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# SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Assessment of the Feasibility of Producing Healthy  
Fish for the Ghanaian Market



**SEPTEMBER, 2017**

THE  
UNIVERSITY  
OF RHODE ISLAND  
GRADUATE SCHOOL  
OF OCEANOGRAPHY



**SNV** SMART  
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**Cover photo:** SNV Advisor, Mr. Emmanuel Kwarteng, interviewing some fish processors in Axim (Credit: Adwoa Anaasor Hema Nsiah)

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## **ACRONYMS**

CCM	Centre for Coastal Management
CEWEFIA	Central and Western Region Fishmongers Improvement Association
CRC	Coastal Resource Center
CSLP	Coastal Sustainable Landscape Project
DAA	Development Action Association
DFAS	Department of Fisheries and Aquatic Science
DMFS	Department of Marine Fisheries Sciences
DQF	Daasgift Quality Foundation
FtF	Feed the Future
GIFA	Ghana Inshore Fishermen's Association
GIS	Geographic Information System
GNCFC	Ghana National Canoe Fishermen's Council
HM	Hen Mpoano
ICFG	Integrated Coastal and Fisheries Governance
MESTI	Ministry of Environment Science and Technology
MOFAD	Ministry of Fisheries and Aquaculture Development
NDPC	National Development Planning Commission
NGOs	Non-Governmental Organizations
SFMP	Sustainable Fisheries Management Project
SMEs	Small and Medium Enterprises
SNV	Netherlands Development Organization
SSG	SSG Advisors
STWG	Scientific and Technical Working Group
UCC	University of Cape Coast
URI	University of Rhode Island
USAID	United States Agency for International Development
WARFP	West Africa Regional Fisheries Development Program

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## **EXECUTIVE SUMMARY**

Fish smoking is done at the artisanal level by women in coastal towns and villages and in areas along rivers and the shores of Lake Volta. In most fishing communities, the main economic activity of women is fish processing and marketing. The reasons for smoking fish are varied but, as far as Ghana is concerned, the process has proved relevant to: prolonging shelf life; enhancing flavor and increasing utilization in soups and sauces; reducing waste at times of bumper catches; storing for the lean season; increasing protein availability to people throughout the year; making fish easier to pack, transport and market.

Despite the fact that modern methods of fish preservation, such as freezing and refrigeration, are available to some extent, the demand still persists in Ghana for the traditional flavor, taste and color obtained by smoking. Before the introduction of the Chorkor smoker in Ghana in 1969, a wide range of traditional stoves were being used for smoking fish. All of which use wood as a source of fuel (Improved fish Smoking Ghana; UNDP).

In the present study, 153 smoked fish processors, traders and consumers from seven communities in the Western, Central and Greater Accra Regions were interviewed to seek their views on healthy fish.

In local village communities that were the project target areas, there was little or no knowledge on what comprises a healthy fish. This study helped to gain a better understanding of what locals presume to be a healthy fish. Eighty-three per cent of the smoked fish processors were not aware of the implications of smoked fish whilst 17% were aware. For majority of smoked fish processors, traders and consumers, healthy fish production, sale and consumption depended much on employing good fishing, healthy fish handling and processing practices. Ninety-four per cent of the respondents were willing to change their old ways of processing fish to make it healthier whilst 6% of the respondents would like to keep to their old ways of processing and handling fish. Sixty-six per cent of the consumers were willing to travel and purchase the healthy smoked fish while 34% declined.

## SECTION 1 BACKGROUND

Ghana has access to significant and valuable stocks of fish. According to the Fisheries and Aquaculture Sector Development Plan for 2011 to 2016, the total domestic production of fish stocks including aquaculture, is roughly 440,000 tons each year. This fish production is worth in excess of US\$ 1 billion in income annually. In terms of the overall economy, the fisheries sector accounts for at least 4.5% of GDP. These figures underscore the prominent role that fisheries play in the Ghanaian economy as they have done for many generations past.

In the fisheries sector, small pelagic landings make up about 83% of the total catch by weight, and are an important source of animal protein contributing to food security and livelihoods FAO (2016). However, the fisheries sock in Ghana has experience some drastic decline over the past years.

The United States Agency for International Development (USAID) has committed funds to the implementation of the Sustainable Fisheries Management Project (SFMP) in Ghana for five years. The objective is to rebuild marine fisheries stocks and catches through adoption of responsible fishing practices. The project will contribute to the Government of Ghana's fisheries development objectives and USAID's Feed the Future Initiative.

The project is being implemented by the Coastal Resource Center (CRC) of the University of Rhode Islands (URI) through a consortium of international and local partners, including SNV Netherlands Development Organization.

The Sustainable Fisheries Management Project (SFMP) seeks to improve the livelihood of about 10,000 fishers including fish processors and fishermen. The post-harvest component of the project implements interventions towards adding value to fish products to increase productivity in the businesses of fish processors, such as the introduction of improved technologies for fish processing, training of processors in best practices, healthy fish processing methods and conducting research into PAH levels and microbiological profiles on processed fish. These activities are geared towards developing healthy fish processing protocols to guide processors in producing healthy smoked and salted fish.

However, there need to be a growing demand for healthy fish to make producers more willing to produce it. It is believed that improved hygiene, processing methods, product quality, packaging, labelling and marketing will significantly increase the shelf life and the value of smoked/dried fish products. This will improve better penetration into domestic markets, where demand is strong, as well as to neighbouring countries. This study seeks to affirm these assumptions with both qualitative and quantitative data. The study also assessed the technical feasibility of producing healthy fish.

Earlier research by SNV revealed that, most of the existing stove technologies used for smoking fish in Ghana leaves deposits of PAH levels on fish being consumed.

In the communities that were the project target areas, there was little or no knowledge on what comprises a healthy fish. Many understood the possibility of fish contamination, but there was almost no knowledge of polycyclic aromatic hydrocarbons (PAHs) which are carcinogenic. Women fish processors are exposed to these chemicals for long periods of time while they are working which puts them at risk for cancer. There is a basic understanding of what a healthy fish looks like when being purchased for processing. There is also some understanding on how fish should be kept after being processed. However, the knowledge is very basic and it does not necessarily act as a guideline for action.



The current market for producing smoked fish has three main categories of stakeholders which include producers, traders and consumers. Each of these main stakeholders play a different role in the fisheries value chain when it comes to smoked fish. Fishery resources in general refer to the elements of a natural aquatic resource which can be legally caught by fishing. This includes strains, species, populations, stocks, assemblages and fishing equipment, technique and handling (FAO, 2016). The management of this resource also refers to:

the integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives (Cochrane, 2002).

At the national level, the management of these resources is under the control of the Ministry of Fisheries and Aquaculture and the Fisheries Commission. This gives the general trend of what goes into fishery management at the community level.

In 1971, a survey of consumer attitudes to processed fish showed that Ghanaian consumers preferred smoked dried fish to fresh fish. In order to further understand the current market for smoked fish a survey is necessary for proper data collection. We are looking to determine attractive factors that qualify fish for purchase. Determination of characteristics that create selling point is necessary information required to understand the current fish market. Currently good quality can be determined in terms of color, shape and taste (FAO and UNDP, 2001).

## **1.1 Objectives**

The research intended to provide insights into the financial and technical feasibility of producing healthy fish for the Ghanaian market by:

1. Identifying available market for healthy fish.
2. Determining the percentage of fish processors, traders and consumers who were aware of the implications of smoked fish.
3. Identifying what clients, consider when purchasing smoked fish.
4. Identifying the factors necessary for the production of a healthy smoked fish.
5. Determining the percentage of fish processors who are willing to change ways of processing fish to make it healthier.
6. Identifying some push factors and conditions that would be considered by fish processors before producing healthy fish.
7. Determining the percentage of consumers who are willing to pay more for healthy smoked fish.

## SECTION 2 METHODOLOGY

The survey was conducted in 7 communities in three regions; Greater Accra, Central and Western regions. The communities where the smoked fish processors were interviewed were Axim, Chorkor, Elmina, Moree, Tema Newtown and Winneba. The popular fish markets visited for the interview were Agona Swedru, Mankesim, Agbogloboshie, Agona Nkwanta, Elmina, and Sekondi markets. In each market, consumers on the spot of purchasing smoked fish were targeted for interview. Also, smoked fish traders were interviewed.

In selecting a sample size representative of the population of the various categories, the appropriate formula below was used.

$$ss = \frac{Z^2 * (\rho) * (1 - \rho)}{c^2}$$

Where:

Z = Z value (2.576 selected for 99% confidence level)

$\rho$  = percentage picking a choice,

c = confidence interval

A confidence level of 99% (Z-value of 2.576) with a corresponding confidence interval (c) of 0.02 which resulted in a sample size of 70 respondents for processors. For the purpose of this study, there was the need to have a detailed information for willingness of production of healthy fish, since traders and consumers will not have much of a choice than to sell and consume what processors produce.

A 20% picking choice was adopted for traders, which resulted in a sample size of 53 respondents for traders. A 10% picking choice was also adopted for consumers, which resulted in a sample size of 30 respondents for consumers, giving a total sample size of 153. To accommodate non-responses, a 10% respondents of adopters was further sampled leading to a total sample size of 168. As required in conducting performance evaluations, the sampling included all communities under the zone of influence (ZOI), which in this case is the Central and Western Regions.

## SECTION 3 RESULTS

### 3.1 Processors

Fish smoking is the major occupation along the coastline and the communities along the freshwater sources, and it is dominated by women. Processors' main role in the value chain is purchasing of fresh fish and converting it into smoked fish. Various techniques and materials are used in the fish smoking process. The popular fish smoking technique used in Ghana is the Chorkor oven. This oven uses fuelwood as its main fuel for smoking, contributing to the high deforestation rate due to its inefficiency. The high level of smoke exposure to the processor and the smoked fish renders the process unsafe for the processor. The processor, after smoking decides to sell it or store it for higher value during the lean season. They are mostly packaged in a basket weaved with rattan or an aluminum pan rapped with brown paper and tied up in a net for market. Some processors sell their fish in bulk at the processing site or market place while others double as trader to retail at the market place.

#### 3.1.1 Demographic characteristics of processors

As part of the survey, 108 processors were interviewed from six major fish processing communities with respondent distribution as follows; Axim (23), Moree (22), Chorkor and Tema Newtown (21), Elmina (16) and Winneba (5). 100% of the respondents were females.

In terms of age distribution, 14% of the respondents were within the range of 18–30 years, 35% of the respondents fell within the age range of 31- 45 years, while 17% percent were within 46-50 years range. 30% of the fish processors interviewed were above 50 years, with 4% of the respondents having no idea about their age range. As much as the fish processing activity require intense labour, most of the aged are still involved by providing some level of support. In some cases, the aged still owns the business with hired labourers or family members.

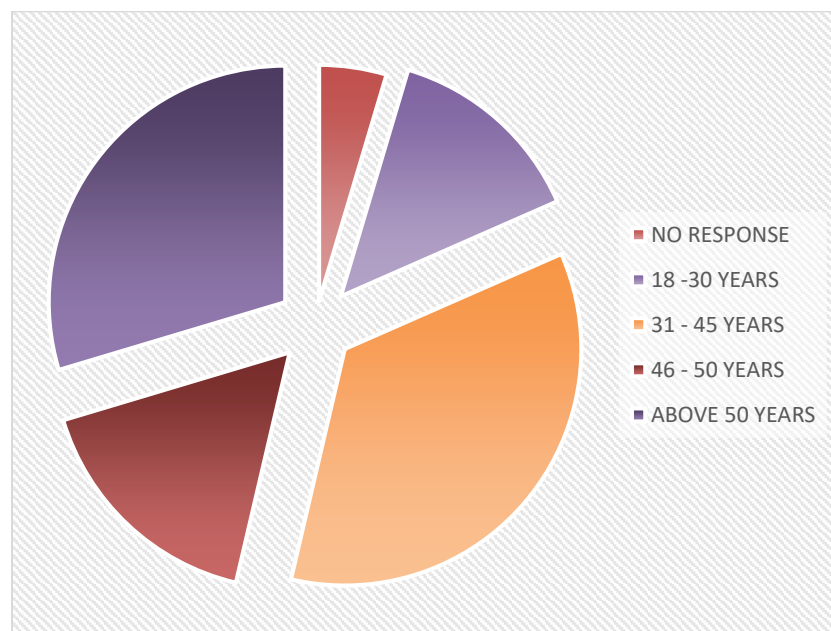


Figure 1 Equation 1 Age ranges of respondents

### 3.1.2 Level of education of respondents

The results indicated that a high percentage (41%) of the processors have not had any formal education. Approximately, 27% had attained primary level education. The respondents who had middle school/JHS education level constituted 22% whilst 0.9% of the respondents had tertiary education. However, approximately 5% of the respondents did not disclose whether they have been to school or not.

From the above assessment, it could be ascertained that, the fish smoking sector is highly dominated by illiterates.

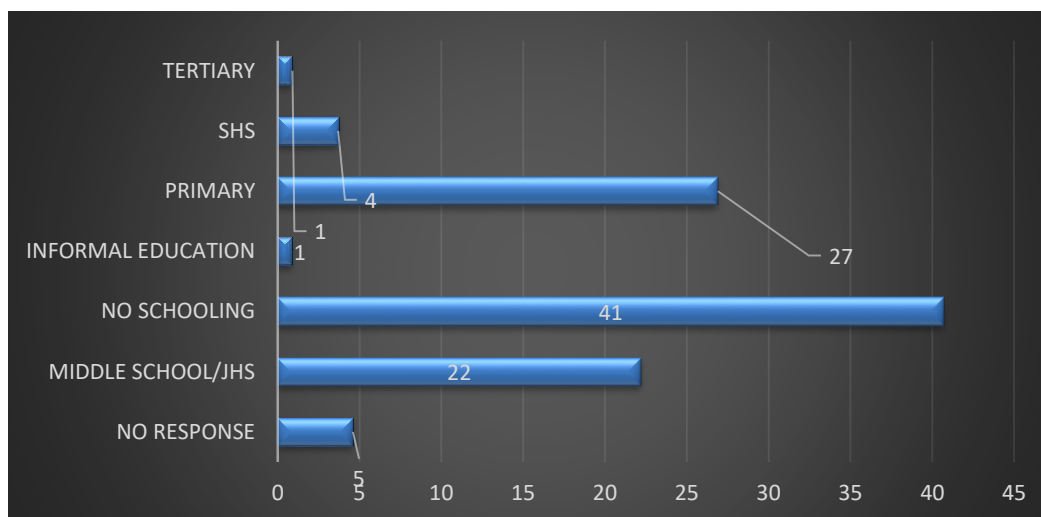


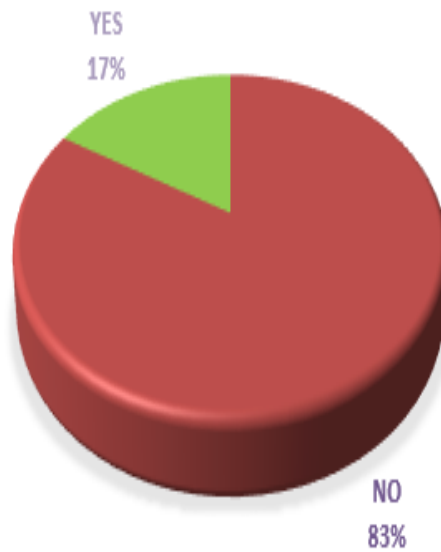
Figure 2 Educational level of respondents

### 3.1.3 Processors Knowledge on Health Risk of Smoked Fish

Smoked fish from Ghana has relatively high concentrations of PAHs. Data generally suggests that smoked fish had extremely high public health risks due to their carcinogenic content. Also, smoked, salted and fresh fish samples carry various loads of microorganisms including bacteria, moulds and yeasts (Aheto D. W *et al.*, 2017).

One of the biggest risks of consuming smoked fish is food poisoning. Smoked fish are prone to be contaminated with bacteria and parasites depending on the processing procedure. Although the parasites contained in smoked fish rarely cause any serious disease, contaminated smoked fish if taken can cause considerable intestinal discomforts. In some cases, it has been advised that pregnant women should not consume smoked fish.

Processors knowledge on the effect of their business on human health were investigated and the results are provided in Figure 3 below.



**Figure 3 Equation 2 4 Respondents' awareness of the implications of smoked fish**

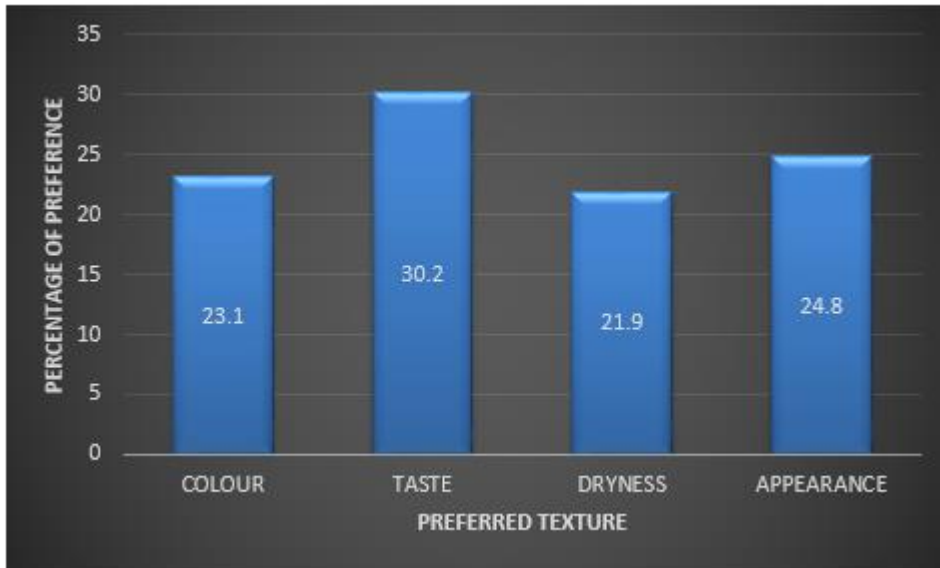
From the survey, 83% of the fish processors said smoked fish has no negative health implications whilst 17% of the respondents said smoked fish could have some negative health implications. Some of the implications listed by respondents includes;

- Diarrhea,
- Swollen mouth,
- Itchiness of hands and mouth
- Abdominal pains.

### **3.1.4 Customers Preference for smoked fish**

Like every customer, certain expectations are required in product or service before a buying decision is made to ensure value for money. From the survey, it was realized that, customers inspect the colour, taste, dryness and wholesomeness /appearance of the smoked fish before purchase. Few customers check out for the immediate environmental sanitation of the sales point of the fish. The customer at this stage of the chain are mostly traders or retailers.

The taste of the fish is the dominant factor for consideration, followed by the wholesomeness or appearance. With the appearance, customers expect to see the scales intact and fish in whole. Customers prefer golden brown coloured smoked fish to very dark. White or pale smoked fish is mostly seen as not well cooked and will not be patronized.



**Figure 4 Customers' preferences in smoked fish**

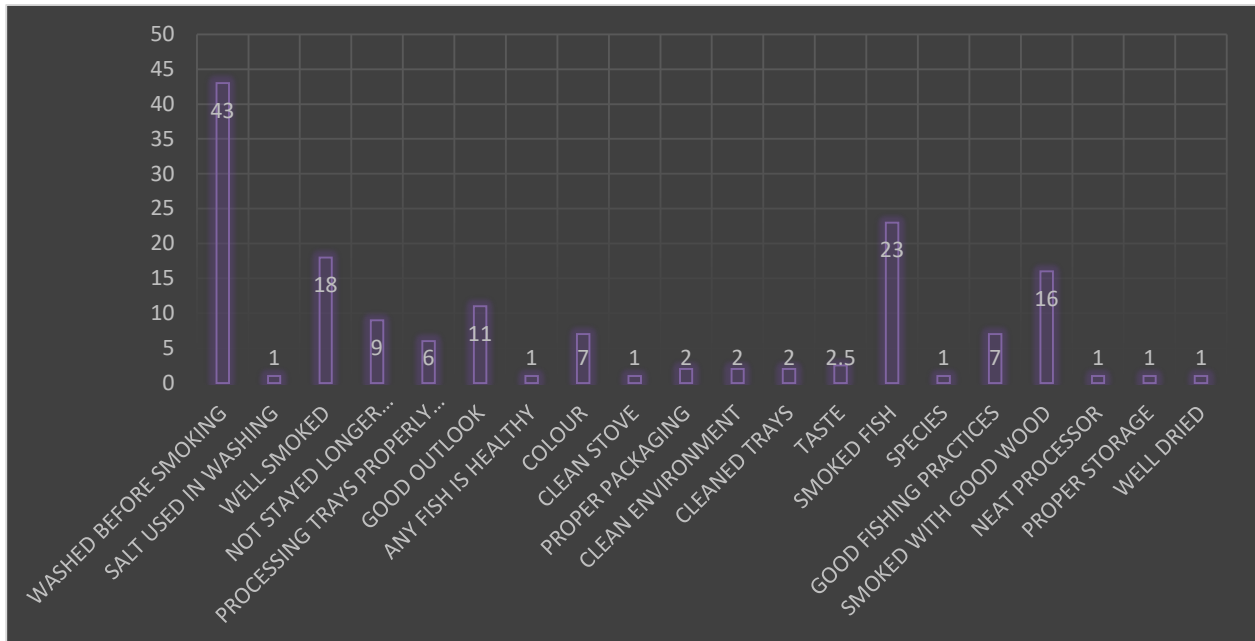
Among other reasons, processors suppose customers look out for the above parameters for the following reasons;

- to ensure that, the smoked fish is hygienic
- to ensure that, the smoked fish has a longer shelve life
- to ensure that, the quality fresh fish is smoked
- to enhance tasty meals
- to avoid diseases
- 

### **3.1.5 Processors' understanding of healthy fish**

There have been series of awareness creations by government agencies and NGOs in the fisheries sector on the hygienic fish handling and the production of healthy fish. Also, in year two under the Sustainable Fisheries Management Project, among the series of post-harvest improvement interventions, awareness has been created on hygienic fish handling in most of the project communities.

As part of the survey, respondents were asked ways of ensuring healthy fish processing. Respondents could state as many ways as possible. Majority of respondents (40%) stated that healthy smoked fish could be achieved if it is washed before smoking, 21% of the respondents were also of the view that, smoked fish is healthy if the raw material (fresh fish) smoked is of good quality. For 17% of respondents, smoked fish is healthy if it is well smoked and 15% associated healthy fish with the kind of wood used in smoking. 10% of the respondents said a healthy fish could be determined from its outlook.



**Figure 5 Respondents' perceived way of processing smoked fish**

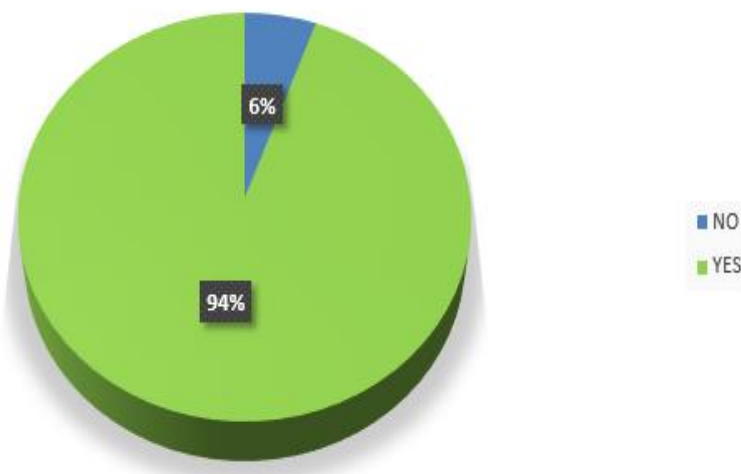
From the results it could be deduced that for majority of fish processors, in producing healthy fish, much was dependent on the following:

- employing good fishing practices
- getting fresh fish that has not gone stale
- washing fish before cooking especially with salt water
- washing fish smoking trays
- Making sure fish is smoked fresh with good wood as shown.

However, little attention was paid to personal hygiene, keeping a clean environment, making sure the stove and everything that comes with the stove were kept clean and properly maintained. Ensuring that the right materials were used for packaging and proper storage system for the processed fish were also not taken into consideration. These form part of the most important parameters, which if not taken into consideration can cause contamination of fish.

### 3.1.6 Willingness of fish processors to change ways of processing fish to make it healthier

Ninety-four percent of the respondents (as shown in Figure 6) are willing to change their old ways of processing smoked fish to healthier way if they are provided with the relevant training and support.



**Figure 6 Equation 3 Willingness of processors to change ways of processing fish to make it healthier**

Some of the reasons given by the respondents as motivation for willing to smoke fish in a more hygienic and healthy way include;

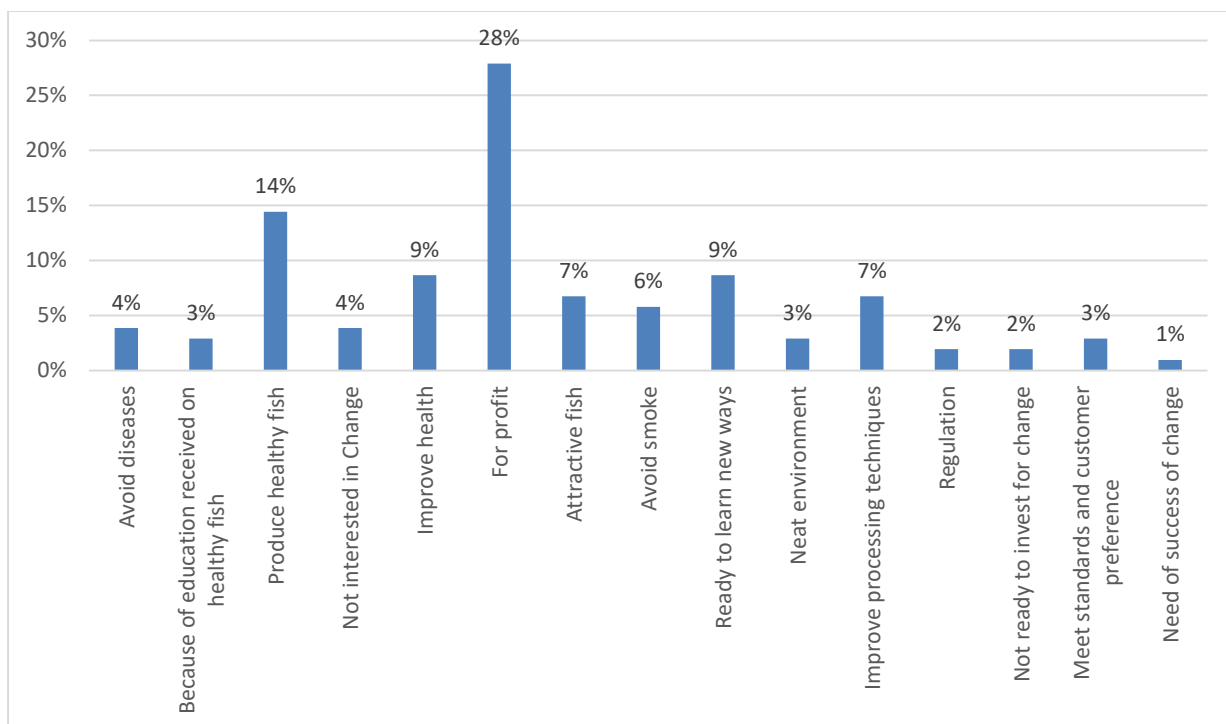
- for profit.
- to reduce smoke levels.
- to improve smoking techniques.
- to make fish attractive.
- to avoid diseases.
- to meet standards and customers' preference.
- for neat environment.

However, 6% of the respondents (as shown in figure 6) would like to keep to their old ways of smoking fish with the following reasons:

- not interested in change
- not ready to invest in the new ways of smoking fish for change.

Some factors will motivate change in behaviours of some of the processors. These factors vary from one processor to another. Figure 7 below provides a comparison of factors processors will consider to change their current behaviour(s) in the way fish is processed for the Ghanaian market.

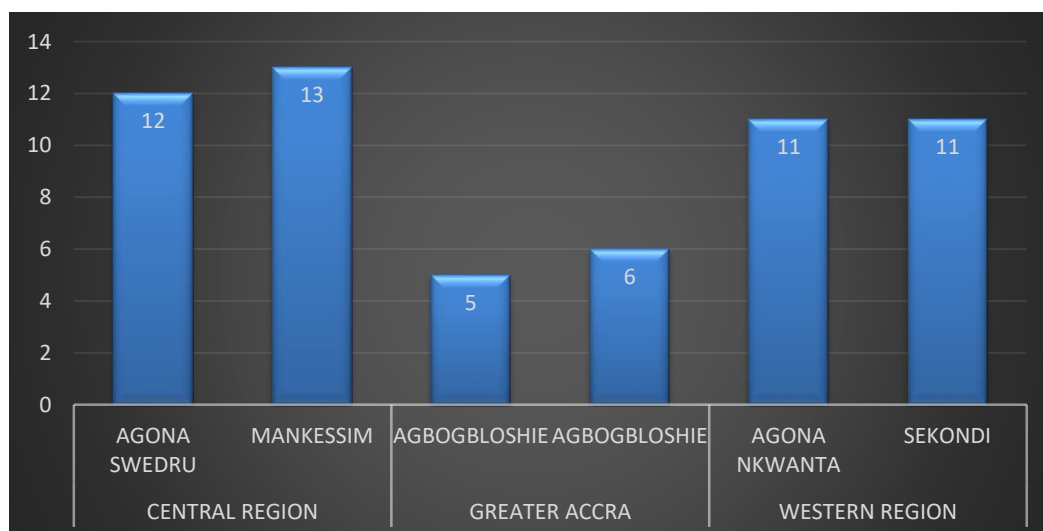




**Figure 7 Processors' reasons for willing to change to producing healthy fish**

### 3.2 Traders

Smoked fish trading is one of the rewarding economic activities within the fish processing value chain. Actors in the category have less risk with product perishability and scarcity since they engage in multiple customer relation across communities. The fish trading business is dominated by women with majority doubling as fish processors. Actors in this group could be business entrepreneurs living outside the coastal zone, who buy and sell in major cities or inland areas of the country. This survey was conducted in selected popular fish markets along the coast of Ghana. Each market and the number of respondents are shown in Figure 8 below.



**Figure 8 Selected markets and number of respondents**

### 3.2.1 Educational background of smoked fish traders

The highest level of formal education realized during the study was Senior High School, which formed only 3% of the population of smoked fish traders interviewed. Nineteen percent (19%) of the people involved in the fish trading business had middle school or JHS education. About a quarter of the population had primary education. 53% of the population had no formal education at all. Figure 9 shows the levels of education of the smoked fish traders interviewed.

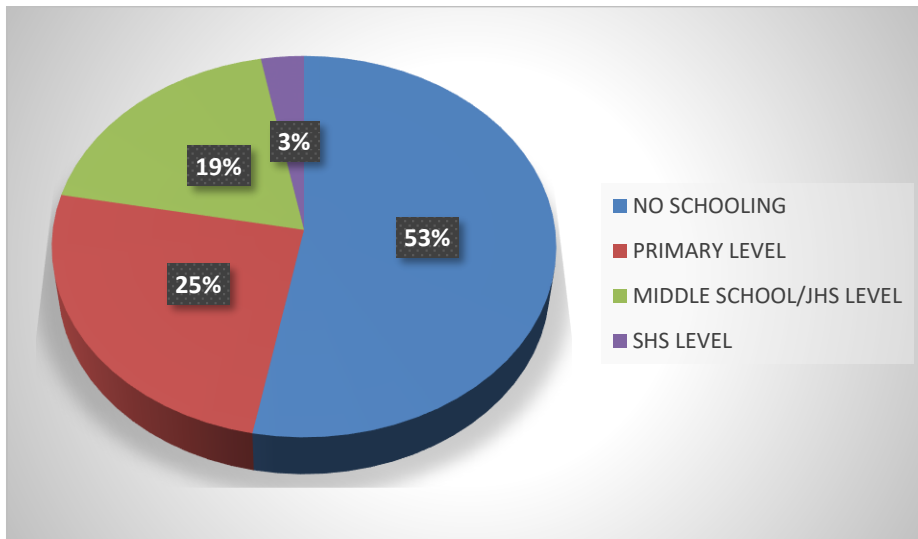


Figure 9 Equation 4 Educational level of respondents (Traders)

### 3.2.2 Age distribution

Fish trading business are dominated by women within the age range of 31 to 45 years making 51% of this age category. 10% of the fish traders fall within the age range of 18 and 30 years. The age range of 46 and above also formed 39% of the population of fish traders.

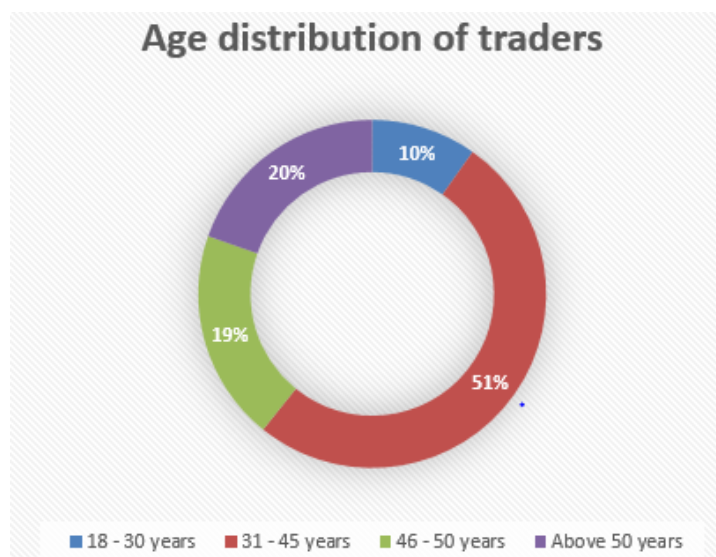


Figure 10 Equation 6 Age distribution of fish traders

### 3.2.3 Traders Knowledge on Health Implications Associated with smoked fish

Fish traders' awareness for possible health hazards with consuming smoked fish were investigated as part of the research. It was realized that, 90% of the fish traders were not aware of any possible health implications with regards to eating smoked fish. 10% of the respondents indicated they have heard that smoked fish can cause health problems. Some of the possible diseases or sicknesses mentioned that can be attributed to consuming smoked fish included diarrhea and stomach ache. They explained that, these diseases come as a results of the fish harvesting technique (chemical fishing) and other illegal means of fishing. None of the respondents attributed any form of disease to the action of the fish processor or the processing techniques used.

### 3.2.4 Traders preference of smoked fish

Before traders and retailers will consider buying any fish, they looked out for smoked fish that can sell in time and produce good returns. This influenced the choice of smoked fish they would buy to sell. The weight, size and species to a larger extend determines the price of smoked fish in the Ghanaian markets. These characteristics with smoked features were as determined by the consumer. Fish demand was also determined by the kind of meal that it would be used to prepare and as such influenced the species that was purchased. The common smoked fish species usually purchased for sale in the Ghanaian market included Edue, Ekyenkyi, Apai, anchovies, Abigon, Poku, mackerel, shrimps and Tuda. For example, anchovies were mostly preferred for preparing shito whiles Edue and Poku were mostly preferred for soup.

Based on accounts from fish traders, consumers' preferences and for that matter, smoked fish demand were ranked based on 6 main factors for all fish species. These included; appearance, dryness, taste, color, texture and others. These consumers' preferences influenced the traders' preferences, and were ranked as illustrated in Figure 11.

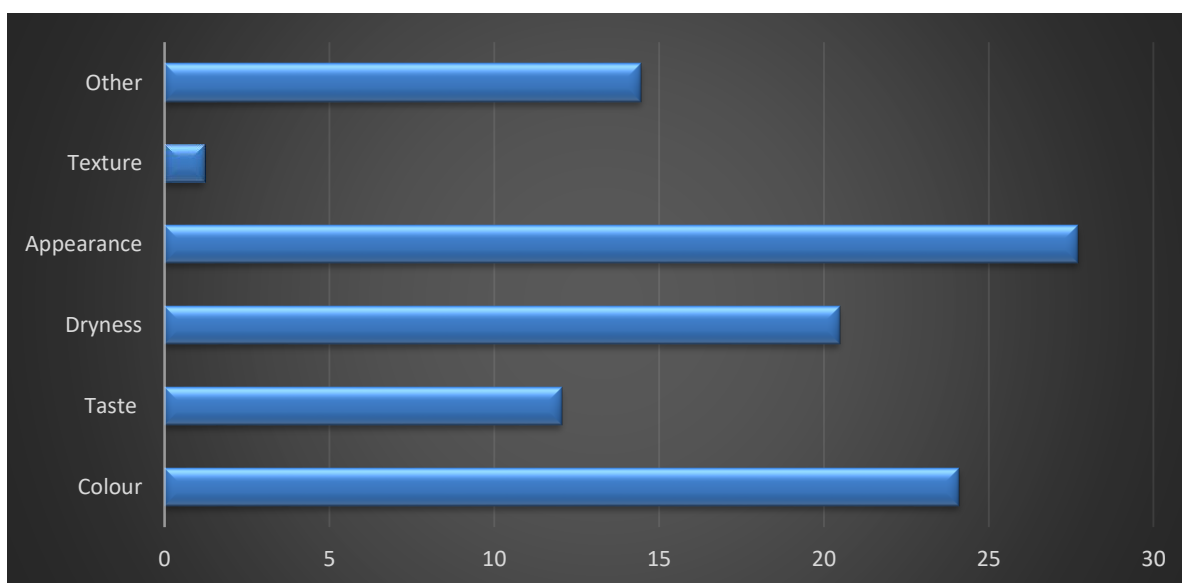


Figure 11 Traders' purchasing preferences

### 3.2.5 Preferred market pricing system for smoked fish

Standardized packaging system for smoked fish may require standard pricing system for each product. This is not the traditional way of smoked fish marketing in Ghana. To investigate traders' reaction to standard or fixed price for a packaged smoked fish, traders were asked to choose between a market that traded in price negotiation for products and markets that traded in fixed or standard market. The research revealed that, most traders (73%) prefer doing business in a market where prices are negotiable to markets where prices are fixed or standard (18%) for smoked fish. About 9% of traders were comfortable with either of the two options.

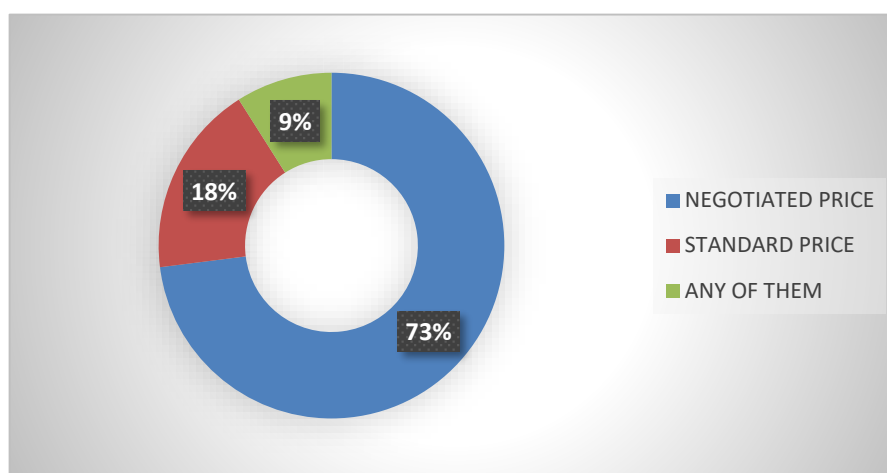


Figure 12 Equation 8 Traders' preferred market

### 3.2.6 Traders' interest in well packaged healthy fish

Although it is predictable that everyone will opt for healthy fish for health safety and good nutrition, some respondents indicated their unwillingness to trade in well packaged healthy smoked fish by justifying with the following stated reasons;

*Reasons why traders will not be interested in trading in packaged smoked fish:*

- If fish is packaged or sealed, it will be difficult to inspect its quality before purchasing.
- Packaging is not the traditional approach. Consumers prefer to touch, taste and see before buying.
- Consumers cannot properly examine the content of the smoked fish.
- There will be difficulty in packaging which will come with additional cost.
- Consumers may not patronize.
- Unsold smoked fish is usually reheated to preserve it after market. How do you reheat packaged smoked fish?
- Packaging will be expensive and also restrict production.
- Packaged smoked fish may be difficult and expensive to transport.

On the other hand, some traders expressed their interest to venture into the healthy fish marketing and stated the following as some of the reasons;

- To avoid trading in fish that can cause diseases.
- To avoid housefly contamination.

- To save time and energy.
- To reduce bacterial infections.
- To promote neat and well packaged healthy fish for the Ghanaian market.
- To protect fish dust.
- To reduce health problems associated with smoked fish.
- It will aid standardization and it will also sell in supermarkets thereby improving business.
- Packaging will attract more customers.
- To increase fish price.

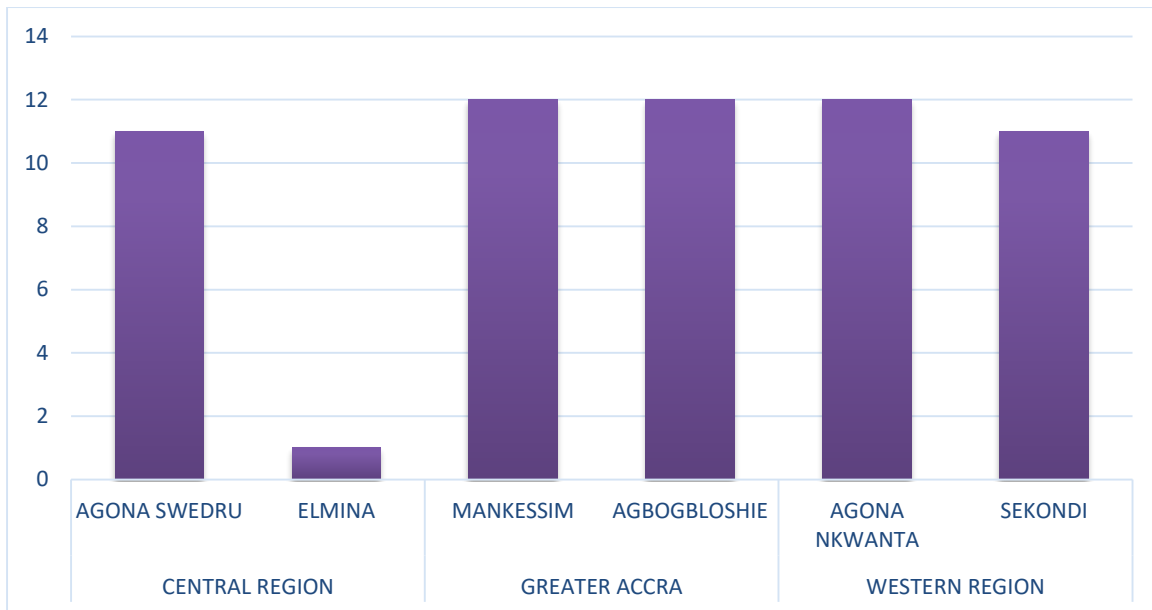
Traders who wish to embark on healthy fish trading said they would only embark on it based on some push and pull factors and some available conditions. They stated the following factors:

- If it is regulated by the government.
- If it will improve fish trading business and increase profit.
- If that is the consumers' preference.
- If all traders are doing the right thing.
- If market queens authorize it.

Smoked fish traders who expressed interest to go into healthy fish marketing indicated that, they will consider that option if they can be sure of a profit margin between 50% and 100%. Others indicated that, they are expecting the same profit margins as trading in the current smoked fish. They advised, the introduction of healthy fish market should not negatively distort the smoked fish market.

### **3.3 Consumers**

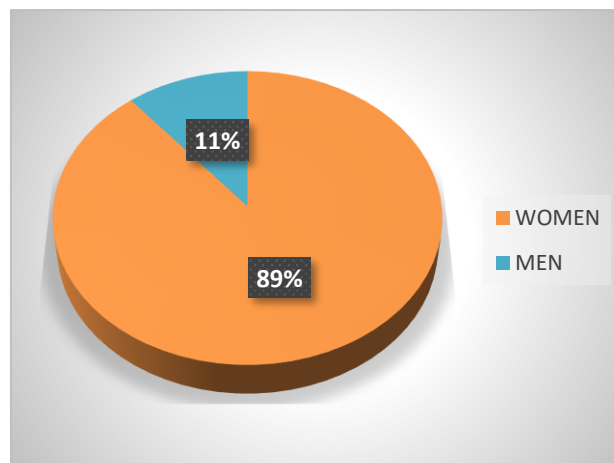
Some popular smoked fish markets across three coastal regions in Ghana (Greater Accra, Central, and Western Regions) were visited to solicit consumers' views on smoked fish handling and contamination. The research also sought consumers' opinion on the need to develop a healthy fish market for Ghana. Popular fish markets visited for these interviews included Agona Swedru, Mankesim, Agbogbloshie, Agona Nkwanta, Elmina, and Sekondi as shown in Figure 13.



**Figure 13 Popular markets selected for the study**

### 3.3.1 Sex of consumers

Women in Ghana are mostly seen in the light of shopping for foodstuffs including smoked fish for households in Ghana. This account for women dominating in market places. Consumers in this actor group of the value chain comprise of the buyer, the payer and user. Although most respondents were selected at a spot during ongoing smoked fish transaction in the market, they also confirmed that, they are part of the final consumption of the product. 89% of respondents were females and 11% of the respondents were males.



**Figure 14 Equation 7 Sex of respondents (Consumers)**

### 3.3.2 Age of consumers

Majority (37%) of the respondents were aged between 31-45 years, followed by an age range of above 50 years forming 33% and then the age range of 18-30 years forming 19%. The age range of 46-50 years represented 11% of the respondents.

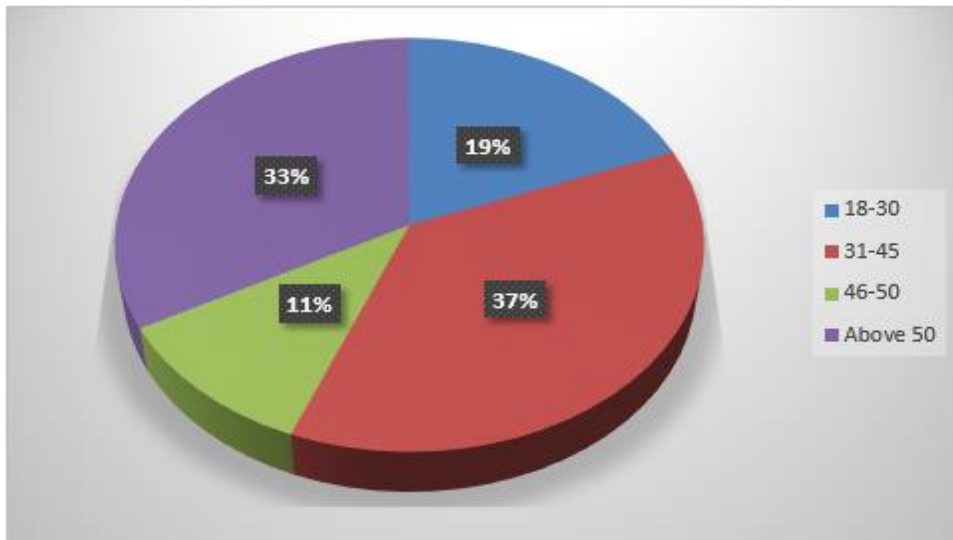


Figure 15 Equation 10 16 Age distribution of consumers

### 3.3.3 Educational levels of consumers interviewed

Majority (86%) of the smoked fish consumers interviewed have various levels of formal education; primary level (12%), Middle/JSS level (39%), SHS level (25%) tertiary level (10%). Only 12% of the respondents had no formal education as shown in figure 16.

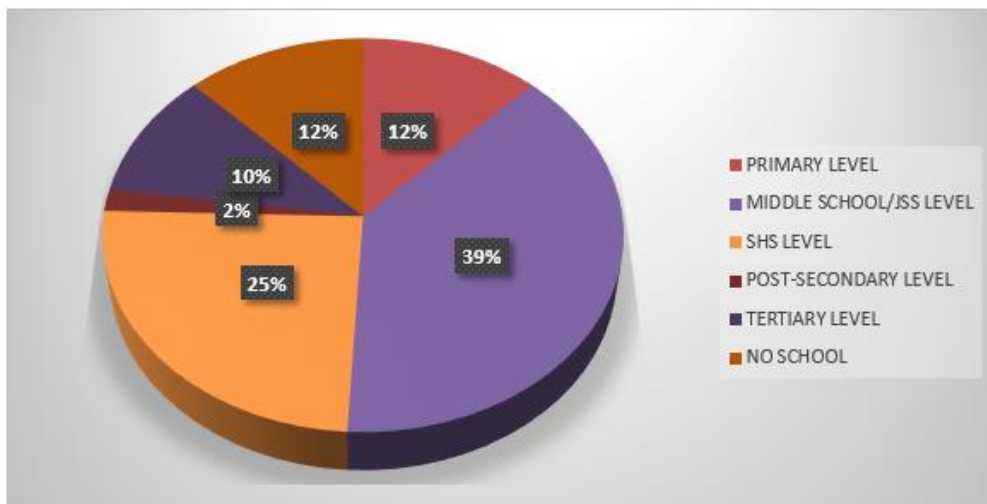
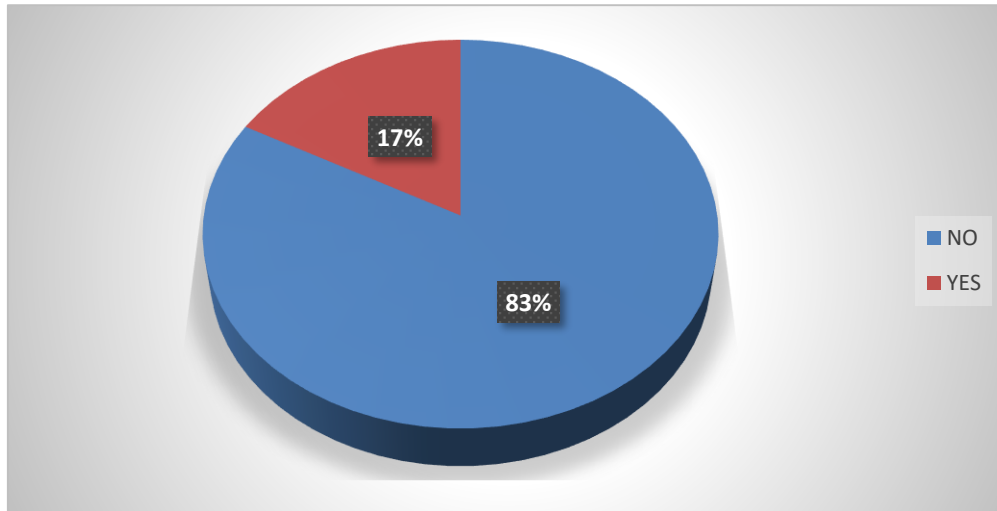


Figure 16 Equation 11 Educational level of consumers

### 3.3.4 Awareness of health implications of smoked fish

Majority (83%) of respondents' interviewed expressed their unawareness about the health implications associated with consuming smoked fish. The few (17%) who stated that smoked fish is capable of causing diseases attributed it to the illegal methods of fishing and sanitation issues. None of the consumers interviewed mentioned any disease associated with the fish smoking processes or techniques. Figure 17 shows respondents' awareness of the health implications of smoked fish.

Some of the diseases mentioned as associated with consuming smoked fish included; cholera, diarrhea, nausea, stomach upset, headache and swelling cheeks. Some respondents indicated that, they had been victims of these diseases. Others said they have heard and seen in few instances, neighbors suffering from these kind of diseases. Others indicated that, their source of information was radio and television shows.



**Figure 17 Equation 12 18 Respondents awareness of health implications of consuming smoked fish**

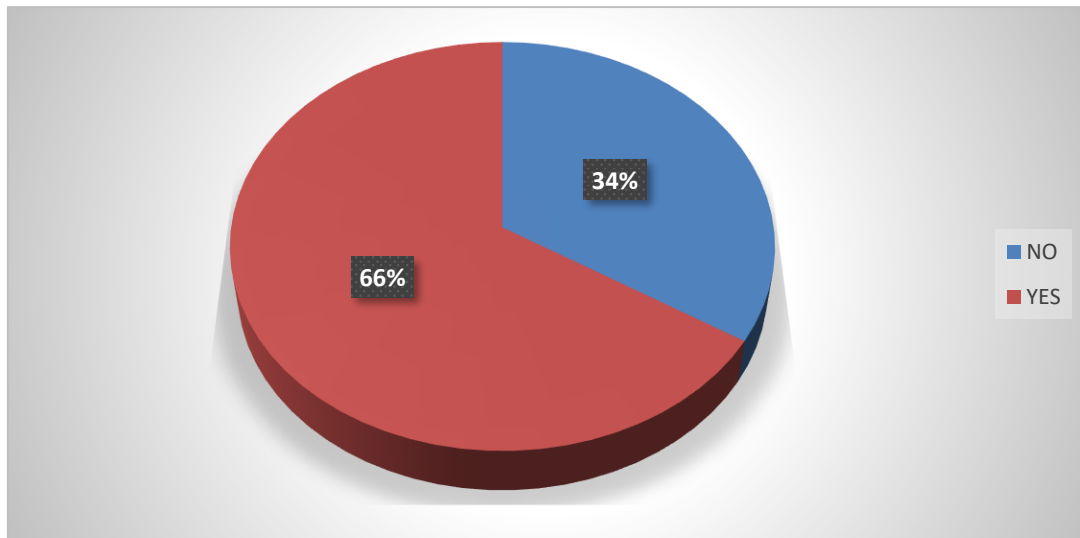
### **3.3.5 Healthy fish patronage**

During the interview, some respondents indicated their dissatisfaction about how smoked fish are processed and handled in the market. They stated that, they buy the smoked fish anyway because of limited options. Very few respondents had a special arrangement for their smoked fish to be processed in a more hygienic manner to reduce contaminations.

The marketing system for smoked fish makes room for price negotiations. People with good bargaining power get the best deal and vice-versa. The choice of the kind of market price (whether fixed price or negotiable price) was investigated to inform the market development strategy. It was realized that, 65% of the respondents said they would prefer a fixed price market for smoked fish to ensure standardization whereas 35% indicated their preference for the existing market system – negotiable price market.

The willingness of consumers to make the effort of travelling outside the current vicinity in search for healthy smoked fish was also investigated. It was observed that 34% of respondents who expressed interest in healthy smoked fish were not willing to travel to purchase the healthy smoked fish. However, 66% of the respondents were willing to purchase the healthy smoked fish regardless of the distance of the healthy smoked fish market. Figure 18 shows respondents' willingness to purchase the healthy smoked fish regardless of the distance of the healthy smoked fish market.

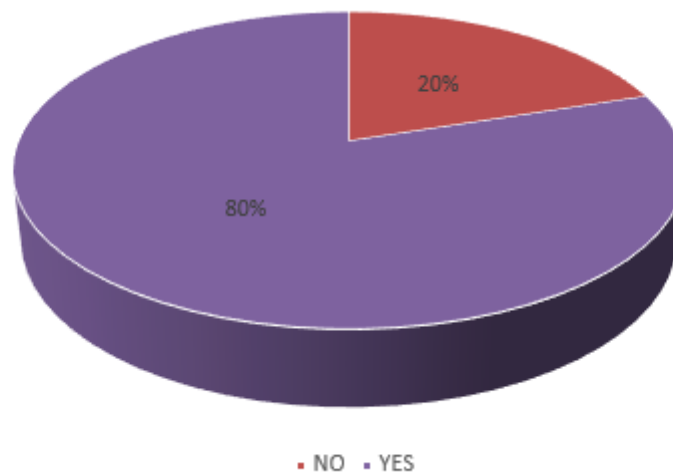




**Figure 18 Equation 13 Respondents willing to purchase healthy smoked fish regardless of the market distance**

### **3.3.6 Willingness to stop purchasing unpackaged smoked fish**

Eighty percent (80%) of respondents stated that, if there is an option of a more “hygienic” smoked fish in a well packaged manner at an affordable price, they will immediately stop patronizing the unpackaged smoked fish being sold in the open market. 20% of the respondents argued that, healthy smoked fish will definitely come with increased cost and as such they were not willing to stop purchasing the unpackaged smoked fish.

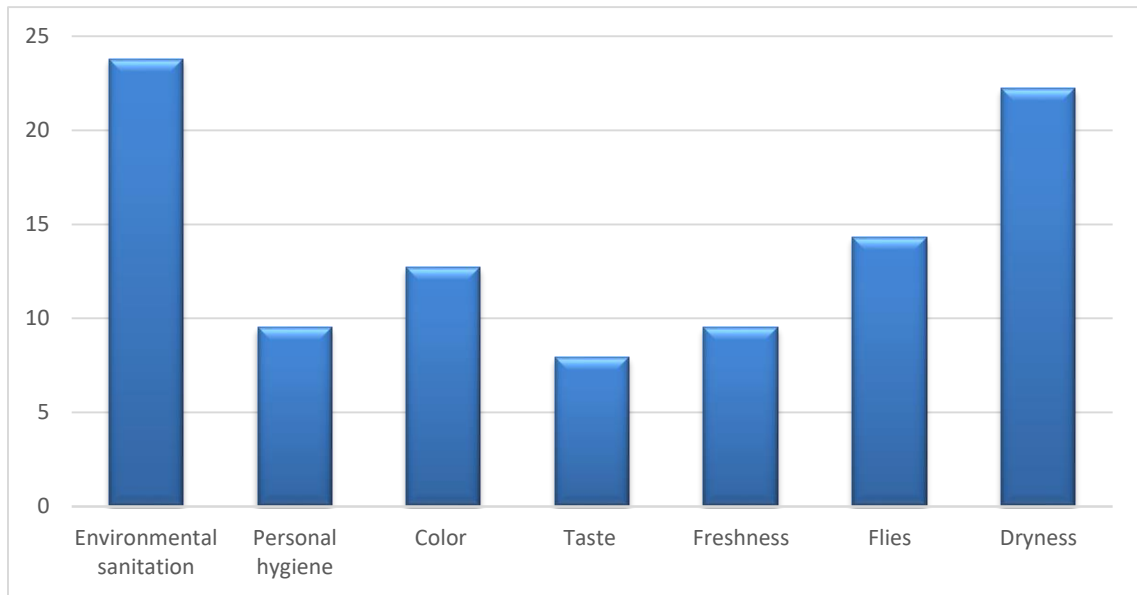


**Figure 19 Equation 14 Respondents willingness to purchase packaged smoked fish**

### **3.3.7 What consumers look out for in smoked fish**

Each consumer interviewed indicated their dissatisfaction with sanitation issues in the fish market. There are a set of characteristics consumers look out for on and around the smoked fish before a decision to purchase is made. These characteristics included environmental

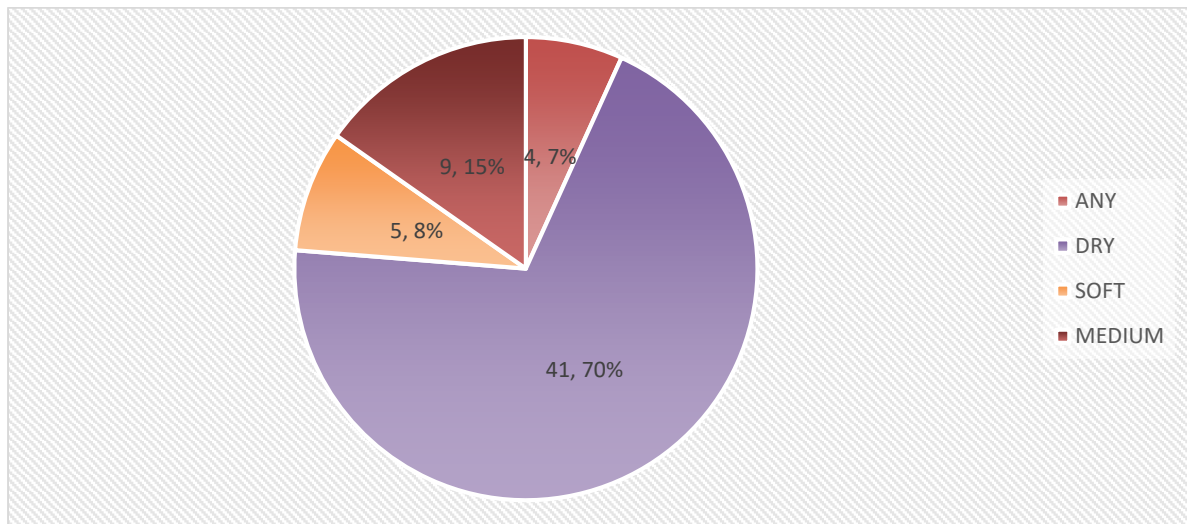
sanitation, personal hygiene, smoked fish color, taste, dryness of smoked fish, flies among others. Figure 20 shows the sensitivity of each characteristic to the consumer.



**Figure 20 Consumers' sensitivity to fish and fish market environment**

### 3.3.8 Preferred texture of smoked fish

The research reviewed that, majority (70%) of the respondents preferred dry smoked fish while 15% of the respondents preferred medium smoked fish. 8% of the respondents preferred soft smoked fish while 7% are indifferent of the texture.



**Figure 21 Equation 15 illustrates the number of consumers and their preferred texture of smoked fish**

### 3.3.9 Preferred species

Herrings were the most preferred smoked fish species by consumers according to the study. The following species are among the common species consumers mostly purchase in the fish market. Most of these species are small pelagic. The rate of purchase is shown in the graph below (Figure 22). Most of these species are in the local language.

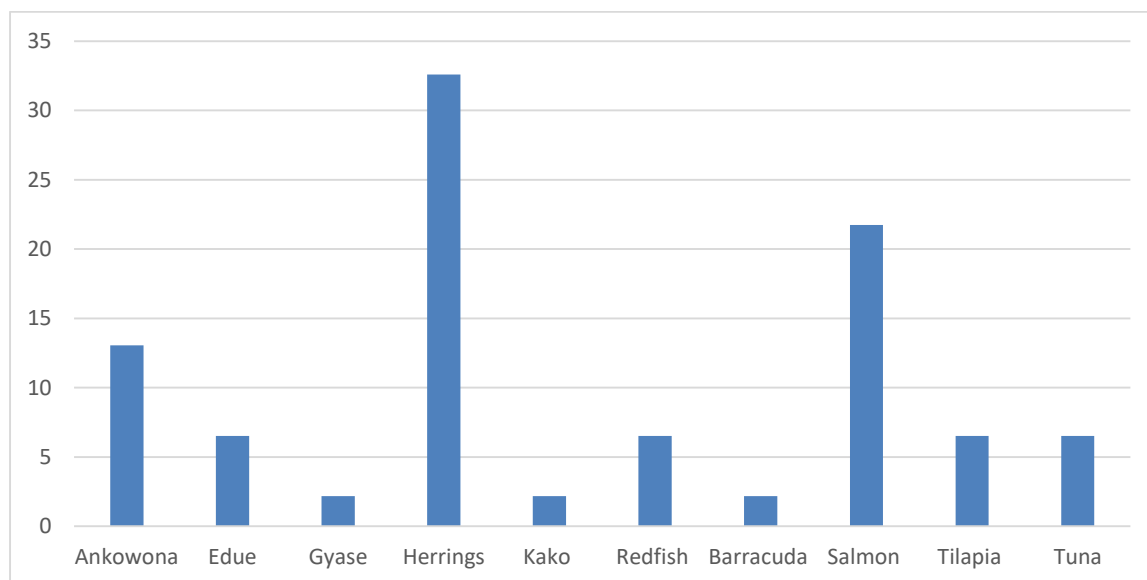


Figure 22 Consumers' preferred smoked fish species

### 3.3.10 Consumers Observations about the Fish Market

Consumers described the current situation in the fish market as not encouraging. They stated the following observations about the fish market;

- Dirty environment.
- Fish exposed to flies and dust.
- Some smoked fish had bad smell, fungus and sometimes maggots.
- Some fish go bad before they were smoked which causes itchy mouth when consumed.

The respondents suggested that, the following measures as addressing and ensuring the production and sale of healthy smoked fish;

- Education of fish processors on how to keep their environment clean.
- Awareness creation on the production and consumption of healthy fish.
- Washing of fish before smoking.
- Selling smoked fish in market stalls covered with sieves or nets to prevent flies from settling on the fish.
- Practicing strict personal hygiene by the processors.
- Avoidance of the use of chemicals and explosives in fishing.
- Proper storage system for both fresh and smoked fish.
- Proper packaging of smoked fish.
- Monitoring of the smoked fish production process and its sale.
- Use of efficient fish smoking stoves to prevent the introduction of carcinogens and the wastage of fuel.

### *Things to consider when selecting a healthy smoked fish*

The respondents stated the following to consider when selecting a healthy smoked fish.

- a. Appearance of the smoked fish.
- b. Dryness of the smoked fish.
- c. Fish with no flies and maggots.
- d. Fish smoked in sanitary facility.
- e. Fish washed with potable water before smoking.
- f. Smoked fish with no fungus.
- g. The appearance of the smoked fish seller.

Consumers' opinion on whether smoked fish should be sold in a well packaged manner or the current practice should be maintained was sorted. The following reasons were suggested by consumers for whether or not smoked fish should be packaged.

#### **3.3.11 Reasons why packaging of smoked fish is not necessary**

The respondents gave the following reasons why packaging of smoked fish is not necessary:

- Packaging of smoked fish could prevent the buyer from direct observation (touch and feel). The consumer will be unable to determine its freshness.
- Packaging of smoked fish could make the smoked fish expensive.
- Packaging of smoked fish for a long period is not possible because of limited shelf life of the smoked fish.
- Packaging could increase heat which could in turn increase the microbial action on the fish resulting in fish spoilage.

#### **3.3.12 Reasons why packaging of smoked fish is necessary**

The respondents agreed that packing of smoked fish is important by stating the following reasons;

- Packaging of smoked fish would prevent dirt and flies from settling on it and thus preventing communicable diseases.
- Promotes healthy smoked fish.
- Prevents direct contact with the smoked fish thereby preventing the transfer of pathogens, chemicals and dirt onto the fish.

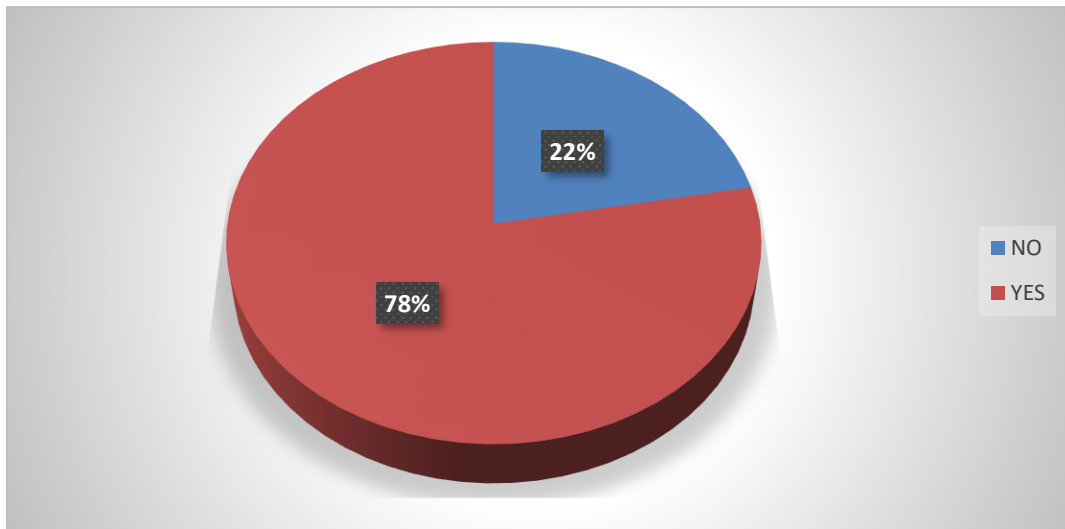
#### **3.3.13 Whether or not respondents were willing to pay more for healthy smoked fish**

When the respondents were asked whether they would pay more for healthy fish, 78% of them (as illustrated in Figure 23) agreed to pay more, citing the following reasons;

- To prevent diseases.
- To increase shelf life.
- To preserve the taste and flavour of the smoked fish.

However, 22% of the respondents (as shown in Figure 23) did not agree to pay more for healthy smoked fish and they gave the following reasons;

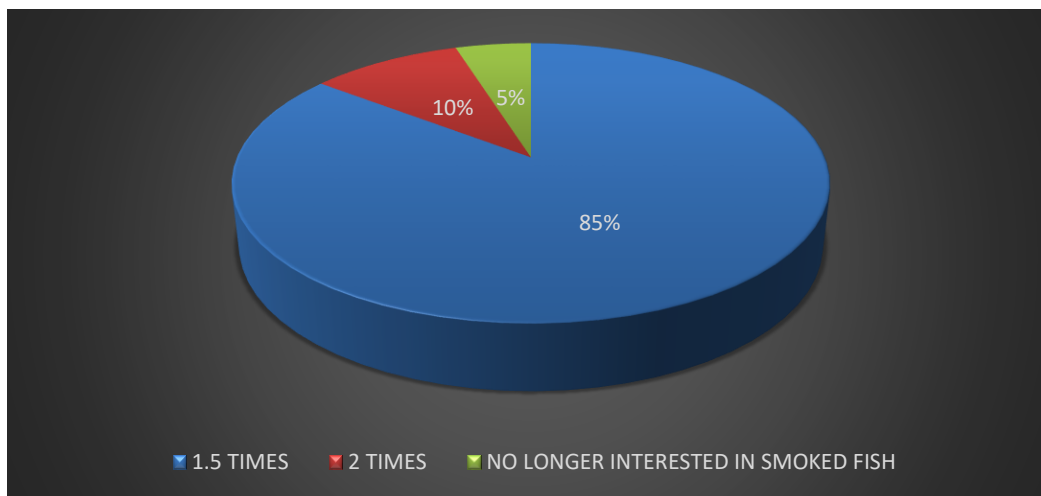
- Not ready to pay more for the same size/weight of smoked fish.
- Not much/insufficient evidence that the fish is healthy enough.
- Lack of money/not having enough money.



**Figure 23 Equation 16 Consumers' willingness to pay more for healthy fish**

**3.3.14 Increment in cost price of smoked healthy fish**

Eighty-five per cent of the consumers willing to pay more said they would purchase healthy smoked fish even if it costs them 1.5 times higher than the usual price of smoked fish whilst 10% of the respondents said they are willing to pay as much as twice the cost price of smoked fish. 5% (as shown in Figure 24) of the respondents are willing to pay the same price for the healthy smoked fish will not purchase the smoked fish if the price is increased for the same quantity.



**Figure 24 Equation 17 Cost increments at which consumers would be willing to purchase healthy fish**

**3.3.15 Kind of market consumers preferred**

The research revealed that, 65% of consumers would prefer standard or fixed priced market for smoked fish whilst 35% of the respondents preferred the market system where smoked fish prices are negotiable.

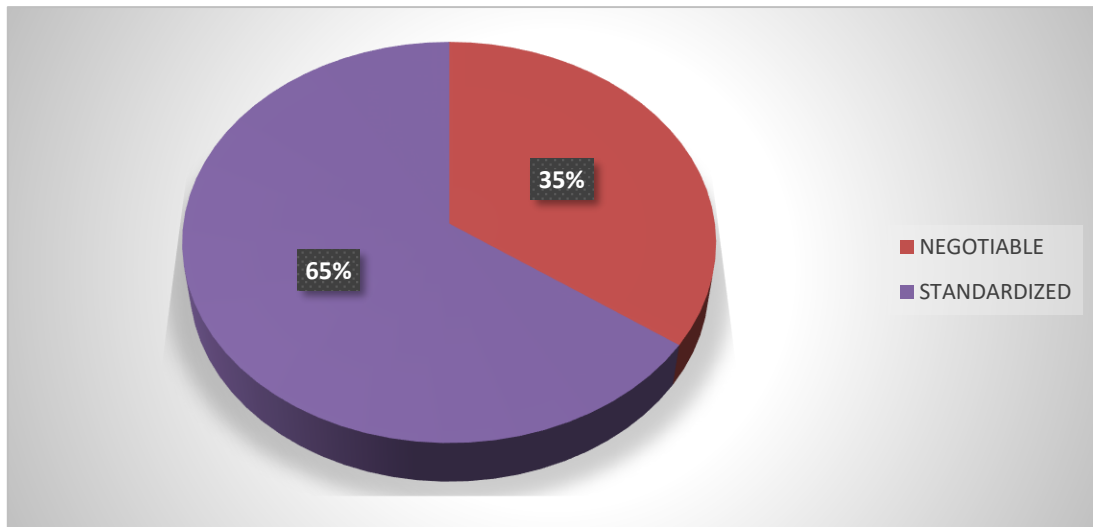


Figure 25 Equation 18 Smoked fish pricing options consumers' preferred

## SECTION 4 CONCLUSION

Despite the inadequate knowledge about the implications of smoked fish on human health, it is obvious that, the public is unaware of the health effects of unhygienic processed smoked fish in the Ghanaian market. The research revealed that, there is a potential market for healthy smoked fish based on the findings that 94% of the smoked fish processors were willing to change their ways of processing smoked fish to make it healthier if it makes economic sense. Consumers on the other hand are not happy about the current sanitation situation in the fish market and expressed their willingness to pay more to access a healthy fish if options are available. Figure 26 below shows the extent consumers are willing to go to get healthy smoked fish.

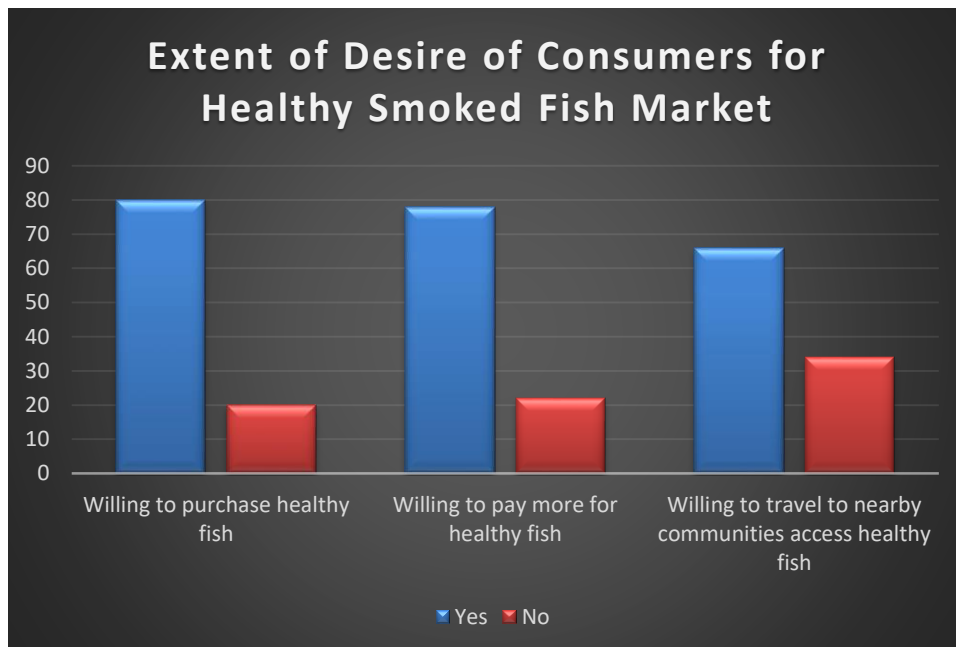


Figure 26 Consumers' willingness to access healthy smoked fish

Although 80% of consumers are willing to patronize healthy fish, 78% of them are willing to pay more for the healthy smoked fish. 66% of interested consumers are willing to travel to nearby communities to access the smoked fish.

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## APPENDIX 1

### QUESTIONNAIRE FOR FEASIBILITY OF A HEALTHY FISH MARKET

<b>Date of Interview</b>			
<b>Region</b>	Central Region [ ] Western Region [ ] Volta Region [ ] Accra Region [ ]		
<b>Community</b>			
<b>Name of Market. Where Applicable</b>			
<b>Name of Respondent</b>			
<b>Name of Enumerator</b>			
<b>STAKEHOLDER</b>			
<b>Processor (SECTION B) [ ]</b>	<b>Trader/Mall (SECTION C) [ ]</b>	<b>Consumer (SECTION D) [ ]</b>	

#### SECTION A: Demographic Characteristic of Respondent

A1	Sex of Respondent	Female [ ]	Male [ ]
A2	Educational Background	No Schooling [ ]	Primary [ ] Middle school/JHS [ ] SHS [ ] Post-Secondary [ ] Tertiary [ ] Non-formal Education [ ]
A3	Age of Respondent	18 – 30 years [ ]	31 – 45 years [ ] 46- 50 [ ] Above 50 years [ ]
A4	Have you ever thought there could be health implications associated with smoked fish?	Yes [ ]	No [ ]
A5	Are you aware of any health implications associated with smoked fish?	Yes [ ]	No [ ]
A6	If Yes, which health implications are you aware of?		
A7	How did you get to know?		



**SECTION B: Processor**

B1	What do consumers look out for when they are buying smoked fish?	
B2	Would you be interested in changing the way you process fish in order to make it healthier?	Yes [ ] No [ ]
	Why/Why not?	
B3	Would you be interested in changing the way you process fish in order to make it healthier if you would receive more money for the fish?	Yes [ ] No [ ]
B4	Would you be interested in making investments into producing healthy fish?	Yes [ ] No [ ]
B5	You would need to invest into new technologies, which of the following would you be most interested in?	New stove that reduces carcinogens Access to compliance facility Gloves, Hairnets, etc. Keeping a sanitary facility (washing hands, washing processing mats –with clean water, get rid of flies) Certification of healthiness (package and label)
B6	Would you be more inclined to create a sanitary facility, or obtain access to a compliance facility if you were given a loan, or if some of the cost was subsidized?	Yes [ ] No [ ]
B7	How much do you sell your fish for now?	
B8	How much more money would you expect to receive for smoked fish that is determined healthy, properly packaged and labelled?	3x [ ] 2x [ ] 1.5x [ ] I do not care if the smoked fish is healthy or not [ ] I no longer wish to smoke fish [ ]

### SECTION C: Traders/Malls

C1	What characteristics in smoked fish do you look out for when you are purchasing fish for the market?	
C2	How much do you purchase your fish for now?	
C3	How much do you sell your fish for now?	
C4	If you saw smoked fish that was in a sealed package would you be more inclined to purchase it?	Yes [ ]                      No [ ]
C5	<b>For market traders</b> What kind of market would you prefer?	Standardized/Fixed Prices [ ] Negotiable Prices [ ]
C6	Would you be interested in purchasing smoked fish that is properly packaged and labelled as healthy for human consumption if you knew you would receive a greater profit?	Yes [ ]                      No [ ]
C7	If you answered YES, how much more would you be willing to pay for smoked fish that is determined healthy?	3x [ ] 2x [ ] 1.5x [ ] I do not care if the smoked fish is healthy [ ] I no longer wish to purchase smoked fish [ ]

### SECTION D: Consumers

D1	What characteristics do you look out for in smoked fish when you are going to buy fish to eat?	
D2	What are your preferences	[ ] Texture : Dry            [ ]            Soft [ ] [ ] Color : White            [ ]            Red/Brown [ ]
D3	How much do you purchase your fish for now?	
D4	Would you be interested in purchasing smoked fish that has been packaged and labelled to be healthy for human consumption?	Yes [ ]                      No [ ]

D1	What characteristics do you look out for in smoked fish when you are going to buy fish to eat?	
D5	Would you be willing to pay more money for smoked fish that has been packaged and labelled to be healthy for human consumption?	Yes [ ]                      No [ ]
D6	How much more would you be willing to pay for smoked fish that properly packaged, labelled and determined healthy?	3x [ ] 2x [ ] 1.5x [ ] I do not care if the smoked fish is healthy, I will still eat it [ ] I no longer wish to purchase smoked fish [ ]
D7	If there were packaged and labelled fish determined healthy and up to standards, would you stop buying the fish in the current market?	Yes [ ]                      No [ ]

**Comments/Observations:**