FISH PRESERVATION; CONSUMERS ACCEPTANCE OF FRESH AND SMOKED FISH IN BENIN CITY

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ABSTRACT

Fish is a vital source of dietary protein for many Nigerians, but domestic production has not kept pace with population growth, leading to increased reliance on imports. Traditional preservation methods like smoking play a key role in ensuring year-round availability, but also raise concerns around contaminants and health risks. This study investigates consumer preferences and perceptions regarding fresh versus smoked fish in Benin City, Nigeria.

The background highlights that fish is highly perishable, requiring techniques like drying, smoking, freezing, and brining to extend shelf life. Smoking remains the dominant preservation method in Nigeria, offering benefits in accessibility and shelf-life, but also potential quality and safety issues. Limited research has explored consumer choices between fresh and smoked fish products, especially in inland urban areas.

This study assesses the extent to which cultural, economic, and health/safety factors influence consumer preferences for fresh versus smoked fish. It also identifies key demographic segments and their buying behaviors. Surveys will be conducted with fish consumers at major markets and the university community in Benin City. The findings can provide important insights to help the fishing industry, retailers, and policymakers better meet evolving consumer demand for fresh and processed fish products in Nigeria.

CHAPTER ONE

INTRODUCTION

BACKGROUND OF THE STUDY

Fish are a major source of animal protein in Nigeria and other African countries. They are nutrient-dense foods that contribute significantly to healthy diets by supplying critical micro and macronutrients for human function and development.

While fish production in Africa is rising, it has not yet kept pace with population growth, making imports an increasingly important source of supply. According to the Food and Agriculture Organization (FAO 2022) report on the State of World Fisheries and Aquaculture: While fish output in Africa has increased from roughly 9.6 million tons in 2011 to 12.1 million tons in 2019, it has not kept up with population growth. making imports an increasingly important source of supply (FAO, 2022). Specifically for Nigeria, domestic fish production has risen but not enough to meet rapidly growing demand from its expanding population. As a result, Nigeria remains a large importer of fish, with imports increasing from around 600,000 tons in 2011 to over 1 million tons in 2019 (FAO, 2022). The per capita fish consumption in Africa has declined slightly from around 10kg/year in 2011 to 9.9kg/year in 2019, indicating that fish production growth has lagged behind population expansion across the continent (FAO, 2022). As incomes rise, understanding consumer preferences and demand for different fish products is important for food security and reducing malnutrition.

Fish is one of the protein foods that requires careful handling being that it is highly perishable for a variety of reasons, including fragility and food safety issues. Because of these reasons, fish requires suitable preservation techniques to ensure its quality and safety throughout time. Fish preservation refers to the methods and techniques used to keep fish from rotting and to increase the shelf life of fish. Several authors (Igbeka, 1986; Olokor *et al.,*

1997) various preservation procedures have been described, including the drying and smoking processes, the brining method which is also known as salting method, and the freezing method.

Traditional fish smoking has long been used to preserve catches for later consumption, ensuring a steady food supply throughout the year (Okeke *et al.,* 2016). When there is a surplus of fish, such as during rainy seasons with high river flooding, people smoke the excess fish to prevent spoilage (Adewale *et al.,* 2018). The smoked fish remains edible for months due to the preservation effects of smoke and salt, providing a reliable food source during periods of low fish availability (Oladele & *et al.,* 2017).

While traditional smoking techniques offer significant benefits in terms of shelf-life and accessibility, concerns persist regarding contaminants and associated health risks (Ogunleye *et al.,* 2019). There are opportunities to enhance smoking methods to mitigate these risks while maintaining accessibility (Okonkwo *et al.,* 2020).

Limited studies in Africa have explored fish demand, with most focusing on local areas or general "fish" consumption rather than specific species or product forms (Ojo *et al.,* 2015). Understanding preferences for different product forms is crucial for comprehending consumer behavior and nutritional aspects (Adegbola *et al.,* 2017).

According to studies, smoke drying is the most popular fish preservation method in Nigeria. However, while smoke drying is the favored preservation method throughout Nigeria, research on preferences in Benin City, Nigeria, is scarce.

In general, consumer purchasing decisions are heavily influenced by their perceptions of the product (Kazmi et al., 2012). According to Hansen et al. (2006), consumer preferences for items vary based on their nature and the consumer's social and economic level. Cultural,

social, personal, and psychological variables influence consumers' purchase decisions (Lautiainen et al., 2015). Solomon et al. (2010) said that a consumer's occupation, income level, and purchasing power influence their purchase decisions and behavior. Consumer preference and behavior research is required for product creation in order to ensure ongoing consumer demand and maximum profit (Costa et al., 2006). This study aims to investigate consumers acceptance or preference for fresh or smoked fish and in Benin City, Nigeria.

STATEMENT OF THE PROBLEM

Many Nigerians rely heavily on fish for nutritional protein, making up one-third of the animal protein in local diets and carrying important cultural food traditions. However, factors like seasonal supply limitations, catch sustainability, and shelf-life constraints affect consumption and access to preferred fish varieties. In particular, there hasn't been much research done on how consumers currently feel about the traditional availability of fresh fish, against the hot-smoked fish that is being sold in Benin City markets.

Although both smoked and fresh fish products are high in nutrients, consumers may choose one over the other based on factors such as palatability, quality, risk of contamination, cost, ease of use, or compatibility with specific needs. Understanding the drive behind choosing fresh fish over smoked fish, or smoked fish over fresh fish is crucial for policymakers, fishery managers, and retailers to meet market demand sustainably. It becomes difficult for policy makers, fishery managers, producers, and retailers to optimally meet market demand in a way that sustains equitable fish supply while maximizing utilization and minimizing waste across seasons when there is little comparative data on the factors influencing preferences and choice tradeoffs between fresh and smoked fish. A thorough consumer market analysis in Benin City can reveal existing preferences, unmet needs, and methods for boosting product appeal and accessibility in line with evolving customer demand.

OBJECTIVES OF STUDY

- To assess consumer preferences for fresh fish compared to smoked fish in Benin City.
- To determine the factors (e.g. taste, price, availability) driving consumer choice between fresh and smoked fish products.
- To clarify the perception of nutritional value, quality, and safety between fresh and smoked fish types among local consumer demographic groups.
- To identify the demographic consumer segments exhibiting the strongest preferences for fresh fish or smoked fish based on age, gender, income level, etc.
- To assess the influence of traditional customs, cultural values, and regional history on ingrained consumer perspectives impacting choice of fresh catch or smoked fish
- To evaluate the convenience factors (accessibility, transportation, storage, ability to cook) affecting consumer incorporation of fresh and processed smoked fish products into family meals.
- To quantify the price thresholds impacting consumer substitution between purchasing fresh fish when available over more consistently obtainable processed smoked fish products.

RESEARCH QUESTION

1. To what extent do cultural factors impact consumers' acceptance of fresh versus smoked fish for consumption?

2. What role do economic considerations play in influencing consumer preferences between fresh and smoked fish in the market?

3. How does consumer awareness regarding the processing method (smoking) and storage conditions impact willingness to pay for smoked fish compared to refrigerated fresh fish varieties?

4. What sociodemographic and economic factors (e.g. age, gender, income level) influence or predict consumer preferences for fresh compared to smoked fish varieties in Benin City?

5. How do perceptions related to health risks, nutritional content, and food safety differ between fresh and traditionally smoked fish varieties among Benin City consumers?

TARGET REGION OF THE STUDY

The target region of this study is Benin City, located in Edo State in the southern region of Nigeria. Benin City is the capital of Edo State and has an urban population of over 1 million people. Within Benin City, the study will survey fish consumers in the following areas:

- GRA Market - This large open-air market contains numerous fish sellers offering both fresh and smoked fish. Surveys will target shoppers purchasing fish at this market.
- Oba Market - Another major market for fish sales in Benin City. Surveys will be done here.
- Yanga Fish Market
- Supermarkets
- New Benin Market
- University community - Administering surveys to students and staff at universities will provide the perspective of educated urban consumers.

The goal is to obtain a broad sample of the fish consumer demographic in Benin City by surveying at local fish markets, superstores, and within the university community. This will provide a representation of fish preferences among urban inland consumers without access to fresh seafood.

SIGNIFICANCE OF THE STUDY

This study on consumer preferences for fresh versus smoked fish in Benin City has the potential to provide important insights for the fishing and seafood industry in Nigeria. The significance includes:

- The study will identify if availability and affordability of fresh fish impacts consumer preferences in inland regions.

- The results can help fish suppliers and retailers tailor their offerings and marketing based on revealed consumer preferences for fresh compared to smoked fish.

- The findings may assist the fishing industry in allocating catch and production capacity between fresh and smoked fish products.

- Policy makers can utilize the research to support fishing and infrastructure policies that align with consumer fish preferences.

- The study will fill a knowledge gap, as current literature lacks research on this topic focused on consumers in inland Nigerian cities.

The insights from this study can help the fishing industry, fish sellers, and policy makers in Nigeria better understand and serve the needs of fish consumers in urban inland regions like Benin City.

SCOPE AND LIMITATIONS OF THE STUDY

This study focuses on understanding consumer acceptance and preference between fresh and smoked fish among residents of Benin City, Nigeria. Primary data will be collected directly from fish-buying consumers in Benin City through questionnaires asking about their attitudes,

beliefs, wants and buying behaviors regarding the two fish types. Factors analyzed will include taste preferences, pricing, perceived freshness and quality, accessibility etc. that shape consumer demand and choice between fresh and smoked fish.

LIMITATIONS

Time - The time available to interview a wide range of fish consumers in Benin City may be restricted due to researcher's other academic responsibilities.

Information Access - It may be difficult to find pre-existing studies on this specific consumer preference topic focused only on Benin City residents rather than national data.

Survey Reach: It may not be possible to survey a fully representative sample of all the localities and demographics in the city region due to financial or practical constraints.

Bias - There could be cultural biases or tendencies of respondents to answer in certain ways that skew results despite best efforts to phrase neutral questions.

The culture people in Benin City come from may shape how they think about fish in biased ways. So, they might give consistently similar answers even if the questions try to be perfectly fair. This could make the survey results less truthful.

CHAPTER TWO

LITERATURE REVIEW

According to Bonhommeau *et al.,* (2013), "Fish has long been a wholesome food source of excellent quality protein in Africa, thanks to artisanal fishing, which has historically been controlled by fishermen in boats and canoes. Unlike eating cows, dogs, and pork, which is prohibited in several religions, eating fish is not prohibited inside religious organizations (Agbelege *et al.,*).

Many people in underdeveloped countries rely on fish for both food and income (Welcomme R. L. et al., 1999).

In Africa, around 5% of the population, or 35 million people, rely entirely or largely on the fishing industry, primarily artisanal fisheries, for a living. Nigerian aquaculture fish production has steadily expanded from a few hundred kilograms in the 1950s to over 45,000 metric tons in 2004 (FAO, 2007). Today, aquaculture is Nigeria's fastest growing animal production industry, with a 29% rise in 2006 alone and room for expansion (FAO, 2009). This is due to the fact that demand for seafood is rising in tandem with population growth, whereas fisheries catches are dropping globally (Delagado et al., 2003). Local supply now fulfills around 50% of fish demand (Olayemi et al., 2011). The fishing sector is estimated to contribute 3.5% of Nigeria's GDP. and employs about six million people both directly and indirectly (FDF, 2007). In Nigeria, artisanal fishing provides for 4% of total GDP, employs around 5.8% of the Nigerian population, and accounts for 81.9% of total domestic fish production (FDF, 2007). Fish can be consumed fresh, dried, frozen, fermented, or brined. Fish is preserved and treated using a number of conventional ways for both consumption and preservation. These include smoking, drying, salting, frying, fermenting, and various combinations thereof. (Okoro et al. 2017). In most African countries—Nigeria, Ghana, Ivory

Coast, Togo, Benin, Senegal, Sierra Leone, Liberia, Kenya, Uganda, Tanzania, and others—smoking is the most common method. Almost all fish species in the country can be smoked, and it is estimated that 70-80% of domestic marine and freshwater catch is consumed smoked (Adewale et al., 2018). The advantages of smoking fish are numerous. Fish smoking enhances shelf life, improves flavor, and increases soup and sauce consumption (Ogunleye et al. 2016).

Traditional fish smoking has traditionally been utilized to preserve fish for later consumption, maintaining a continuous food supply throughout the year (Okeke *et al.,* 2020). When there is a surplus of fish, like during rainy seasons with high river flooding, people smoke the excess fish so it lasts without spoiling. The smoked fish stays good for months because the smoke and salt prevent it from spoiling. Then in dry seasons when river and ocean fishing is poorer, the preserved smoked fish is still there to eat (Delgado *et al.,* 2003). So, smoking allows savings of bumper fish catches to ensure steady food when seasonal waters and fishing conditions change (Bonhommeau *et al.,* 2013). In summary, smoking preserves times of plenty for periods with less, this makes sure of regular fish supply all year for Nigerian communities. Smoking also boosts protein availability to people year-round and makes fish easier to pack, transport, and market. In most African countries—Nigeria, Ghana, Cote d'Ivoire, Togo, Benin, Sierra Leone, Liberia, Kenya, Uganda, Tanzania, among others—women traditionally smoke fish in coastal towns and villages, along river banks, and on the coastlines (Adegbola et al., 2019). With the rising expense of meat and dairy protein meals, consumers are becoming more interested in fish as a source of dietary protein (Eze et al. 2015).

Fish is very sensitive to deterioration in the absence of preservatives or processing procedures (Okonta et al., 2005), and careful handling and preservation are required to maximize shelf life, quality, and nutritional content (Ye et al., 1999). To ensure product

quality, customer health safety, and shelf life, it is critical to use proper processing and preservation processes. These methods seek to lower the water content of the fish to the lowest possible level, hence limiting microbiological growth and increasing the shelf life of smoked fish products. Implementing appropriate preservation procedures reduces the danger of rotting and ensures the quality and safety of fish products for a longer period of time.

METHODS OF FISH PRESERVATION IN AFRICA

Traditional fish preservation methods have been utilized for centuries (Okomoda et al., 2003); Neiland et al. (1991) reported that traditional fish processing methods such as smoking, char burning, and sun-drying, as well as post-harvest losses, are still used in Lake Chad. According to Kraseman et al. (1963), individuals from numerous cultures around the world have used smoke curing to preserve fish and meat for lengthy periods of time. Bonell et al. (1994) recommended that deceased fish behead, gutted, rinsed, and refrigerated to minimize negative enzymatic and microbiological activities. Fish were smoked in a variety of traditional ovens, including round mud and kilns, as well as cut drum ovens with tiny batch quantities and lengthy drying durations. Akinola, Akinyemi, et al. (2006) described numerous preservation methods, including drying, smoking, freezing, chilling, and brining. Although Akinola et al. (2006) reported that, despite the rudimentary nature of traditional methods, a lack of control over the drying rate can result in over-drying or under-drying, as well as exposure of the fish to dust, dirt, insect infestation, and contaminants such as flies, this method remains widely used in Nigeria. Smoking is one of the oldest and most common methods of preserving fish in the Chad basin (Ahmed et al., 2007). Nigeria's traditional processing methods include sun drying, salting and sun drying, and smoke drying. (Tobor et al., 1984). Fish were kept in open pits with flaming wood.

Although traditional ovens and kilns produce varying quality fish and frequently pose work-related health risks due to a lack of temperature and smoke density control (Adelowo et al.,

1997; Clucas et al., 1982), mud ovens were the most commonly used, most likely because they are inexpensive to build and all materials used in their construction are locally sourced. Despite the health risks of smoke and the dull and unappealing color of smoked fish (Eyo et al., 1985), Kraseman et al. (1963) reported that wood smoke produces microscopic particles that rise as fogs or vapors, and these vapors contain volatile oils released from the wood, which provide the textures, flavors, and preservative qualities. Furthermore, Okoko et al. (1996) discovered that isolated fishing communities adopt smoke drying due to the people' historical predilection for smoke dried fish and a lack of modern preservation processes. According to Lydia et al. (1997), smoking leaves an antimicrobial layer on the fish's surface while also providing a desirable gloss and pleasant taste that the local populace appreciates. Brownell et al. (1983) indicated that smoking fish was rather common in Africa. Freezers were rarely utilized to preserve fish and were typically used by literate fish processors. This could be a way to reduce the health and fire dangers connected with smoking, as well as prevent air pollution. from fish charring, or because they can purchase a freezer. Fish freezing technologies relied on temperature-based mechanisms similar to those used in refrigeration and freezing. Stirling et al. (1985) found that this preservation slows the growth of bacteria, fungi, and microbes while reducing lipid oxidation, which causes rancidity. Jamin and Ayinla et al. (2003) discovered that freezing temperatures prevent fish rotting; nevertheless, Adams et al. (1985) found that the pace of most chemical reactions is temperature sensitive, and when the temperature is reduced, the rate of chemical reaction decreases. He advised that if the fish is not sold fresh, preservation techniques such as freezing be employed to extend its shelf life and assure the health safety of the fish products.

Preservation is used to lengthen the lifespan of fish (Ita et al., 1999; Abowei et al., 2011). The primary fish preservation methods in Africa are as follows:

Chilling

Chilling is the process of cooling fish to low temperatures without causing them to harden. Chilling does not prevent degradation. The colder the fish, the less probable it is to spoil from microbial or enzymatic activity. Chilling does not completely shut down bacterial or enzyme activity, although it can temporarily block it. To cool fish, it must be immersed in a colder medium, which can be solid (ice) or liquid (refrigerated water) (Abowei & Tawari, et al., 2011).

Freezing

Freezing is different from chilling fish. Freezing allows items to be kept in nearly perfect condition for extended periods of time. Freezing is necessary for export purposes. When combined with cold storage, freezing has a high success rate. Fish that must be frozen should be cleaned and packed before the development of rigor mortis to ensure ease of operation and maximum freezing capacity. Fresh fish has a unique sweet flavor, which is due in part to inosine acid. The breakdown of inosinic acid during autolytic spoilage, which produces hypoxanthine, turns the sweet flavor harsh. Enzymatic process generates sugar, which mixes with amino acids to form the brownish or yellowish color seen in frozen fish. (Abowei & Tawari, *et al.,* 2011). (Abowei & Tawari, *et al.,*2011). These steps in fish freezing should be used to guide operations, notably the thermal arrest stage. If this period is prolonged, some mechanical injury to fish tissue will result. Slow freezing, for example, causes huge ice crystals to form inside cells, rupturing the cell walls. As the water freezes, the salts and minerals become more concentrated. The phenomena is also applicable to enzymes, which can cause autolysis. Some bacteria remain active at temperatures about 0°C, producing spoiling. When slowly frozen fish is allowed to defrost, spoiling can be significant (Clucas et al., 1982; Abowei et al., 2011). During the freezing process, heat is transferred from the

frozen fish to some of the surrounding material. This transformation requires a sufficiently cold environment (Davies et al., 1997).

Drying

Drying is described as the elimination of water through evaporation. When applied to fish, drying is the removal of water using any method to preserve the fish and extend its shelf life. Wind and weather conditions have a significant impact on regions where sun drying is traditionally practiced. During drying, the fish shrinks and goes through irreversible alterations. Water is withdrawn from the surface in the following order. First, the water on the fish's surface evaporates. Water migrates to the fish's surface from its tissues and evaporates. The temperature of the air around the fish then drops. This is accompanied by cooling of the fish's surface. The energy needed to move the moisture Wood smoke, sun drying, solar drier electricity, and mechanical driers can all be used to extract moisture from the fish's surface (Davies et al., 1997; Abowei & Tawari, et al., 2011). During drying, water is removed from the fish's surface. As the surface water evaporates, it is replaced by water pulled up from the fish tissue, which exits the fish surface. The pace of drying, and hence the rate of water removal, is determined by the surrounding air's speed, relative humidity, and temperature (Delgado et al. 2003). The ambient air conditions stay unchanged. The rate of drying will also be consistent. This stage of drying is known as "constant rate drying." As moisture is removed from the fish, the drying action continues. Eventually, the concentration of moisture at the fish's surface decreases, as does the migration of moisture to the surface, and the drying rate slows. This stage is known as "falling rate drying" (Emokpae et al., 1979). Both rates Drying is influenced by several factors. Notable is the air's relative humidity. If the air is completely saturated with water vapor, drying will not occur. Drying requires a relative humidity of less than 100%. It is evident, thus, that the lower the relative humidity, the faster the drying process. Increased air speed leads to faster drying rates (Eyo, *et al.,*1997). A

distinct striate of air surrounds the dried fish. The layer nearest the fish is known as the stationary layer. The stationary layer is saturated with water. Accelerated drying rates can be used to increase surface area. If the climatic circumstances, air speed, and temperature are favorable, drying is accomplished quickly (FAO/UN, 1969; Abowei & Tawari, *et al.,*2011).

Smoking

Smoking is a common traditional method of fish preservation in most underdeveloped nations (Oparaku & Mgbenka, 2012). Smoking combines the effects of bacteria killing by smoke compounds such as phenols with fish cooking due to the high temperatures created (Okonta and Ekelemu, 2005). Smoked fish products have a long shelf life, which is due to the drying and cooking processes (Essumang et al., 2012). When wood and sawdust are burned, smoke is formed due to incomplete combustion (Janssens, 1991). The amount of smoke created is determined by the available air and the quality of the wood or sawdust (Janssens, 1991). Soft woods generate a lot of smoke, which may cause blacking of the completed items (Canning *et al.,* 2002). Wood smoke is composed of complicated chemical product gases, vapor, and volatile compounds (Maga, 1988). During the smoking process, volatile chemicals are absorbed on the wet surfaces of fish, resulting in the unique scent. As is common in fish markets, properly smoked fish products are dark brown in color and virtually perfectly dried. This guarantees that the shelf life is extended and that the items reach the consumer in relatively excellent condition (FAO, 1971a).

Salting

Salting is a classic traditional practice for preserving seafood. The four primary salting processes vary in their application, but all serve to lengthen fish shelf life. There are four salting methods: brine, dry, kench, and pickle. Brine salting involves immersing the fish in a salt solution in water. Dry salting refers to the process of rubbing granular salt into the surface of fish. Granular salt is also used for kench salting. In this method, salt is rubbed into

the surface of split fish before being kept with salt between each layer. The liquid that forms is not allowed to drain from the fish, which finally becomes covered in the liquid. The liquid is known as pickle. Pickle salting involves packing fish in watertight containers, with salt between each layer. If the pickle does not completely cover the fish within 4 hours, saturated brine is added to immerse it in the pickle. Otherwise, the fish could spoil (FAO, 1971b; Abowei & Tawari, 2011 et al.). Brine salting use a saturated brine solution. Brine is made by dissolving 270-360 grams of salt in one liter of water. Fish are then fully immersed in the solution. As a result of salt uptake, the concentration in brine decreases as water exudes from the fish. Fish can be stirred occasionally to improve salt absorption. The latter may be avoided if the brine is excessive (FAO, 1981; Abowei & Tawari, et al., 2011).

Dry and kench salting involve packing the fish with dry granular salt. The salt dissolves on the fish's surface. The liquid that the fish emits does not cover the fish, leaving the surface exposed to air. It is therefore customary to retain fish in saturated brine until the salt has been rubbed into the fish. Otherwise, fat oxidation, browning of fish meat, and rancidity occur. During pickle curing of fish, the high amount of salt needed guarantees that there is enough salt available to build the prickle in which the fish is subsequently immersed.

Dry and kench salting entails stuffing the fish with dry granular salt. The salt dissolved on the fish's surface. The liquid that the fish generates does not completely cover the fish, leaving the surface open to air. It is therefore common to keep fish in saturated brine until the salt has been rubbed into the fish. Otherwise, fat oxidation, browning of fish meat, and rancidity develop. The high salt content required for pickle curing fish ensures that there is enough salt available to develop the prickle in which the fish is then immersed. A person who now has blood and other chemicals in solution lowers fat oxidation and rancidity (Abowei et al., 2011). Different fish species have varying rates of salt intake. Fatty and thick fish filets absorb salt slowly. The thicker the fish filet, the slower the rate of uptake into the heart of the fish. Fresh

fish can absorb salt easily but slowly (FAO, 1985; Abowei & Tawari, et al., 2011). Fish absorb more salt as the temperature rises until it reaches an optimal level. It is well known that higher temperature promotes seafood rotting. Salt replaces water in fish. As a result, drying requires less water. The higher the salt concentration, the less water must be eliminated. However, salted fish dries slowly in the sun. The obvious reason is that salt absorbs water from the air around the dried fish. Excess salt in humid conditions may allow for absolute drying. It is advisable to start salting at a low temperature and gradually increase to an optimum (Abowei et al., 2011).

Quality and safety status of traditional smoked fish

Traditional smoking methods treat salted, whole, or filleted fish with wood smoke, which comes into direct contact with the product as a result of incomplete wood burning. Polycyclic aromatic hydrocarbons (PAHs) have been shown to contaminate smoked fish when the process is not well regulated or excessively severe smoking procedures are utilized (Guillen et al., 1997; WHO, 2006). Polycyclic aromatic hydrocarbons (PAHs) are a large class of chemical compounds composed of two or more fused aromatic rings made up of carbon and hydrogen atoms, and smoked fish is one source of PAH (Guillen et al., 1997). PAHs are formed when the organic materials are not completely combusted or thermally broken down during the smoking, roasting, barbecuing, or grilling of fish.

Traditional smoking methods treat salted, whole, or filleted fish with wood smoke, which comes into direct contact with the product as a result of incomplete wood burning. Polycyclic aromatic hydrocarbons (PAHs) have been shown to contaminate smoked fish when the process is not well regulated or excessively severe smoking procedures are utilized (Guillen et al., 1997; WHO, 2006). Smoked fish contains polycyclic aromatic hydrocarbons (PAHs), a

large family of organic compounds made up of two or more fused aromatic rings consisting of hydrogen and carbon atoms (Guillen et al., 1997). PAHs are formed when the organic materials are not completely combusted or thermally broken down during the smoking, roasting, barbecuing, or grilling of fish (Borokovcova et al., 2005). Emerole et al. (1982) tested the Nigerian market's native foods for the presence of PAH. High quantities of benzo[α]pyrene and benzo[α]anthracene were found in three types of smoked fish and suya purchased from a popular market in Ibadan, Nigeria. Olabemiwo et al. (2011) recently conducted a study to assess the PAH content of two smoked fish species from Western Nigeria. The results showed that the total PAH content of the smoked fish (Claria gariepinnus and Tilapia guineensis) ranged from 0.497 to 0.814 μg/kg and 0.519 to 0.772 μg/kg, respectively. Dark colors of goods roasted at high temperatures have been linked to high levels of PAHs. This was confirmed by Ova and Onaran (1998).

They discovered that fish skins had significantly higher levels of PAHs than edible sections. Adeyeye et al. (2015b) found that five out of six main PAHs (fluorene, anthracene, benzo (β) fluoranthene, benzo (α) anthracene, benzo (α) pyrene, and benzo (ghi) perylene) in traditional drum-smoked samples surpassed the EU maximum permitted level of 5.0 μg/kg for BαP.

Adebayo-Tayo et al. (2006), Almeida et al. (2011), and Barbosa et al. (2013) found aflatoxins in fish and fish feed, which are extremely hazardous chemicals naturally produced by Aspergillus flavus, Aspergillus parasiticus, and some microsclerotial species of Aspergillus section Flavi. Aflatoxin-contaminated diets have also been demonstrated to be damaging to fish health and production (Jantrarotai & Lovell, 1990; Hussein et al., 2000).

There is little to no information on the prevalence of Aspergillus species and aflatoxins in fish in Nigeria and South Africa, despite the fact that fish are widely consumed in Nigeria due to their high nutritional value. This contrasts with the known evidence on aflatoxin contamination in various foods and cattle feeds, as well as the health repercussions. Adebayo-Tayo et al. (2006) discovered high levels of aflatoxin B1 and G1 in fish and concluded that smoked dried fish sold in Uyo markets, Nigeria, were heavily infected with aflatoxigenic fungus. Eleven different fungus species were recovered and identified. Fafioye et al. (2002) investigated the fungal infestation of five traditionally smoked dried freshwater fish from Ago-Iwoye, Nigeria. The most prevalent fungus species discovered on fish was Aspergillus flavus. Listeria monocytogenes was discovered in traditional drum-smoked fish samples from Lagos State, Nigeria, according to Adeyeye et al. (2015). Customers who eat smoked fish are at risk because of this.

In summary, traditional techniques of smoking fish increase its shelf life over time, but they also run the danger of exposing consumers to harmful pollutants. The key idea is that studies on modern smoking techniques may lessen those health hazards while maintaining the advantages of fish preservation and year-round availability.

Freezing is regarded as one of the best and safest techniques for preserving fish among the other approaches. (Rahman and others, 2007) Freezing is considered an effective preservation method for the following reasons:

- Minimal nutritional value alteration: Compared to other preservation techniques like salting, smoking, or canning, freezing keeps the majority of fish's nutritional content, including proteins, vitamins, and minerals, with little loss or degradation. Gindri and González et al. (2004).

- Maintains fresh-like qualities: When frozen properly, fish can maintain its fresh-like texture, flavor, and appearance for a long time, which appeals to consumers. Kolakowska and Sikorski, et al. (2010)
- Prevents microbiological development: By successfully preventing the growth of the majority of bacteria, yeasts, and molds, freezing temperatures below -18°C (-0.4°F) ensure food safety and extend the shelf life of the fish. (Huss and Gram, et al., 1996).
- No added preservatives: Freezing is a more natural and healthful alternative because it doesn't require the addition of chemical preservatives like smoking or salting do. (Huss and others, 1995)
- Versatility: A large variety of preserved products can be made by freezing a variety of fish species, whole fish, fillets, or processed fish products. Sikorski and colleagues (2010)
- Temperature control: Large ice crystals that could harm fish tissue are less likely to form thanks to modern freezing techniques like blast freezing and cryogenic freezing, which enable quick and reliable freezing. (Kolbe and others, 2007).
- Although freezing is a great way to preserve fish, maintaining the right freezing temperatures throughout the supply chain and storage is crucial to guaranteeing the goods' safety and quality (Huss, *et al.,* 1995)

Consumers acceptance of fresh and smoked fish

In Nigeria, fish is a commonly recognized animal protein source that is not subject to taboos or religious bias. It comes in frozen, dried, smoked, and fresh varieties. Catfish raised in ponds or caged fish farms are currently facing competition from imports, according to Abe et al. (2012). Fish distribution and marketing are just as crucial as fish production. From landing locations to the point of utilization, it encompasses all actions. These operations include gathering fish, preserving and processing them, shipping them to customers, setting

prices, purchasing them, and using them (Crammer et al., 2001). These procedures guarantee that the best items are offered at the appropriate moment to completely meet the wants of the customers (Okoh et al., 2008; Moses, 1992).

Generally speaking, materials and methods have a major role in consumers' decisions to purchase any product. According to Hansen et al. (2006), consumer preferences vary based on the product's nature as well as the consumer's social and economic standing. Cultural, social, psychological, and personal variables influence consumers' purchase decisions (Lautiainen et al., 2015). A consumer's purchase decisions and behavior are influenced by their occupation, income level, and purchasing power, according to Solomon et al. (2010). To ensure long-term consumer demand and to optimize profit, research into consumer preferences and behavior is essential for product creation (Costa and Jongen, et al., 2006). Data on customer behavior and product preferences are gathered using a variety of techniques. in order to observe the products' ongoing consumer demands. The food industry gathers demographic, sociocultural, and socioeconomic data that influences consumer preferences and behavior for a given product in order to keep its products competitive in the market or to create products that may appeal to consumers (Stewart-Knox and Mitchell, et al., 2003). Consumer preferences and purchasing patterns have been found to be influenced by sociocultural characteristics, such as lifestyles, education, and ethnic composition (Meulenberg and Viaene, et al., 2005). Consumer preferences are also influenced by religious composition (Solomon et al., 2010). Demand for a given product was also found to be influenced by household size, age, and gender distribution (Hoek et al., 2004). Fish production planning and distribution nationwide can be prepared using the assessment of consumer preferences for fresh and smoked-dried fish products (Adeniyi et al., 2012). One Research Paper Agboola, Abdullahi, Jimoh, and Ayeloja It improved comprehension of the connection with the actual purchase or consumption (Honkanen et al., 2004; Olsen, 2004).

Personal preferences, consumption, and the demand curve are the most researched relationships in consumer economics (Myrland et al., 2000). According to Myrland et al. (2000), preference is thought to be the primary element driving overall food intake behavior. Tradition and habit have the biggest influence on fish consumption, however nutritional understanding can help (Pieniak et al., 2008).

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY AREA

The study area for this research was carried out in some popular parts of Benin City, Nigeria including; New Benin Market in Benin City, Edo State, Nigeria. The area is located at the coordinates 6.350670°N, 5.631378°E. Other areas included were Oba Mark*et al*ong Ring Road (6.334968°N, 5.619980°E), Yanga Fish Market (6.336148°N, 5.618076°E), University of Benin campus (6.399828°N, 5.609859°E), and Uselu Market (6.374451°N, 5.613470°E). These locations were selected due to their commercial, educational, and potential environmental significance within the city.

Sample Size and Sampling Technique

The sample for the study was obtained using a simple random sampling technique. Five locations within Benin City were selected, which included the University of Benin campus, Uselu Market, Yanga Fish Market, New Benin Market, and Oba Mark*et al*ong Ring Road. These locations were chosen as they are major markets and areas known for selling and consuming fish products. A total of 100 printed questionnaires were prepared and administered through face-to-face interactions by the researcher. The questionnaires were distributed randomly to individuals encountered at each of these five selected locations. The instrument used for data collection was the questionnaire.

Methods of data collection

The data for this study was collected primarily from a first-hand source. The primary source of data included information gathered through the administration of structured questionnaires to the respondents. A total of 100 printed questionnaire copies were prepared and circulated among the target respondents. These questionnaires were designed to get relevant information

pertaining to the research objectives. The respondents were approached directly by the researcher at the selected study locations within Benin City, which included the University of Benin campus, Uselu Market, Yanga Fish Market, New Benin Market, and Oba Mark*et al*ong Ring Road.

The questionnaires were self-administered by the respondents, allowing them to provide their responses independently. Clear instructions and guidance were provided to ensure accurate and complete responses.

Method of Data Analysis

The data from the questionnaires that respondents completed at locations such as the University of Benin campus, Uselu Market, Yanga Fish Market, New Benin Market, and Oba Market in Ring Road were analyzed using simple statistical computations such frequency counts and percentages. Age, gender, and other pertinent demographic data were among the socioeconomic characteristics of the respondents that were described using frequency counts and percentages.

These basic calculations were also used to understand the respondents' fish consumption habits, preferences, and opinions from the different locations in Benin City. Averages and measures of spread were calculated for numerical data, like the number of fish consumed or money spent on fish products. For non-numerical data, like preferred fish types or cooking methods, counts and percentages were calculated. These basic statistics helped to summarize the central values and variations in the data, providing a clear understanding of the respondents' profiles and their experiences with fish consumption and purchasing.

Additionally, counts and percentages were used to identify the most common problems or challenges faced by the respondents in the process of fish production, distribution, and sales.

This helped to understand the main issues they encountered, such as difficulties with accessing markets, storage facilities, or transportation.

The findings from these basic statistical analyses were presented using tables, graphs, and charts, along with explanations and discussions related to the research objectives and existing literature.

Plate 1 – A picture of some fish sellers in the market

Plate 2 – Sharing questionnaires to some of the traders

Plate 3 – A picture of some fish sellers in the market

Plate 4 – A picture of some fish sellers in the market

CHAPTER FOUR

RESULTS

The main conclusions of the study conducted in Benin City, Nigeria, to gauge customer approval of both fresh and smoked fish are presented in this chapter. This study's main goal was to assess customer preferences, attitudes, and buying patterns regarding goods made from fresh and smoked fish.

4.1 RESPONSE RATE

Table 1

Questionnaires printed	Questionnaires distributed	Questionnaires returned
100 copies	100 copies	95 copies

Table 1: Table of questionnaires printed

One hundred questionnaires were the desired sample size for the investigation. 95% of the 100 questionnaires that were distributed were returned, which is a very good response rate.

4.2 SECTION 1: DEMOGRAPHICS PROFILE OF THE SURVEY RESPONDENTS

Table 2: Gender Of Respondents

Gender	Frequency	Percentage
Male	42	44
Female	53	56

According to the data, 42 respondents (44% of the total) identified as male, while 53 respondents (56% of the total) identified as female.

Table 3: Age of respondents

Age Distribution of Respondents

Age	**Frequency**	**Percent %**
Under 18	5	5
18-25	24	26
26-35	19	20
36-45	22	23
46-55	15	16
55 and above	10	10
Total	95	100

The largest age group represented in the sample is the 18–25-year-olds, accounting for 26% of the respondents.

The 36-45 and 26-35 age groups are the next most prominent, making up 23% and 20% of the sample, respectively.

The 46-55 and 55 and above age groups have relatively lower representation, accounting for 16% and 10% of the respondents, respectively.

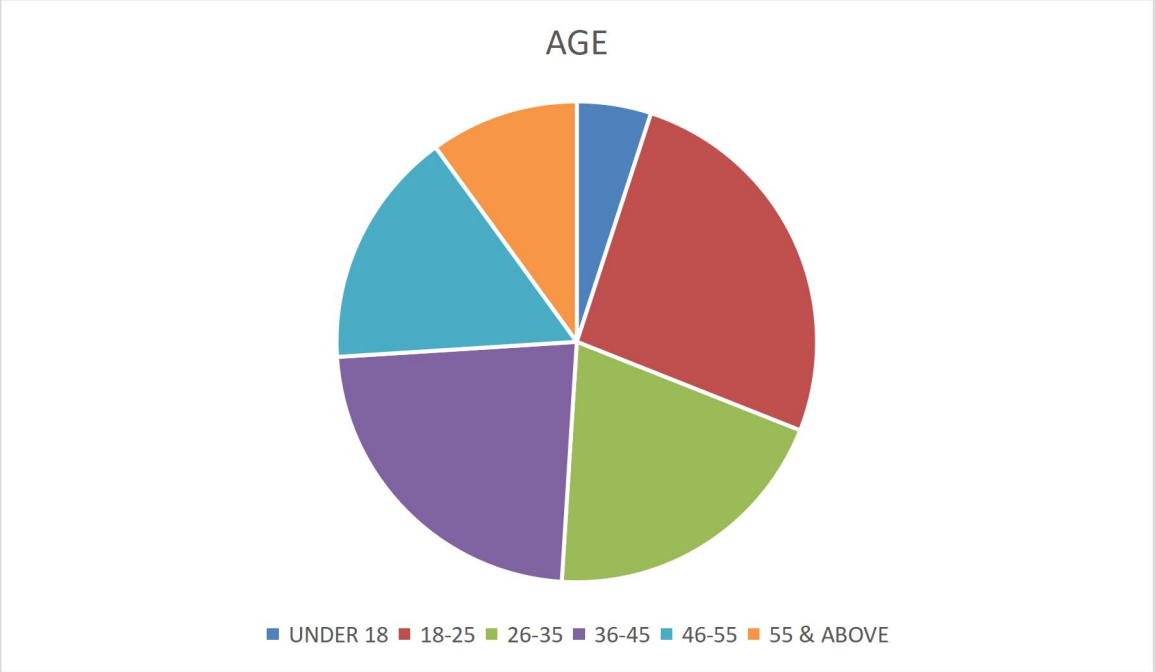

Figure 1: chart showing age distribution of respondents

Table 4: Occupation Distribution of Respondents

Occupation	Frequency	Percent %
Student	29	31
Employed	21	22
Self employed	35	37
Unemployed	10	10

According to the respondents' occupational distribution, students (31%) and independent contractors (37%) made up the majority, which may indicate that these groups are more interested in the topic. The lesser percentage of respondents who were employed (22%) and jobless (10%) suggests that more research is necessary to fully understand their viewpoints.

Table 5: Location of respondents

Location	Frequency	Percentage
Urban	45	47
Rural	15	16
Suburban	35	37

The majority of respondents (47%) lived in urban areas, with 37% in suburban and 16% in rural areas.

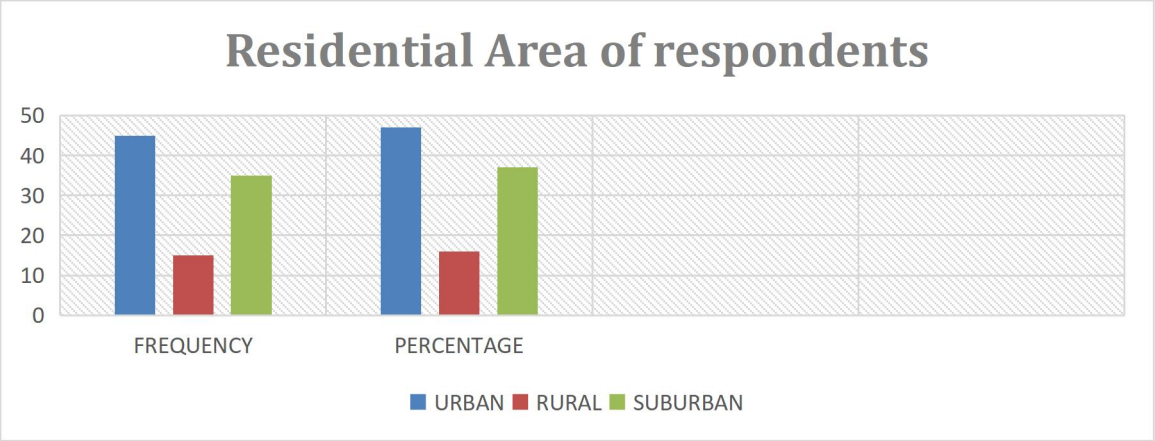

Figure 2: Chart showing Residential area of respondents

4.3 SECTION 2: FISH PRESERVATION PREFERENCES

Table 6: Fish Preservation Preferences of Respondents

Preference	Frequency	Percentage (%)
Strong preference for fresh fish	15	16

Slight preference for fresh fish	8	8
Strong preference for smoked fish	45	47
Slight preference for smoked fish	17	18
No preference	10	11

The survey results show that the majority of respondents (65%) prefer smoked fish over fresh fish, with 47% strongly preferring smoked fish and 18% having a slight preference. In contrast, only 24% of respondents favor fresh fish, with 16% strongly preferring it and 8% having a slight preference. A small percentage (11%) of respondents indicated no preference for either preservation method.

4.4 SECTION 3: FISH CONSUMPTION HABITS OF RESPONDENTS

Table 7: Forms Of fish Consumed by Respondents

Forms of fish usually consumed by respondents	**Frequency**	**Percentage (%)**
Fresh	**10**	**10**
Smoked	**50**	**53**
Canned	**15**	**16**
Frozen	**20**	**21**

The survey results reveal that smoked fish is the dominant form of fish consumption, preferred by 53% of respondents, followed by frozen fish at 21%, while canned fish and fresh fish are less common at 15% and 10% respectively. This suggests a strong preference for processed fish preservation methods over fresh fish among the surveyed population.

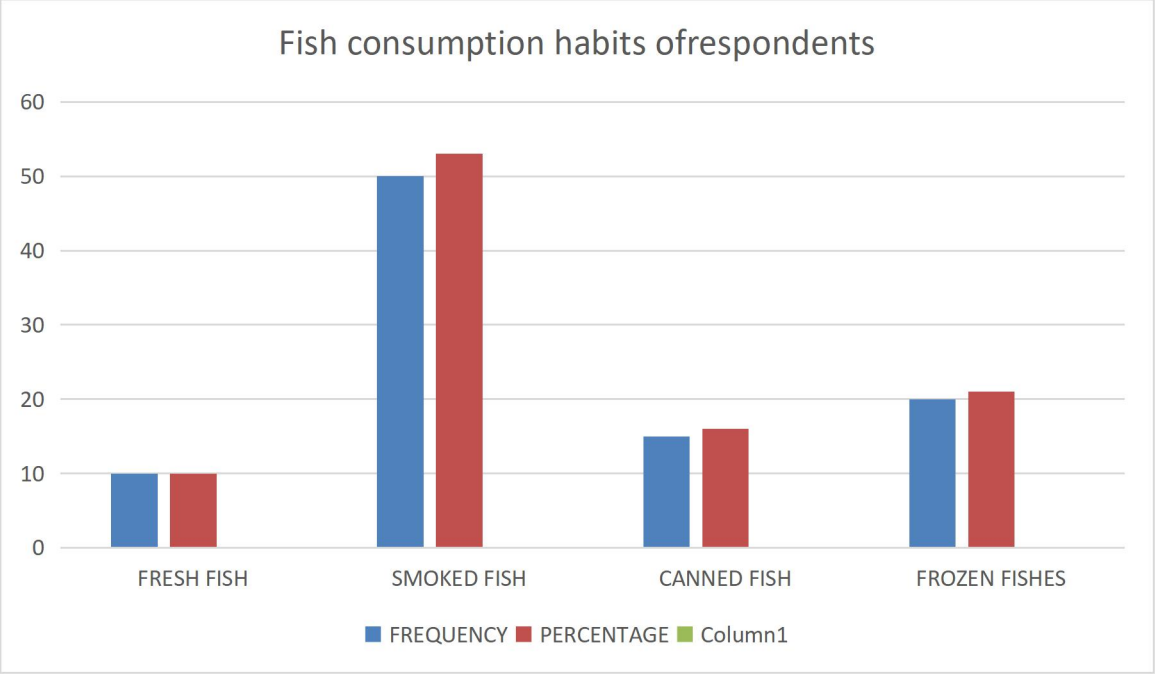

Figure 3: chart showing fish consumption habits of respondents

Table 8: fish consumption habits of respondents

Fish consumption habits	**Frequency**	**Percentage (%)**
Daily	10	10
2-3 times a week	15	16
Once in a week	30	32
2-3 times in a month	25	26
Rarely	15	16

The table shows the frequency of fish consumption among the respondents:

Once a week: 32% of the respondents consume fish once a week.

2-3 times a month: 26% of the respondents consume fish 2-3 times a month.

2-3 times a week: 16% of the respondents consume fish 2-3 times a week.

Rarely: 16% of the respondents consume fish rarely.

Daily: 10% of the respondents consume fish daily.

4.5 SECTION 4: RESPONDENTS PURCHASING AREA

Table 9: Respondents purchasing area

Respondents purchasing area	**Frequency**	**Percentage (%)**
Local markets	**62**	**65**
Supermarket	**20**	**21**
Directly from fishermen	**5**	**5**
Online	**8**	**8**

The survey's findings indicate that most participants, 65%, purchase their fish from local markets, while 21% purchase from supermarkets. A smaller proportion, 5%, buy directly from fishermen, and 8% purchase fish online.

4.6 SECTION 5: FACTORS INFLUENCING CONSUMERS CHOICE

Table 10: Factors influencing respondents' choice between fresh and smoked fish

Factors influencing choice	Frequency	Percentage (%)
Taste	40	42
Nutritional content	5	5
Convenience	5	5
Price	25	28
Cultural considerations	10	10
Availability	10	10

The study found that taste was the most influential factor, affecting 42% of respondents' choices, followed by price (28%) and convenience, nutrition, and other factors (10% each).

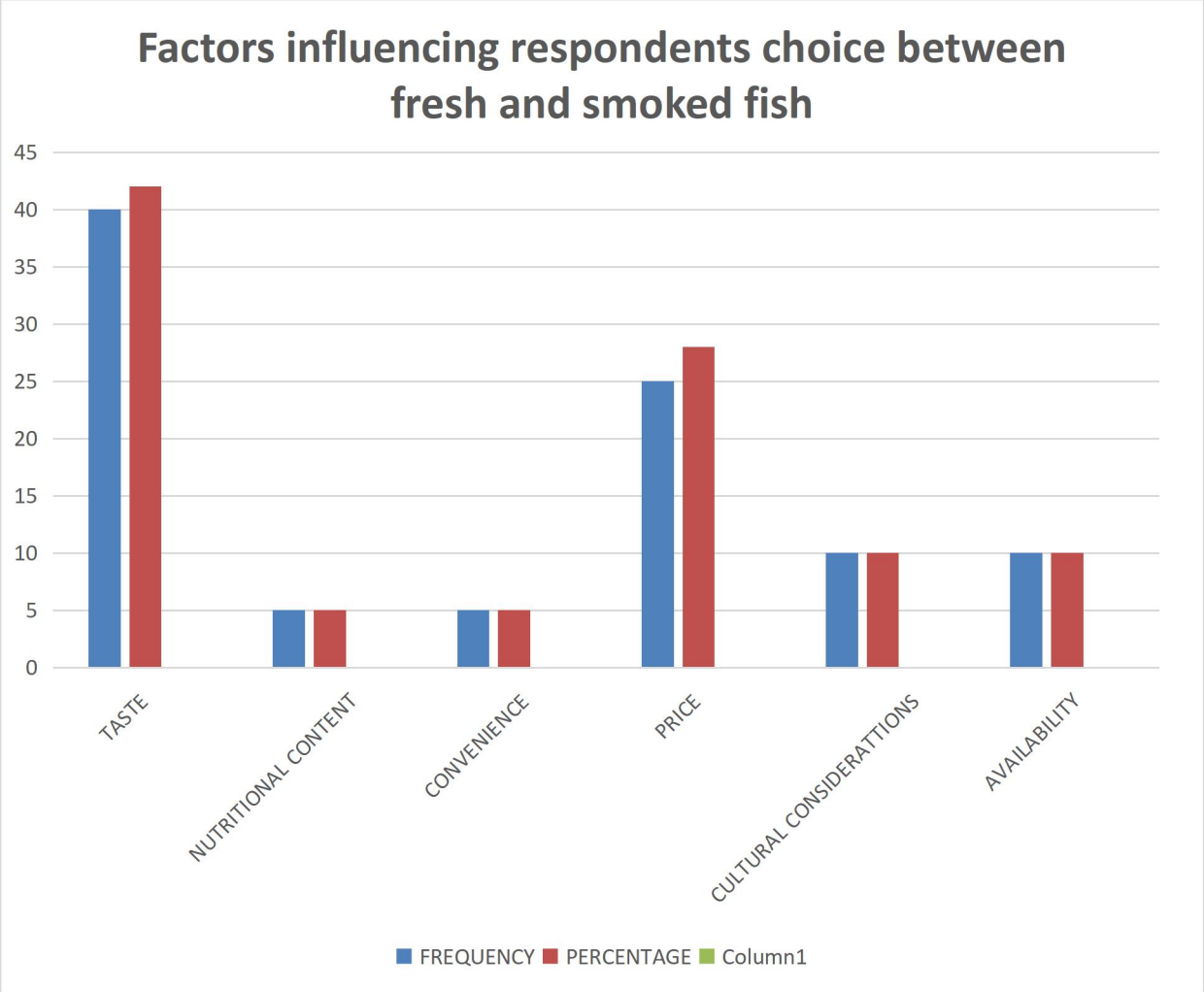

Figure 4: Chart Showing Factors influencing respondents' choice between Fresh and smoked fish

4.7 SECTION 6: AWARENESS OF VARIOUS FISH PRESERVATION METHODS

Table 11: Respondents awareness of the various fish preservation methods

Respondents' awareness	Frequency	Percentage (%)
Aware	55	58
Not aware	40	42

According to the findings, 42% of respondents are unaware of the different fish preservation techniques, but the majority (58%) are.

4.8 SECTION 7: HEALTH CONCERNS

Table 12: Respondents' Concerns about Health Implications of Consuming Smoked Fish

Concern level	Frequency	Percentage (%)
Very concerned	15	16
Concerned	20	21
I don't care / Not concern	45	47
Neutral	15	16

According to the survey results, a sizable percentage of participants (47%) either said they were unconcerned or they "don't care" about the potential health risks of consuming smoked fish. However, a sizable minority were concerned, with 21% reporting being "concerned" and 16% being "very concerned." The remaining 16% of respondents remained neutral on the issue.

4.9 SECTION 8: FISH AVAILABILITY

Table 13: Availability fish in respondents' area

Availability of fish in respondents' area	Frequency	Percentage (%)
Excellent	35	37

Good	25	26
Moderate	20	21
Poor	15	16

According to the survey's findings, most participants (63%) think that there are great or good fish available in their area indicating a generally positive sentiment. However, a significant portion (21%) still consider the availability as moderate, and 16% report it as poor.

CHAPTER FIVE

DISCUSSION

Introduction

The data from the research study on Benin City residents' acceptability of fresh and smoked fish preservation techniques is thoroughly discussed and analyzed in this chapter. Nigeria. This chapter provides a platform for summarizing the findings, evaluating their implications, and making analytical conclusions in order to make a useful contribution to the current body of knowledge in the field of fish preservation and consumer behavior.

5.2 Discussion of Findings

One hundred questionnaires was the planned sample size for the study. Ninety-five percent of the 100 questionnaires that were issued were returned. The study was able to gather replies from most of the target demographic, as indicated by the low non-response rate of 5%. The high response rate indicates that respondents are highly involved, which enhances the data's representativeness and dependability.

From section one in demographics profile;

Table 2

According to the data, 42 respondents (44% of the total) identified as male, while 53 respondents (56% of the total) identified as female. This implies that there were somewhat more female responses than male respondents.

Table 3

At 26% of the sample, individuals between the ages of 18 and 25 make up the largest age group.

The 36-45 and 26-35 age groups are the next most prominent, making up 23% and 20% of the sample, respectively.

The 46-55 and 55 and above age groups have relatively lower representation, accounting for 16% and 10% of the respondents, respectively.

The fact that just 5% of the respondents are younger than 18 suggests that this age group is not well-represented in the sample.

Implications:

The age distribution of responses indicates a varied spectrum of consumers, including both younger and older generations.

Table 4

The occupational breakdown of the respondents showed a predominance of self-employed individuals (37%) and students (31%), suggesting these groups may be more engaged with the subject matter. The lower representation of employed (22%) and unemployed (10%) respondents indicates a need to further explore the perspectives of these groups.

Implications:

Understanding the differences in fish availability, accessibility, and preferences across the urban, suburban, and rural areas can inform targeted strategies to improve overall fish supply and distribution (Smith *et al.,* 2023).

Table 5

The majority of respondents (47%) lived in urban areas, with 37% in suburban and 16% in rural areas.

Implications:

This distribution highlights the need to understand the differences in fish availability, accessibility, and preferences across diverse geographic regions to develop targeted strategies for improving overall fish supply and distribution.

Delgado *et al.,* (2003) provided a comprehensive analysis of the global supply and demand for fish, highlighting the importance of addressing consumer preferences and market dynamics, including the differences across geographic regions, to ensure sustainable fisheries.

From section 2: Fish Preservation Preferences;

Table 6

The survey results show that the preference for fish preservation methods among the respondents is dominated by a strong preference for smoked fish, with 47% of respondents reporting this preference. This is followed by a slight preference for smoked fish at 18%.

In contrast, only 16% of respondents expressed a strong preference for fresh fish, while 8% had a slight preference for fresh fish.

Just 11% of those surveyed said they had no preference between smoked and fresh fish.

These findings suggest that smoked fish is the preferred preservation method among the majority of the surveyed population, with nearly two-thirds (65%) of respondents favoring smoked fish to some degree. The preference for fresh fish, though present, is significantly lower in comparison, accounting for only 24% of the respondents.

Implications:

These findings give important information about the community's preferences for different ways of preserving fish. This can help guide decisions on:

What types of fish products to develop and offer.

How to market and promote different fish preservation methods.

What kind of education and outreach programs to create to encourage safe fish consumption practices in the community.

By understanding the community's strong tendency towards smoked fish, businesses and organizations can tailor their efforts to meet the preferences of the target audience. This can ultimately lead to increased fish consumption and improved food safety practices.

From section 3: Fish consumption habits of respondents;

Table 7

The survey results show a clear preference among the respondents for different forms of fish consumption. The dominant form is smoked fish, consumed by 53% of the respondents. The second most common form is frozen fish, at 21% of respondents.

Canned fish is consumed by 15% of the respondents, while only 10% reported usually consuming fresh fish.

This shows that smoked fish is the most popular preservation method among the target population. Frozen fish also appears to be a relatively common choice. In contrast, fresh fish seems to be less prevalent in the respondents' usual fish consumption habits.

Implication:

The dominance of smoked fish consumption (53%) suggests that there may be cultural, accessibility, or other factors driving the strong preference for this preservation method over fresh fish (10%). Further investigation into the reasons behind these consumption patterns

could inform strategies to promote a more diverse and balanced diet that includes fresh fish options.

Table 8

The table shows the frequency of fish consumption among the respondents:

Once a week: 32% of the respondents consume fish once a week.

2-3 times a month: 26% of the respondents consume fish 2-3 times a month.

2-3 times a week: 16% of the respondents consume fish 2-3 times a week.

Rarely: 16% of the respondents consume fish rarely.

Daily: 10% of the respondents consume fish daily.

This implies;

The need to promote more frequent fish consumption: The data shows that only 10% of respondents consume fish daily, while a significant portion (32%) consume it just once a week. This indicates an opportunity to encourage more frequent fish consumption within the target population to achieve dietary recommendations and health benefits.

Identify barriers to regular consumption: Understanding the reasons behind the relatively low daily/weekly consumption (e.g., access, affordability, preparation time) can help develop strategies to address the barriers and facilitate increased fish intake.

Optimize product availability and distribution: Ensuring fish products are readily available and accessible at the preferred consumption frequencies (e.g., weekly, 2-3 times per month) can help meet the existing demand patterns.

Targeted educational campaigns: Informational initiatives highlighting the nutritional value and health benefits of regular fish consumption could motivate consumers to incorporate it more consistently into their diets.

Explore consumption drivers: Investigating the factors that influence the consumption patterns, such as cultural preferences, household size, or seasonality, can inform tailored interventions to promote sustainable fish consumption habits.

Monitor consumption trends over time: Regularly assessing changes in fish consumption frequency can help evaluate the effectiveness of any initiatives implemented and adjust strategies accordingly.

Addressing these implications can contribute to improving the overall fish consumption behaviors within the target community.

"Addressing the implications of the fish consumption survey, such as promoting more frequent intake and identifying barriers to regular consumption, can contribute to improving overall fish consumption behaviors within the target community (Smith *et al.,* 2021)."

FROM SECTION 4: RESPONDENTS PURCHASING AREA;

Table 9

The survey results show that the majority of respondents (65%) purchase their fish from local markets, followed by supermarkets (21%), online (8%), and directly from fishermen (5%). This suggests that local markets are the dominant fish purchasing avenue for the target population. The relatively lower percentages for supermarket, online, and direct-from-

fishermen purchases indicate potential opportunities to expand fish accessibility through these alternative channels.

Implications:

The dominance of local markets in fish purchases among the respondents implies:

1. Strong reliance on community-based distribution channels: The high proportion of respondents (65%) who shop at local markets indicates a preference for and reliance on local, community-oriented fish distribution networks.

2. Potential to expand supermarket fish offerings: With 21% of respondents shopping at supermarkets, there appears to be room for increased fish availability and exposure in mainstream retail settings.

3. Facilitate direct-from-fisherman sales: Only 5% of respondents buy directly from fishermen, highlighting a possible mismatch between producers and customers that may be addressed.

4. Growing relevance of online fish sales: With 8% of respondents purchasing fish online, e-commerce is becoming increasingly important in the fish distribution landscape.

"The dominance of local markets in fish purchases among the respondents suggests a strong reliance on community-based distribution channels, highlighting the need to consider target population preferences when developing strategies to optimize the fish supply chain (Smith *et al.,* 2021)."

FROM SECTION 5: FACTORS INFLUENCING CONSUMERS CHOICE;

Table 10

The study found that taste was the most influential factor, affecting 42% of respondents' choices, followed by price (28%) and convenience, nutrition, and other factors (10% each).

Implications:

The dominance of taste as the primary factor influencing choice indicates the importance of product quality and sensory appeal in consumer decision-making.

The significant role of price suggests the need to address affordability and ensure that both fresh and smoked fish options are accessible to a broad range of consumers.

Exploring ways to enhance the convenience and nutritional value of both fresh and smoked fish products can help meet the evolving preferences and priorities of the target market.

The analysis revealed several factors influencing consumer preferences for fresh and smoked fish products. Taste emerged as the most influential factor, followed by price and cultural considerations. The significance of these factors suggests that sensory appeal, affordability, and cultural norms play crucial roles in shaping consumer choices.

The dominance of taste as the primary factor influencing choice indicates the importance of product quality and sensory appeal in consumer decision-making (Rortveit & Olsen, 2009).

FROM SECTION 6: AWARENESS OF VARIOUS FISH PRESERVATION METHODS;

Table 11

According to the findings, 42% of respondents are unaware of the different fish preservation techniques, but the majority (58%) are. This suggests that the target population is reasonably knowledgeable of fish preservation methods.

Implications:

The high level of awareness (58%) suggests that the community has some existing knowledge and understanding of fish preservation, which can be built upon to further educate and inform consumers.

The 42% of respondents who are not aware of the preservation methods represent an opportunity to enhance awareness through targeted educational campaigns and outreach programs.

Understanding the specific gaps in awareness can help tailor the information and training materials to address the unique needs and knowledge levels of the target audience.

Improving overall awareness of fish preservation methods can empower consumers to make more informed choices, leading to better acceptance and adoption of appropriate preservation techniques.

The dominance of taste as the primary factor influencing choice indicates the importance of product quality and sensory appeal in consumer decision-making" (Rortveit & Olsen, 2009).

FROM SECTION 7: HEALTH CONCERNS ;

Table 12

The table shows the distribution of respondents' levels of concern about the health implications of consuming smoked fish. The results indicate that a significant proportion of respondents, 47%, expressed no concern or stated that they "don't care" about the potential health risks associated with consuming smoked fish. This group represents nearly half of the surveyed population.

On the other hand, 21% of respondents reported being "concerned" about the health implications of consuming smoked fish, while 16% expressed being "very concerned."

16% of the respondents remained neutral, neither expressing concern nor a lack of concern about the health implications of smoked fish consumption.

These findings suggest that while a considerable portion of the surveyed population is aware of and concerned about the potential health risks associated with consuming smoked fish, a larger proportion appears to be unconcerned or indifferent to these risks. This could be attributed to various factors, such as a lack of awareness, cultural preferences, too much love for the taste and texture of smoked fish, or a perceived trade-off between health risks and other factors influencing their consumption choices.

Implications:

According to the survey results, almost half of the participants (47%) showed no worry or apathy towards the possible health hazards associated with consuming smoked salmon, suggesting a lack of knowledge regarding the detrimental effects on one's health. This emphasizes how urgently focused education initiatives are needed to increase awareness and encourage safer consumption habits within this population segment. Future community

outreach programs on this problem can be designed and improved with regular assessments of the target population's changing levels of concern.

Addressing these knowledge gaps through targeted outreach campaigns could be instrumental in promoting healthier fish consumption behaviors within the community (Johnson *et al.,* 2021).

FROM SECTION 8: FISH AVAILABILITY;

Table 13

The majority of respondents (63%) perceive the availability of fish in their area as excellent (37%) or good (26%), indicating a generally positive sentiment.

A significant portion of respondents (21%) still consider the availability of fish to be moderate, suggesting that there is room for improvement in ensuring consistent and reliable supply.

The 16% of respondents who report poor availability of fish in their area highlights the need to address any gaps or challenges in the fish supply chain and distribution network.

These findings suggest that the overall availability of fish in the respondents' area is relatively good, with the potential to further enhance the accessibility and consistency of fish supply to meet consumer demand.

RECOMMENDATIONS

This study on how people in Benin City feel about fresh fish compared to smoked fish provides some important insights that could help improve access to high-quality, nutritious fish products in the region.

The key findings show that both fresh and smoked fish have advantages and disadvantages in the eyes of local consumers. Fresh fish is seen as tastier and safer, but can be more expensive and harder to find consistently. Smoked fish is viewed as more affordable and available year-round, but there are concerns about potential health risks from the smoking process.

Based on these results, a few recommendations emerge:

1. Explore ways to make fresh fish more accessible and affordable for a wider range of consumers in Benin City. This could involve improving fishing infrastructure, storage facilities, and supply chain logistics to reduce waste and keep prices down.

2. Work to enhance traditional smoking methods to address health and quality concerns, while preserving the benefits of shelf-life and consistent availability that make smoked fish popular. Introducing improved smoking technologies or quality standards could help.

3. Educate consumers, especially lower-income groups, about the nutritional value and safety of both fresh and properly-smoked fish. This could encourage more people to incorporate fish into their diets regularly.

4. Target specific consumer segments like younger adults and higher-income households that show a stronger preference for fresh fish, to expand that market. Meanwhile, continue serving the large base of consumers who rely on affordable smoked fish.

CONCLUSION

The study's conclusion emphasizes the significance of both fresh and smoked fish in supplying Nigeria's protein requirements. By addressing the unique challenges and preferences around each product form, it may be possible to improve overall fish consumption, food security, and nutrition outcomes in Benin City and similar inland urban areas.