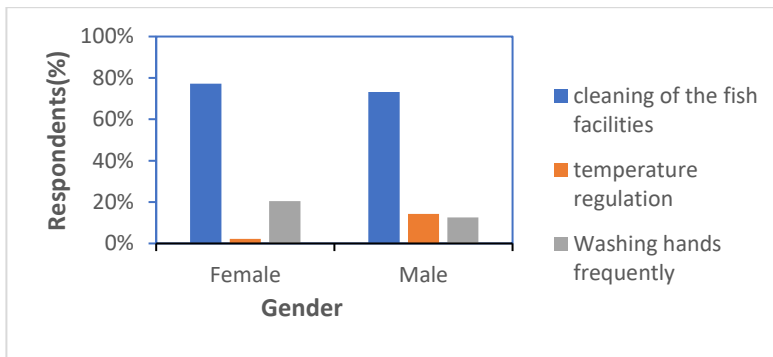


Figure 4. 32 Comparison of hygiene practices done by respondents to prevent contamination with gender.

Responses stratified according to education shows cleaning facilities was rated high -75%, for Advanced level holders; Degree holders at 63.6%, diploma holders-85.7%, yet those with no formal education exclusively focus only on cleaning facilities (100%) while

Ordinary Level holders reported cleaning facilities at 58.1% and Primary education holders- 89.3%,

Temperature regulation was rated important by all apart from those with Primary level education as a good hygienic practice as follows: Advanced level holders at 12.5%, Degree holders at 18.2%; Ordinary Level holders-12.9%.and nothing was mentioned by the Diploma holders.

All responses apart from the illiterates vendors mentioned washing hands was crucial in the hygienic handling of fish: Primary education holders rated 10.7%; Ordinary Level holders -29.03%; Advanced level holders- 12.5%, Degree holders 18.2%.

Lower education correlates with a focus on cleaning facilities, while higher education includes a variety of practices (Figure 4.33).

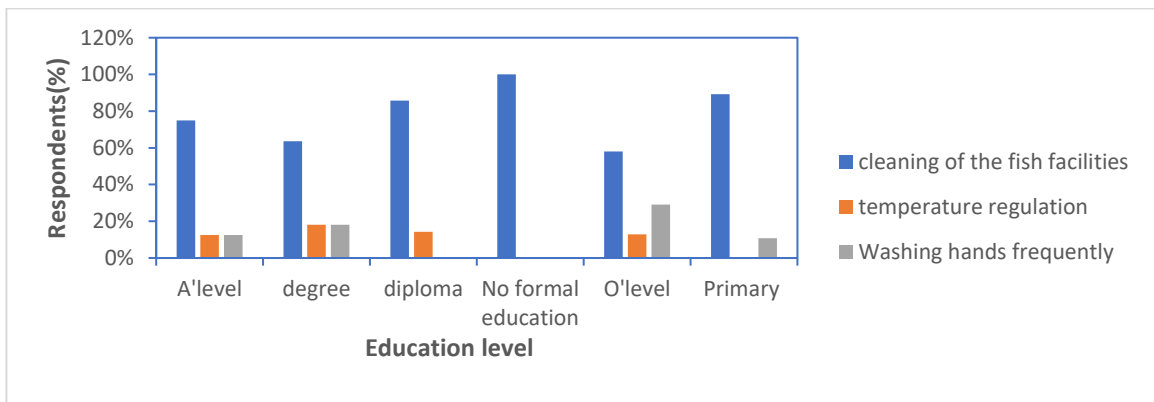


Figure 4. 33 Showing hygiene practices and level of education

Fish market vendors report cleaning facilities dominating at 76.71%, followed by washing hands at 17.81% and temperature regulation at 5.48%. Fish suppliers to the market indicate cleaning facilities lead at 73.08%, followed by temperature regulation at 15.38% and washing hands at 11.54%. Fisheries personnel focus exclusively on temperature regulation (100%), highlighting a difference where fisheries personnel prioritize temperature regulation, unlike vendors and suppliers (Figure 4.34).

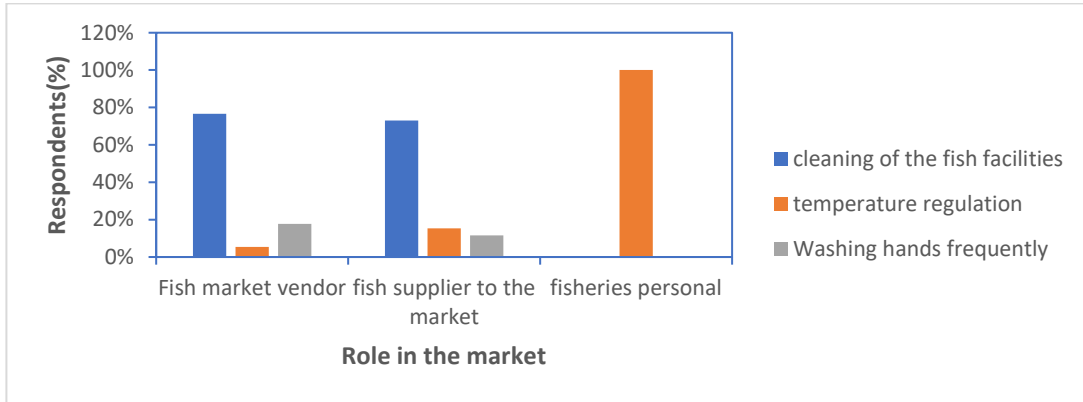


Figure 4. 34 Comparison of hygiene practices with role in the market.

All vendors irrespective of years of experience in the business, rate clean facilities (>74%), followed by washing hands (>11%) followed by temperature regulation at 8% responses for 1-5 years of experience, 11.1% for 6-10 years of experience, 10.5% for less than 1 year of experience. For individuals with more than 10 years of experience, cleaning facilities are exclusively reported at 100%, indicating that more experienced individuals focus solely on cleaning facilities.

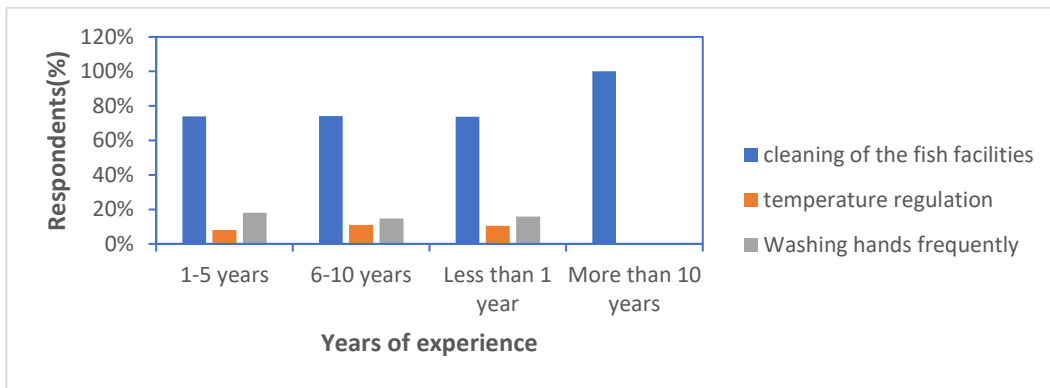


Figure 4. 35 Comparison of hygiene practices with years of experience.

4.7.1 Sources of information for fish handling and demographics.

55% of the respondents reported training programs to be their source for information about fish handling and hygiene compared to the 19%, 18% and 8% who reported fellow vendors, government or health officials and media (T.V, radio/internet) respectively as their sources for information about fish handling and hygiene. (Figure 4.36)

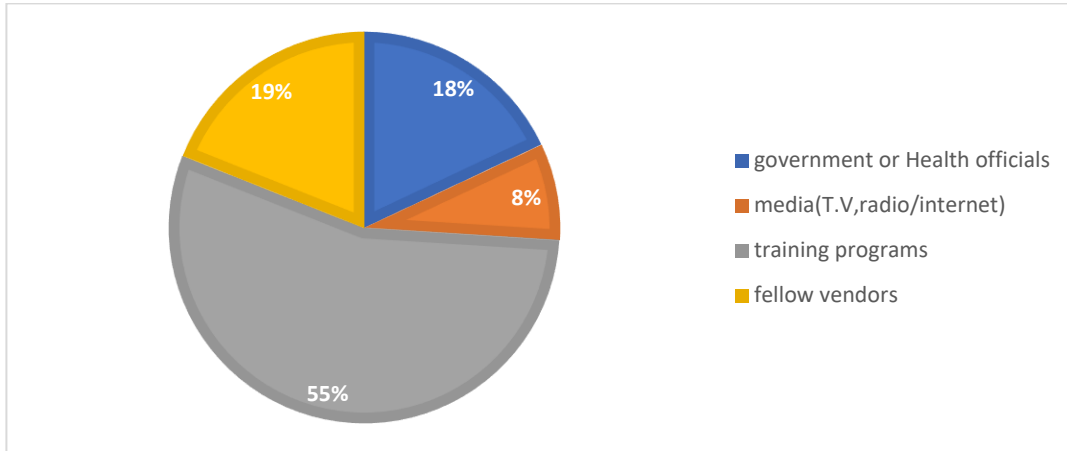


Figure 4. 36 Showing the sources for information about fish handling and hygiene.

Among female respondents, training programs dominate as the source of information at 50%, followed by fellow vendors at 20.45%, government/health officials at 18.18%, and media at 11.36%. In contrast, male respondents rely on training programs at a higher rate of 58.93%, with fellow vendors and government/health officials each at 17.86%. Media is minimal at 5.36%. Both genders heavily rely on training programs, though females utilize media more frequently (Figure 4.37).

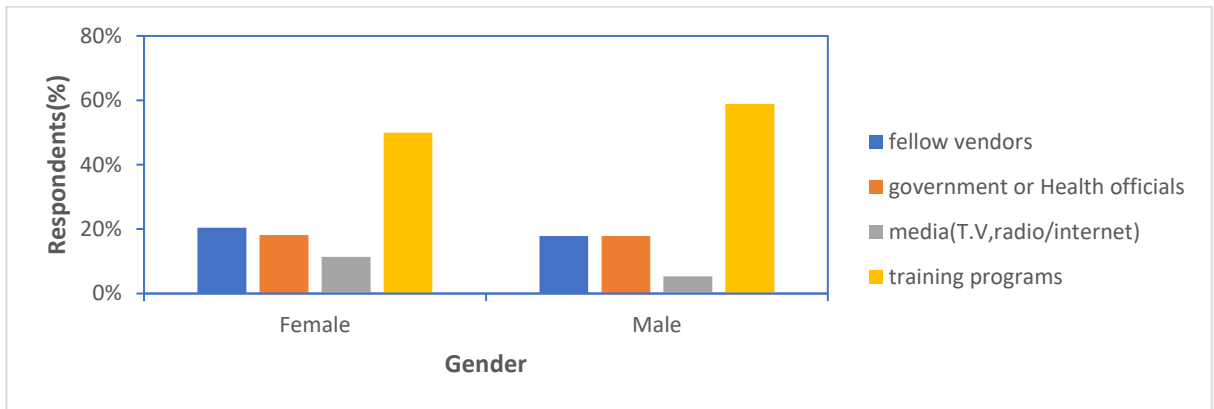


Figure 4. 37 Comparison of sources for information about fish handling and hygiene with gender.

Divorced respondents report training programs as the primary source at 73.33%, followed by government/health officials at 20% and media at 6.67%, with no reliance on fellow

vendors. Married individuals also favor training programs at 59.62%, followed by government/health officials at 19.23% and fellow vendors at 17.31%. Media is minimal at 3.85%. Single respondents indicate training programs as the leading source at 39.29%, followed by fellow vendors at 32.14%, and government/health officials and media at 14.29% each. For widowed individuals, both training programs and fellow vendors lead at 40% each, followed by government/health officials and media at 20% each. Divorced respondents heavily prioritize training programs, while singles utilize fellow vendors more (Figure 4.38).

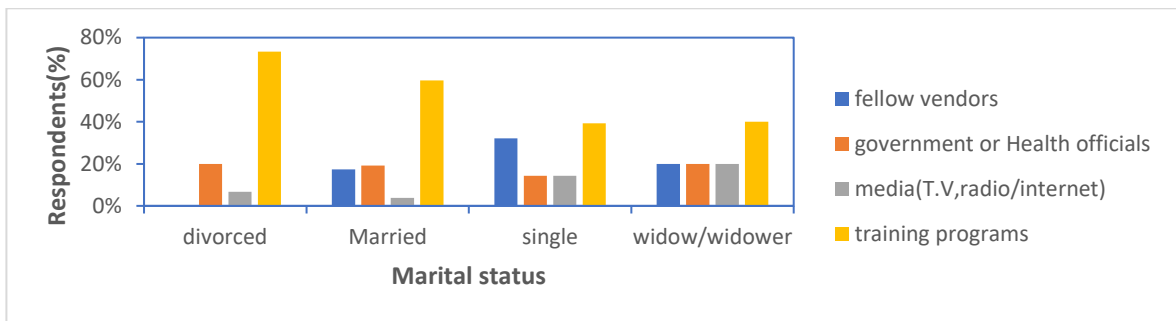


Figure 4. 38 Comparison of sources for information about fish handling and hygiene with marital status.

Respondents under 18 report an equal split between training programs and media at 50% each, with no other sources noted. Individuals over 55 rely on training programs at 75%, followed by fellow vendors at 25%, with no other sources. Among those aged 18-30, training programs lead at 45.95%, followed by fellow vendors and government/health officials at 24.32% each, with media being minimal at 5.41%. For the 31-45 age group, training programs again lead at 58.82%, followed by fellow vendors and media at 11.76% each, with government/health officials being minimal. Those aged 45-55 show training programs leading at 60.87%, followed by government/health officials at 21.74% and fellow vendors at 13.04%, with media minimal at 4.35%. Older groups tend to rely more

on training, while younger groups utilize a more diverse range of sources (Figure 4.39).

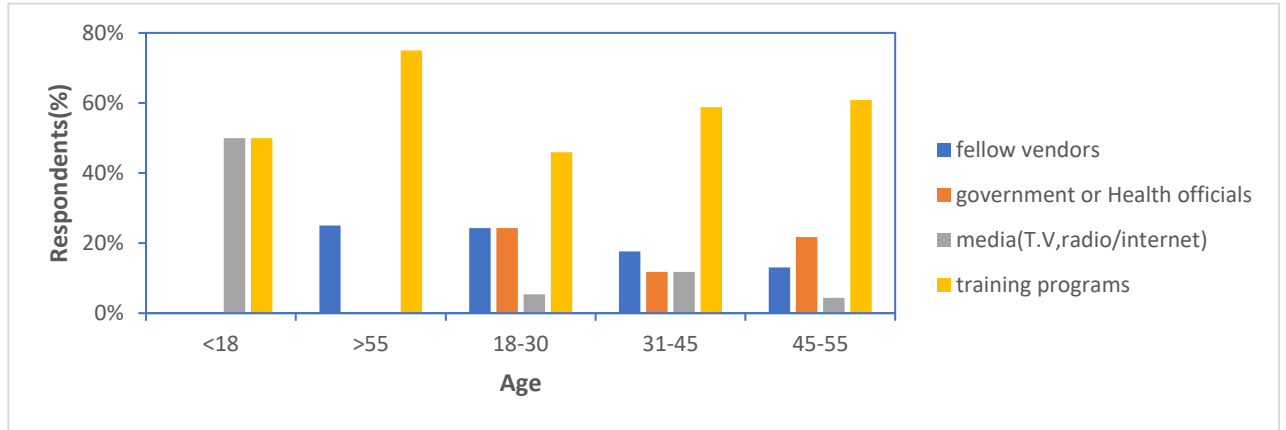


Figure 4. 39 Comparison of sources for information about fish handling and hygiene with age.

Advanced Level holders report training programs leading at 50%, followed by fellow vendors at 31.25% and media at 12.5%, with government/health officials being minimal at 6.25%. Degree holders also favor training programs at 45.45%, followed by government/health officials at 36.36% and fellow vendors at 18.18%, with no media reported. Diploma holders show training programs leading at 42.86%, followed by media and fellow vendors at 28.57% each, with government/health officials being minimal at 14.29%. Those with no formal education report training programs and media each at 42.86%, followed by fellow vendors and government/health officials at 14.29% each. Ordinary Level holders indicate training programs leading at 51.61%, followed by government/health officials at 22.58% and fellow vendors at 19.35%, with media minimal at 6.45%. Primary education holders report training programs dominating at 71.43%, followed by fellow vendors and government/health officials at 14.29% each, with no media noted. Higher education correlates with reliance on government officials, while lower education emphasizes training programs (Figure 4.40).

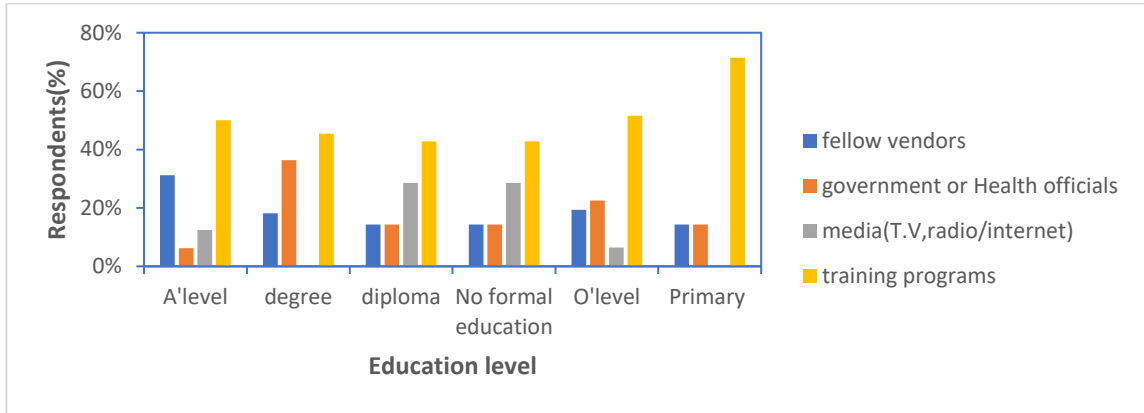


Figure 4. 40 Comparison of sources for information about fish handling and hygiene with level of education.

Fish market vendors report training programs leading at 54.79%, followed by fellow vendors at 20.55% and government/health officials at 19.18%, with media being minimal at 5.48%. Fish suppliers to the market also indicate training programs as the primary source at 53.85%, followed by fellow vendors, government/health officials, and media at 15.38% each. Fisheries personnel rely exclusively on training programs at 100%, indicating that they focus solely on formal training, while vendors utilize a more diverse set of sources (Figure 4.41).

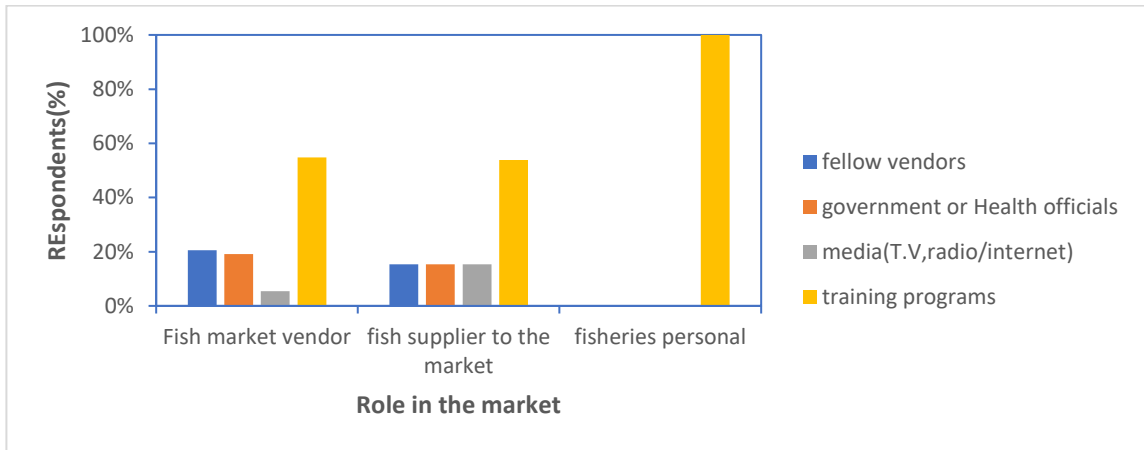


Figure 4. 41 Comparison of sources for information about fish handling and hygiene with role in the market.

Among those with 1-5 years of experience, training programs lead at 48%, followed by fellow vendors at 24% and government/health officials at 22%, with media being minimal at 6%. Individuals with 6-10 years of experience report training programs dominating at 66.67%, followed by fellow vendors and media at 7.41% each, with government/health officials being minimal at 18.52%. Respondents with less than 1 year of experience show training programs leading at 52.63%, followed by fellow vendors at 21.05% and media at 15.79%, with government/health officials being minimal at 10.53%. Among those with more than 10 years of experience, training programs dominate at 75%, followed by fellow vendors at 25%, with no other sources reported.

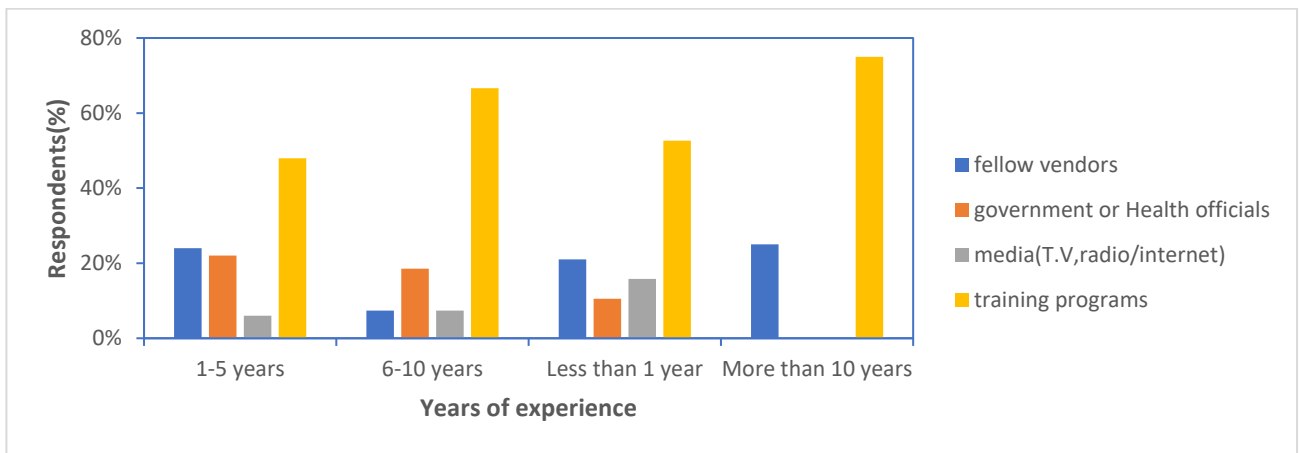


Figure 4. 42 Comparison of sources for information about fish handling and hygiene with years of experience.

4.8 Challenges faced in adopting proper fish handling

A total of 36% and 32% of respondents reported limited access to refrigeration and lack of training, respectively, as the main challenges faced in adopting proper fish handling practices. This is compared to 30%, 4%, 2%, and 2% who cited high equipment costs, lack of clean water, and other challenges (Figure 4.43).

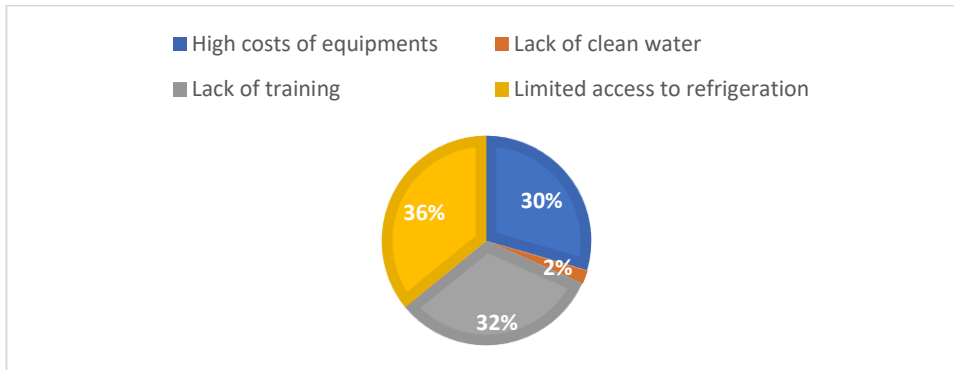


Figure 4. 43 Showing the challenges faced in adopting proper fish handling practices.

4.9 Measures to improve fish quality in Iganga fish and demographics.

A total of 52% of respondents reported improving hygiene as a key measure to enhance fish quality in the Iganga fish market, while 25%, 12%, and 11% suggested improving fish facilities, implementing training programs about fish quality, and enhancing transportation networks, respectively (Figure 4.44).

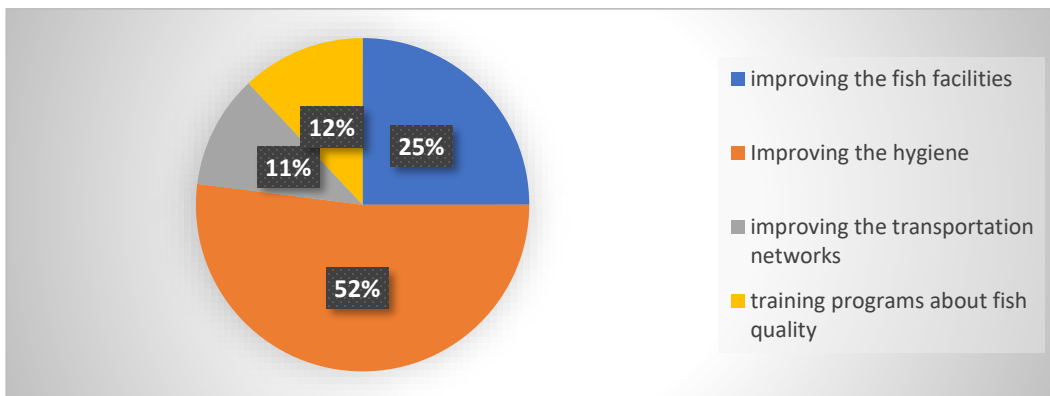


Figure 4. 44 Measures to improve fish quality in Iganga fish market.

Among female respondents, improving hygiene dominates at 50%, followed by fish facilities at 25%, transportation networks at 13.64%, and training programs at 11.36%. Male respondents also prioritize improving hygiene at 53.57%, followed by fish facilities at 25%, training programs at 12.5%, and transportation networks at 8.93%. Both genders

emphasize hygiene, with similar importance placed on facilities and training (Figure 4.45).

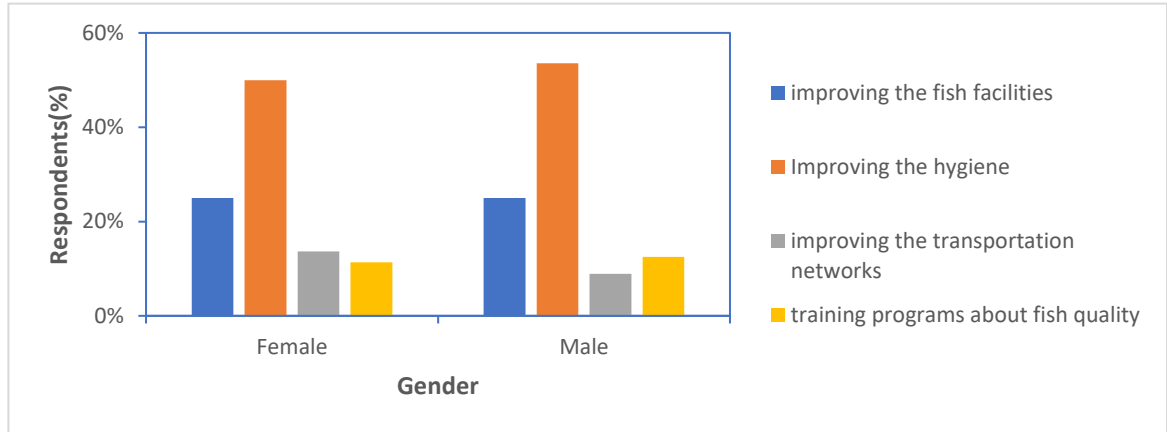


Figure 4. 45 Comparison of measures to improve fish quality in Iganga fish market and gender.

Divorced respondents report improving hygiene as the primary measure at 86.67%, followed by fish facilities and transportation networks at 6.67% each, with no training programs noted. Married respondents also prioritize improving hygiene at 57.69%, followed by fish facilities at 21.15%, training programs at 13.46%, and transportation networks at 7.69%. Single respondents indicate improving hygiene and fish facilities as leading measures at 42.86% and 28.57%, respectively, followed by transportation networks at 17.86% and training programs at 10.71%. For widowed individuals, training programs lead at 40%, followed by hygiene, facilities, and transportation networks at 20% each. Divorced individuals heavily prioritize hygiene, while singles focus more on facilities (Figure 4.46).

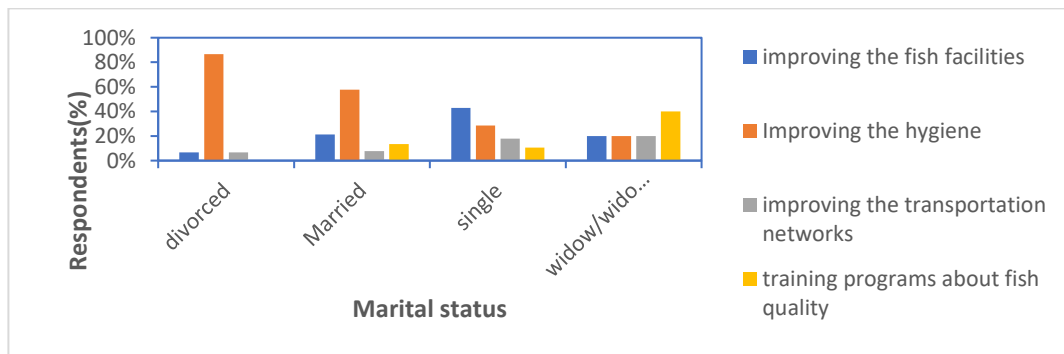


Figure 4. 46 Comparison of measures to improve fish quality in Iganga fish market with marital status.

Among respondents under 18, there is an equal split between improving hygiene and fish facilities at 50% each, with no other measures reported. Individuals over 55 prioritize transportation networks at 50%, followed by hygiene and training programs at 25% each, with no facilities mentioned. Those aged 18-30 indicate improving hygiene as the leading measure at 43.24%, followed by fish facilities at 32.43%, transportation networks at 13.51%, and training programs at 10.81%. For the 31-45 age group, improving hygiene leads at 44.12%, followed by fish facilities at 32.35%, training programs at 17.65%, and transportation networks at 5.88%. Respondents aged 45-55 report improving hygiene dominating at 82.61%, followed by transportation networks at 8.7% and fish facilities at 4.35%. Training programs are minimal at 4.35%. Older groups prioritize transportation, while middle-aged respondents focus on hygiene (Figure 4.47).

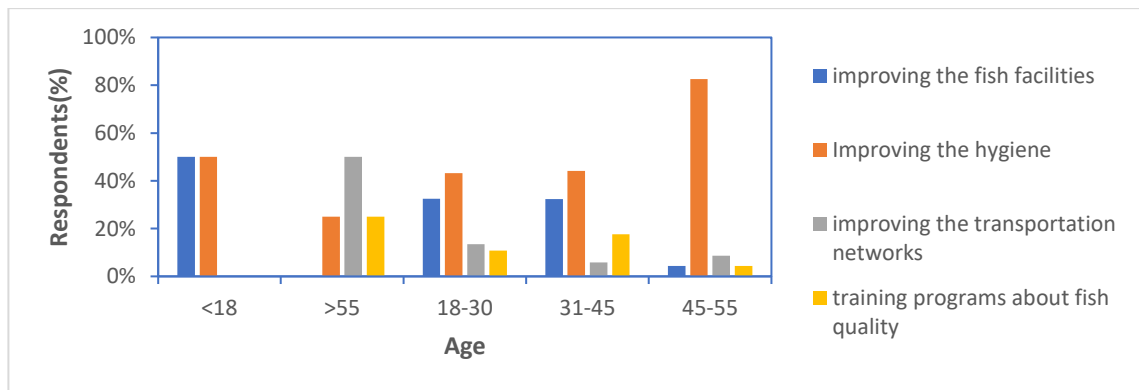


Figure 4. 47 Comparison of measures to improve fish quality in Iganga fish market with age.

Among Advanced level holders, improving hygiene leads at 37.5%, followed by fish facilities and training programs at 18.75% each, along with transportation networks at 18.75%. Degree holders indicate fish facilities leading at 54.55%, followed by hygiene at 36.36% and transportation networks at 9.09%, with no training programs reported. Diploma holders report improving hygiene leading at 42.86%, followed by fish facilities and training programs at 14.29% each, and transportation networks at 14.29%. Individuals

with no formal education prioritize improving hygiene at 85.71%, followed by fish facilities at 14.29%. Ordinary Level holders report improving hygiene leading at 58.06%, followed by fish facilities at 22.58%, training programs at 16.13%, and transportation networks at 3.23%. Primary education holders indicate improving hygiene leading at 53.57%, followed by fish facilities and transportation networks at 17.86% each, and training programs at 10.71%. Lower education emphasizes hygiene, while higher education includes a focus on facilities (Figure 4.48).

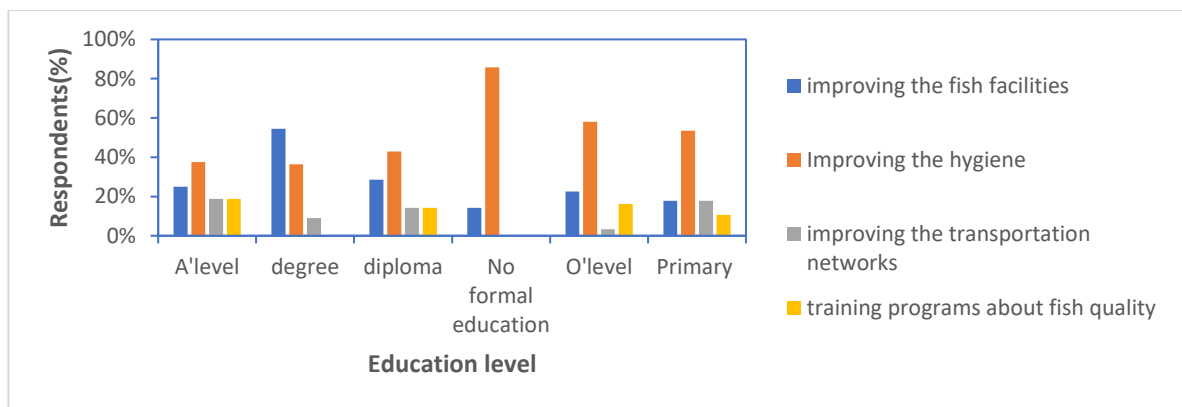


Figure 4. 48 Comparison of measures to improve fish quality in Iganga fish market with level of education.

Fish market vendors prioritize improving hygiene at 56.16%, followed by fish facilities at 23.29%, transportation networks at 10.96%, and training programs at 9.59%. Fish suppliers to the market also indicate improving hygiene as a priority at 42.31%, followed by fish facilities at 26.92%, training programs at 19.23%, and transportation networks at 11.54%. Fisheries personnel exclusively focus on fish facilities at 100%, indicating that they prioritize facilities, while vendors emphasize hygiene (Figure 4.49).

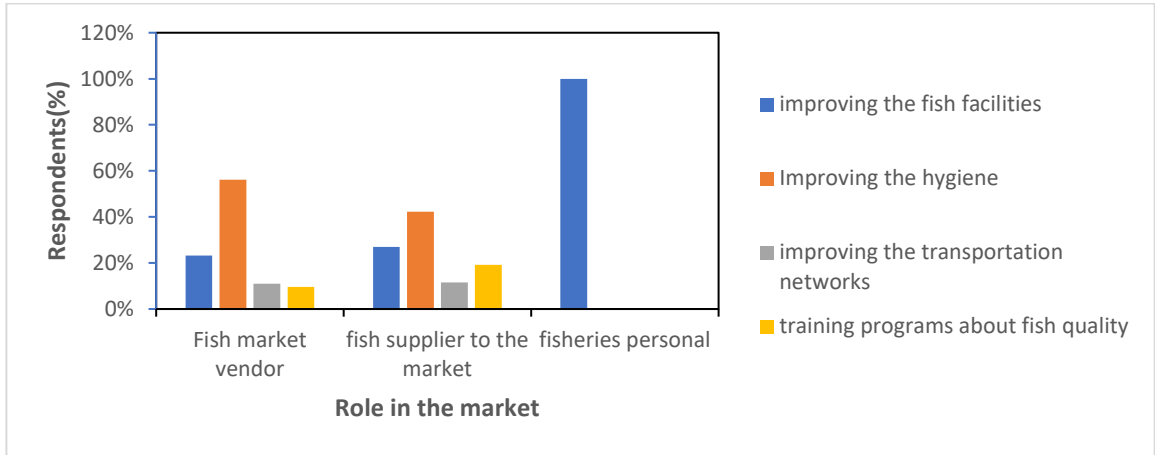


Figure 4. 49 Comparison of measures to improve fish quality in Iganga fish market with the role in the market.

Among respondents with 1-5 years of experience, improving hygiene leads at 48%, followed by fish facilities at 26%, training programs at 16%, and transportation networks at 10%. Individuals with 6-10 years of experience also prioritize improving hygiene at 59.26%, followed by fish facilities at 22.22%, transportation networks at 11.11%, and training programs at 7.41%. Respondents with less than 1 year of experience report improving hygiene leading at 57.89%, followed by fish facilities at 31.58%, transportation networks at 5.26%, and training programs at 5.26%. Among those with more than 10 years of experience, transportation networks and hygiene lead at 50% and 25%, respectively, followed by training programs at 25%, with no mention of facilities. Less experienced individuals focus on hygiene, while more experienced respondents emphasize transportation (Figure 4.50).

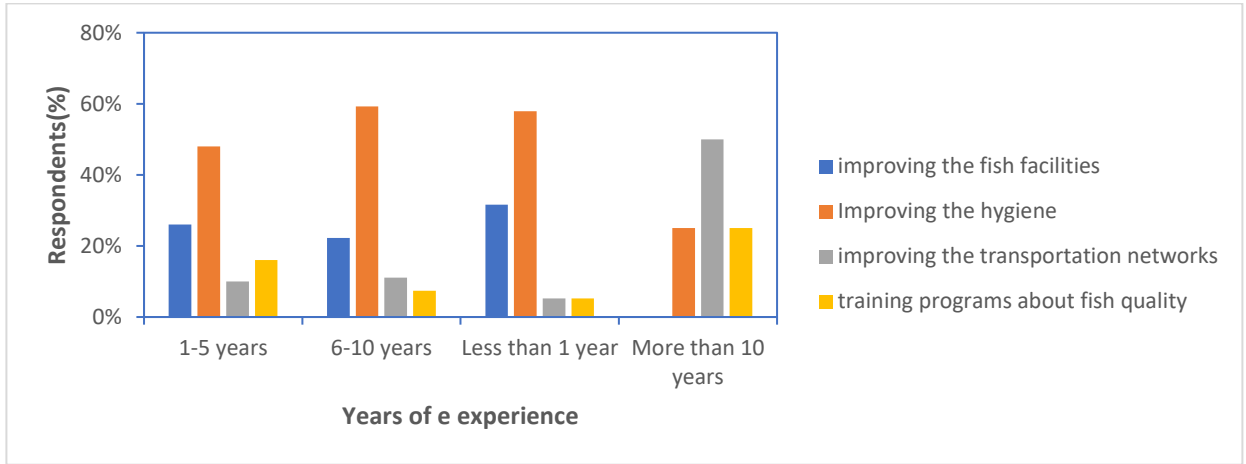


Figure 4. 50 Comparison of measures to improve fish quality in Iganga fish market with years of experience.

CHAPTER FIVE:

5.0 DISCUSSION, RECOMMENDATIONS, AND CONCLUSION

5.1 Discussion of Results

The study found that tilapia (48%) and Nile perch (42%) dominate trade in Iganga fish market, with 73% of fish received fresh (not refrigerated). Motorcycles (76%) are the primary transport mode, using open baskets (46%) or insulated containers with ice (37%). Use of ice during was shown to be high (48%) and refrigeration (26%), but only 17% store fish at room temperature. Display is predominantly on tables is common practice 84%) is good for the urban trade. Many fishmongers remove scales before sales (72%). Fishmongers remove scales before sales to enhance customer convenience, as pre-scaled fish are easier to prepare and cook, appealing to urban consumers who value time-saving and ready-to-use products., The use clean tap water (52%) to clean fish is good indicator for good fish handling, though 16% use river/lake water (FAO, Code of practice for fish and fishery products., 2015).The use of open baskets and room-temperature storage, especially among less-educated vendors (85.71% with no formal education use open baskets), aligns with (Kaaya, 2010), highlighting gaps in cold chain maintenance and hygiene that compromise fish quality.

These findings reflect a mix of traditional and semi-modern methods, consistent with (Akande, 2010), who noted that rudimentary transport and storage in African markets increase spoilage risks.

High spoilage rates (80%) reported, with bad odor (64%) as the primary spoilage indicator, followed by soft flesh (27%) and gill discoloration (9%), point to inadequate post-harvest handling and storage practices, particularly insufficient cold chain infrastructure, as evidenced by the heavy reliance on ice (48%) and limited refrigeration (26%), coupled with 17% room temperature storage and 16% use of potentially contaminated river/lake water for cleaning, all of which contribute to rapid microbial growth and fish deterioration. Key spoilage factors include high temperatures (36%), inadequate facilities (31%), and poor hygiene (25%), corroborating (Huss, 1995), on the role of temperature and hygiene

in bacterial growth. The use of river/lake water (16%) and open displays increase contamination risks, as noted by (Olafsdottir, 1997) . Customer complaints (59%) about bad odor (76%) further highlight quality issues. Respondents suggested improving hygiene (52%), enhancing facilities (25%), and training (12%) to address these issues, aligning with (Diei-Ouadi, 2011) recommendations for ice use and hygiene training. These findings confirm that current practices significantly impair fish quality, necessitating interventions to reduce spoilage and contamination.

Only 69% of vendors received training, mostly from government agencies (56%), with 59% rating their knowledge as good. However, reliance on fellow vendors (19%) and media (8%) for information indicates limited formal education, as found by (Omojowo, 2014). Challenges include limited refrigeration (36%) and lack of training (32%), particularly among less-educated vendors (100% with no formal education focus on cleaning facilities). Higher-educated vendors use more refrigerated storage (36.36% of degree holders) and clean tap water (63.64%), suggesting education influences awareness, as per (Adewumi, 2014) . The 89% willingness to participate in training programs reflects a positive attitude, supporting (FAO, Guidelines for improved quality and safety., 2020) on the need for capacity building to improve practices.

5.2 Conclusion

The study confirms that improper fish handling practices in Iganga Fish Market, including open basket transport, limited refrigeration, and inconsistent hygiene, drive high spoilage rates (80%) and compromise fish quality. Bad odor is the primary spoilage indicator, exacerbated by high temperatures and inadequate facilities. Limited training (69% coverage) and education gaps among vendors further hinder quality improvements. The hypothesis that improper practices decrease fish quality is supported. Targeted training, infrastructure upgrades, and stricter hygiene regulations are essential to reduce spoilage, enhance safety, and support economic and nutritional outcomes. The 89% willingness for training provides a strong foundation for these interventions.

5.3 Recommendations

Implement regular training by developing government-led training programs on cold chain management, hygiene, and preservation, targeting less-educated vendors to bridge knowledge gaps (32% cited lack of training).

Upgrade infrastructure through provision affordable refrigeration and insulated storage units through subsidies, addressing the 36% reporting limited refrigeration access.

Enforce hygiene standards by mandating clean tap water use (only 52% currently) and regular inspections to reduce contamination risks (25% cited poor hygiene).

Promote cold chain practices through Subsidizing ice and refrigerated transport to replace open baskets (46%) and reduce spoilage from high temperatures (36%).

Raise community awareness by launching campaigns to educate vendors and consumers on fish quality and safety, supporting the 52% prioritizing hygiene improvements.

Foster stakeholder collaboration by partnering with NGOs and local authorities to improve facilities (31% cited as a spoilage factor) and ensure regulatory compliance.

References

- Ababouch, L. (2005). An overview of health and quality considerations. *FAO fisheries Technical paper*, 466.
- Adebayo-Tayo, B. (2012). Microbiological and physico chemical changes during storage of tilapia fish . *Journal of food science and technology* , 49(6),747-755.
- Adebowale, B. O. (2008). Effects of handling and processing on the quality of fish . *African journal of biotechnology*, 7(16),2906-2911.
- Adewumi, A. (2014). Effects on fish quality and consumer safety. *African journal of food science*, 119-125.
- Akande, A.-O. (2010). fish handling practices in the fish market:best practices and recommendations. *FAO technical paper*, 534.
- akinola, J. (2021). implications for quality and safety. *Nigerian journal of Fisheries and aquaculture.*, 89-97.
- Assefa, A. (2017). Post-harvest fish handling and quality assessment. *Journal of ventinary science and technology*, 8(4),1-7.
- Ayinia, G. D. (2020). A review of best practices and recommendations. *aquatic sciences*, 15(2),145-157.
- Babalobi, o. (2020). fish handling practices:challenges and recommendations. *journal of fisheries and aquaculture.*, 12(4),235-245.
- Diei-Ouadi, Y. (2011). Best practices and recommendations. *FAO fisheries and aquaculture*, 540.
- FAO. (2015). Code of practice for fish and fishery products.
- FAO. (2016). Fishery and aquaculture country profiles. *Uganda food and agriculture organisation of the united nations*.
- FAO. (2020). Guidelines for improved quality and safety. *Food and Aquaculture organisation of the united Nations*.
- FAO. (2021). A guide for improved safety and quality. *FAO fisheries and aquaculture*, 1234.
- Gram, L. (1996). Fish handling practices and quality in fish markets. *Journal of food protection.*, 59(3),316-321.

- Huss, H. (1995). Fish handling practices in fish market: impact on quality. *fisheries science*, 22(3),165-173.
- Kaaya, A. (2010). A study of challenges and solutions. *African journal of aquatic science* , 35(11),123-130.
- Katongole, M. (2018). Implications for fish quality and safety. *African Journal of aquatic science* , 104-111.
- MUGabe, C. (2020). Implications for fish quality and safety. *Journal of food quality*, 43(6).
- Mugisha, s. (2019). Fish handling practices:challenges and improvements. *African journal of aquatic science* , 44(3),231-240.
- Ngutadayo, H. (2021). Fish handling practices:Enhancing quality and safety standards. *Asian fisheries science* , 34(1).
- Odeyemi, O. (2018). Assessment of challenges and opportunities . *journal of fisheries and aquatic science*, 13(4),164-172.
- Olafsdottir, G. a. (1997). Methods to evaluate fish freshness in research and industry. *Trends in food science and technology*, 8(8),258-265.
- Omojowo, F. U. (2014). Fish handling,preservation and processing. *African Journal of agriculcultural research*, 9(16),1252-1257.
- Onyango, M.-O. (2009). Challenges and opportunities for improvement. *journal of fishery sciences*, 45-52.
- Onyango, M.-O. (2019). Evaluation of current methods and their impact on quality. *journal of aquatic food product technology*., 28(2),142-156.
- oparaku, N. (2012). Effects of fish handling on post harvest losses in smoked fish i. *Journal of applied sciences and environmental management*., 16(2) 215-220.
- Uddin, M. (2021). Impacts on quality and safety measures. *Journal of fisheries and aquaculture*, 67-75.
- Vanderzant, c. (2019). Fish handling practices:strategies for improvement and sustainabilty. *Journal of food safety*, 39(5).

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QUESTIONNAIRE

Dear Respondent.

I am **Mukisa Araphat** a student of Busitema University pursuing Bachelor's degree of Science in Fisheries and Water Resource Management at Namasagali campus. I am conducting a study on

'Assessment of fish handling practices in Iganga fish market and their perceived impacts on fish quality'

You are requested to respond to these questions; your response will be treated with confidentiality and will be anonymously used for purpose of only writing this research report.

Thank you for your cooperation.

SECTION A: Demographic information

1. Name (optional):

2. Gender (**tick as appropriate**): (Male/Female)

3. Marital status

Marital Status	Single	Married	Divorced	Widow/widower
(Tick (√))	1	2	3	4

4. Age group

Age (years)	<18	18 -30	31-45	45- 55	>55
(Tick (√))	1	2	3	4	5

5. Highest level of formal education attained:

Education level	No formal education	Primary	Secondary		Tertiary		Others (specify)
			O Level	A Level	Diploma	Degree	
(Tick (√))	1	2	3	4	5	6	

6.Role in the Fish Market

Role	Fish Market Vendor	Fish Supplier to the market	Fisheries personnel	Other local government personnel	Other (specify)
Tick (√)					

7.Years of Experience in the Fish Market business

Number of years	Less than 1 year	1–5 years	6–10 years	More than 10 years
Tick (√)				

Section B: Current Fish Handling Practices

8.What types of fish do you trade in most frequently? (Select all that apply)

Species	Tilapia	Nile Perch	Catfish	Others (please specify)
Tick (√)				

9.In what form/state is this fish received by you?

State of the fish	Fresh (not refrigerated)	Fresh Refrigerated	Frozen	Other (please specify):
Tick (√)				

10.Means of transport to the fish market? (Select all that apply).

Means of transport	Bicycle	Trucks	Motorcycle.
Tick (√)			

11.How is the fish transported to the fish market

Methods	Tick
Insulated containers with ice	
Open baskets	
Plastic bags	
Refrigerated vehicles	
Other (please specify):	

11.How do you store fish at the market before selling?

Methods of storing fish	Tick
On ice	
In a refrigerator/freezer	

At room temperature	
In water tanks	
Other (please specify)	

12. What cleaning practices do you follow before selling fish?

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.....

.....

13. How often do you clean your facilities used in marketing fish?

Number of times	Tick
After every use	
Once a day	
Several times a week	
Rarely	
Never	

14. How do you display fish for sale?

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.....
.....

15. do you preserve fish before selling? Yes or No

.....
.....if yes how.....
.....

16. Where do you store unsold fish at the end of the day?

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.....
.....

17. What type of water is used for washing fish and containers?

Type of water	Clean tap water	River or lake water	Borehole water
Tick			

Other (specify):
.....

Section C: Impact on Fish Quality

18. Do you often have your fish get spoilt before sales

Yes or No

19. How often do you experience spoils of fish in your business

Number of times	Tick
Daily	
Weekly	
Rarely	
Never	

20. What signs of spoiling do you observe most frequently?

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21. In your opinion, what factors contribute most to fish spoiling in the market?

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22. What hygiene practices do you follow to prevent contamination?

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.....

23. Have you ever received complaints about fish quality from customers? (tick)

Yes (please specify the nature of complaints):

.....

No

If yes how often

24. Do you think the current fish handling practices in the market affect fish quality? (tick)

Yes, significantly

Yes, slightly

No

25. On a scale of 1 to 5, how would you rate the overall hygiene of the fish market?

Scale	Tick
1 (Very poor)	
2 (Poor)	
3 (Average)	
4 (Good)	
5 (Excellent)	

Section D: Knowledge and Awareness of Fish handling practices

26. Have you received any training on proper fish handling, storage, or hygiene practices? (tick)

- Yes (please specify when):
- No

27. If yes, who provided the training?

Provider	Tick
Government agencies	
NGOs or private organizations	
Fellow vendors/suppliers	
Other (specify)	

28. How would you rate your knowledge of proper fish handling practices? (tick)

- Excellent
- Good
- Fair
- Poor

29. Are you aware of the risks of contamination in fish handling? (tick)

- Yes (please specify what risks you know):
.....
- No

30. What sources do you rely on for information about fish handling and hygiene? (Select all that apply)

Sources	Tick

Training programs	
Fellow vendors/suppliers	
Government or health officials	
Media (radio, TV, internet) Other (please specify)	

31. What challenges do you face in adopting proper fish handling practices? (Select all that apply)

Challenges	Tick
Lack of training	
Limited access to refrigeration	
High costs of equipment	
Lack of clean water	
Other (please specify)	

Section E: Suggestions for Improvement

32. What measures do you think could improve fish quality in Iganga Fish Market

.....

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.....

33. Would you be willing to participate in training programs on fish handling and hygiene? (tick)

- Yes
- No

Maybe (please explain):

.....

34. Do you think introducing stricter regulations on hygiene and fish handling would improve fish quality? (tick)

- Yes
- No

35. Do you have any additional suggestions to improve fish handling practices or fish quality in the market?

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.....
.....
.....
.....

Thank you for taking the time to complete this questionnaire. Your input is valuable in improving fish handling practices and ensuring better fish quality in Iganga Fish Market.