



Pattern of Fish Consumption and Fish Distribution: A Study on Sunyani Municipality, Ghana

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Authors' contributions

This work was carried out in collaboration among all authors. Author RF designed the study, managed the literature searches and wrote the first draft of the manuscript. Authors IA and SKKA performed the statistical analysis and analyses of the study. Author SKKA wrote the protocol and reviewed the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJFAR/2020/v10i130173

Editor(s):

(1) Dr. Pinar Oguzhan Yildiz, Ataturk University, Turkey.

Reviewers:

(1) Pinakshi Bag, Biju Pattanaik University of Technology (BPUT), India.

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(3) Lucas Paulo Jacinto Saavedra, State University of Maringá, Brazil.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/60698>

Received 15 August 2020

Accepted 21 October 2020

Published 20 November 2020

Original Research Article

ABSTRACT

Fish consumption and marketing has become an essential phenomenon due to the increasing appreciation of the health and the economic benefits of fish to households in Ghana. Given this, the study sought to identify the pattern of fish consumption and distribution channels using semi-structured interview guides, administered to fifty (50) consumers and fifty (50) fish traders. Data obtained were analyzed using the Statistical Package for Social Sciences (SPSS). *Scomber japonicus*, *Sardinella aurita*, *Trachurus trachurus* and *Clarias gariepinus* were the most preferred consumed fish. The majority of consumers preferred smoked fish to other fish products based on taste, flavor, shelf life, and wholesomeness in diets. Based on the findings from the binary logistic model, educated respondents as well as respondents below 20 years could be more prone to calcium deficient diseases, particularly in the absence of supplementary sources of calcium in their diets. Fish traders purchased their fish products from Sunyani, Yeji, Techiman, Cape Coast, and Buiepe. The study showed that simple and complex marketing and distributing channels for frozen and smoked fish products, respectively. The main challenge encountered by fish traders and

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consumers was fish spoilage. Fish traders should be schooled on proper fish handling techniques to reduce the rate of fish spoilage. Sensitization programs regarding the consumption of fish products entirely must be promoted among consumers.

Keywords: Consumption; distribution channels; fish products; Ghana.

1. INTRODUCTION

Fish is an essential animal source of food for a healthy diet. It is a source of cheap first-class protein, which provides essential amino acids [1], unsaturated fatty acids [2], calcium, phosphorus, vitamin A and D [3]. Furthermore, it is easy to digest due to the lack of connective tissue [4]. Several researchers have investigated the nutritional value of fish and its importance in the human diet from various perspectives [5,6]. Some studies revealed that fish consumption helps in preventing cardiovascular diseases, high blood pressure, cholesterol, Alzheimer's disease, and various types of cancer [7]. The omega-3-fatty acids in oily fish also give optimum brain function, reduces the danger of heart attacks, strokes and osteoporosis. Consuming fish has been found to slow down the aging process as well as enabling people to lose weight since a fishy diet switches off the hunger hormone and thus, makes people feel satisfied with smaller and more nutritious amounts of food [8].

Despite its nutritional value, fish is an extremely perishable commodity, spoiling soon after death due to microbial activities, and resulting in disagreeable taste, smell and texture and thereby reducing consumer acceptability [9]. Ghaly et al. [10] suggested the use of refrigeration as a means of preventing the fast rate of deterioration in fish. However, some bacteria like Salmonella, which survive in refrigerators and brine, can only be destroyed by heating or smoking [11]. In Ghana, refrigeration, smoking, salting, drying and steaming are some of the methods used to preserve fish [12].

The Sunyani Municipality in recent years has been characterized by an increasing population, at a rate of 3.4% per annum [13]. The rising population has partly resulted in high dependence on fish as a source for animal protein [14]. The increased demand for fish products relies on its nutritional values [15] as well as accessibility and availability due to the daily influxes of various species into markets in Sunyani, which are smoked, frozen, canned, fresh or even salted [15,14]. The high demand for fish increases the cost of fish.

Fish consumption, frequency, and consumer preferences are affected by consumers' geographic, social, and cultural characteristics [4]. Food preferences are also affected by some sensory (taste, smell, and texture) and non-sensory factors (behavior, beliefs, personal characteristics, and risk perception) [16]. There is, however, limited documentation on factors influencing the preference of consumers, despite the high dependence on fish in the Sunyani municipality [15]. Furthermore, there has not been much documentation on consumption patterns and marketing channels, pricing and sources of fish in the Sunyani Municipality.

Few works have focused on marketing channels for smoked freshwater fishes in Ghana by Opoku [15] and the effects of fuelwood on the quality of smoked freshwater fishes [14]. Currently, there has not been much documentation on consumption patterns and marketing channels, pricing and sources of fish concerning the Sunyani Municipality. Given this paucity of information, the research aimed to determine the level of preference for smoked fresh and frozen fish, outline the marketing channels of smoked, fresh and frozen fish to improve consumption and marketing channels of fish in the Sunyani Municipality. This study seeks to outline the consumption and marketing channels of smoked, fresh and frozen fish in the municipality. It also aims to identify fish consumption and distribution channels within the Sunyani municipality, Ghana.

2. METHODOLOGY

2.1 Study Area

The study was conducted in the Sunyani Municipality of the Brong Region of Ghana as shown in Fig. 1. This area was selected based on its importance as a source of fish for the Sunyani populace. Geographically, the municipality lies between latitude 90 24'N and longitude 00 50'W. There are three main market centers within the Sunyani municipality namely, Fiapre and Sunyani markets. These markets operate every day with the designated market days being every six days. All the markets have well-defined areas for the sale of smoked fish

with a few individuals hawking within and around the markets. Fresh or frozen fish sellers own or use cold stores with some dispersed especially along streets and a few found in the houses of individuals. One-third of the total land area is not inhabited or cultivated which provides arable lands for future investment [17]. Nearly one-half of the region's annual aquaculture production in 2010 was from the Sunyani Municipality [18]. According to the 2012 population estimates, 80,245 people reside in the city of Sunyani, with a growth rate in the city of 3.4% per annum. The economy is predominantly agrarian with approximately 48% of the population engaged in agriculture production [19].

2.2 Data Collection

Data collection was done mainly through the use of interview guides using semi-structured questionnaires. Hundred (100) respondents (i.e. 50 fish traders and 50 consumers) were selected randomly to ensure that respondents have an equal chance of being selected. Inclusion criteria for respondents included, i) above 18 years, and ii) more than a year of experience in the fish

trade. The questionnaires were used to collect data on the most preferred form of fish (frozen or smoked) marketing channels and sources of fish. The fish were identified using their external features and with the help of the sellers, especially for smoked fish.

2.3 Data Analysis

The univariate analysis was used to describe the background characteristics of the study sample. This was carried out by statistically tabulating frequencies, percentages and graphs (pie and bar graphs) of the background characteristics of the respondents for both consumers and traders. Bivariate analysis was carried out to examine the relationship or association between the predictor variable (market or sampling location), the predicted variable education, age and marital status. The significance of association was tested using the chi-square test at alpha level 0.05 (95%) confidence level. At the multivariate analysis level, binary logistic regression was applied because the dependent variable is dichotomous which was measured as (Yes for consuming and No for not consuming fishbone).

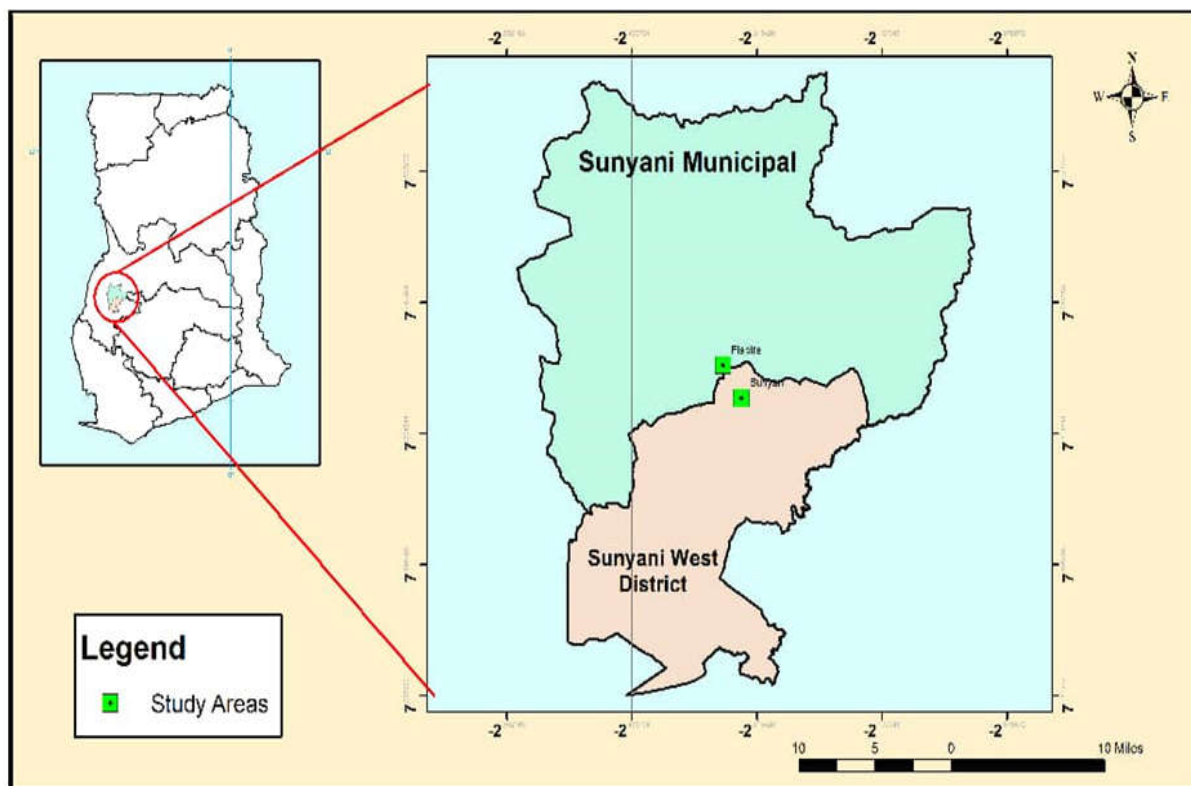


Fig. 1. A map of the study area

For each predictor variable, a reference category, (the first category) was selected from all the available categories. The binary logistic regression was run using the Statistical Package for the Social Sciences (SPSS) software, based on the enter method (entering all the independent variables at the same time).

2.4 Data Limitation

The study was not without constraints. The sample size was small, however, despite this limitation, the selected variables for the study are expected to yield important findings concerning fish consumption and fish distribution pattern in Sunyani Municipality, Ghana.

3. RESULTS AND DISCUSSION

3.1 Fish Consumers

3.1.1 Demographics

The mean age of the respondents from the Sunyani market was approximately thirty-one (31) years, ranging from 13 years to 54 years. For the Fiapre market, the mean age was twenty-four (24) years with both minimum and maximum age as 15 years and 41 years. The sample T-test revealed a significant difference in ages among respondents from Sunyani and Fiapre markets

(Table 2). The mean number of children of the respondents from the Sunyani market was approximately three (3) persons, ranging from 1 to 5 persons. For the Fiapre market, the mean number of children was four (4) persons with both the minimum and the maximum number of children as two (2) and six (6), respectively. The sample T-test did not reveal any significant difference in the number of children among respondents in Sunyani and Fiapre markets (Table 1).

Most of the respondents (36%) indicated that the terminal educational level was Junior High School (JHS), while a minority (8%) indicated that primary as their last level of education. Only 8% of the respondents reported not having a formal education. The Chi-square test did not show a significant difference relating to the market type and the level of education (Table 2). The majority of the respondents (78%) were married while the minority (22%) indicated that not married. Chi-square test did not show significant difference relating to the type of market and marital status of respondents (Table 2). The majority of the respondents (88%) were Akans, predominantly from the Bono, while the minority (1%) were Dagate and Frafras. Chi-square test did not show significant difference relating to the type of market and ethnicity of respondents (Table 2).

Table 1. Descriptive statistics of fish consumers' age and number of children in Sunyani municipality

| Number of children | Market | Mean | SE | Minimum | Maximum | df | p-value |
|--------------------|---------|-------|------|---------|---------|----|---------|
| | Sunyani | 3.16 | 0.7 | 1 | 5 | 11 | 0.39 |
| | Fiapre | 4.00 | 0.6 | 2 | 6 | | |
| Age | Fiapre | 23.97 | 1.47 | 15 | 41 | 54 | <0.001 |
| | Sunyani | 30.53 | 3.58 | 13 | 54 | | |

Table 2. Descriptive statistics of fish consumers' education level, marital status and ethnicity in Sunyani municipality

| Variables | | Sunyani | Fiapre | Total | N | df | X ² | P-value |
|--------------------|----------|------------|------------|----------|----|-------|----------------|---------|
| Level of education | JHS | 3 (20%) | 15 (42.9%) | 18 (36%) | 50 | 4 | 4.233 | 0.375 |
| | None | 2 (13.3%) | 2 (5.7%) | 4 (8%) | | | | |
| | Primary | 2 (13.3%) | 2 (5.7%) | 4 (8%) | | | | |
| | SHS | 3 (20%) | 3 (8.6%) | 6 (12%) | | | | |
| | Tertiary | 5 (33.3%) | 13 (37.1%) | 18 (36%) | | | | |
| Marital status | Single | 11 (73.3%) | 28 (80%) | 39 (78%) | 1 | 0.272 | 0.602 | |
| | Married | 4 (26.7%) | 7 (20%) | 11 (22%) | | | | |
| Ethnicity | Akan | 14(93.3%) | 30 (85.7%) | 44 (88%) | 3 | 4.545 | 0.208 | |
| | Ga | 0 | 4 (11.4%) | 4 (8%) | | | | |
| | Dagate | 1 (6.7%) | 0 | 1 (2%) | | | | |
| | Frafra | 0 | 1 (2.9%) | 1 (2%) | | | | |

3.1.2 Fish consumption pattern

3.1.2.1 Fishbone consumption

The majority of the respondents (72%) affirmed consuming fishbones while the minority (28%) indicated that they do not consume fishbone. The Chi-square test did not show a significant difference relating to the type of market and the consumption of fishbone among respondents (Table 3). The consumption of fishbone was due to the nutritional value of fishbone. Fishbone is known to provide calcium to the body, essential for the formation of robust bones. Nonetheless, some respondents opposed the consumption of fishbone because fishbones tend to choke them when swallowed.

3.1.2.2 Section of fish consumed (head, middle & caudal section of fish)

The majority of the respondents (54%) preferred taking the mid-section of fish products, while a minority (2%) consumed both the middle and caudal parts of fish products. The preference for the middle and caudal sections of fish among most respondents is attributable to the quantity of flesh on the various parts of the fish (head, mid and caudal). Nutrients such as vitamin D, iron and Zinc are abundant in the mid-section of fish, while the caudal section has an abundance of iodine, protein, selenium, phosphorus and vitamin B₁₂. Therefore, consuming both the mid and caudal parts of the fish products increases the quantity of these nutrients. Only 12% of the respondents ingest only the head section of fish.

This form of consumption increases the number of nutrients. These nutrients include vitamin, calcium and omega-3 fatty acids. However, only 5% of the respondents reported that they consume all the sections of fish products (head, mid and caudal). Hence masticating all the portions of fish products increases the quantity of all the micronutrients present in fish. The Chi-square test revealed a significant difference regarding the section of fish products consumed (Table 4).

3.1.2.3 Small fish consumed wholly

The majority of the respondents (58%) affirmed consuming small fish wholly while the minority (42%) indicated that they do not consume small fish entirely (with the head inclusive). The Chi-square test did not show a significant difference in the consumption of small fish wholly among respondents (Table 5). The decision not to consume small fish entirely was based on the presence of dirt or sand particles in the fish head during processing. Also, the kind of dish and the age of the household members contribute to the consumption of small fish. Most households tend to remove the head before using it in preparing any dish. Also, for children below one (1) year, preparation of fish diets is done without the head portion. However, removing the heads of fish before consuming has negative implications on the health of consumers. For instance, removing the head makes consumers vulnerable to vitamin D, iron and zinc-deficient diseases. Therefore, there is a need to create awareness on the importance of consuming fish entirely.

Table 3. Consumption of fishbone among respondents

| Type of market | Sunyani | Fiapre | Total |
|----------------|-----------|------------|-----------|
| Yes | 8 (53.3%) | 28 (80.0%) | 36 (72%) |
| No | 7 (46.7%) | 7 (20.0%) | 14 (28%) |
| Total | 15 (100%) | 35 (100%) | 50 (100%) |

($\chi^2 = 3.704$, $df = 1$, $N = 50$ p -value = 0.054)

Table 4. Section of fish consumed among respondents

| Part consumed | Sunyani | Fiapre | Total |
|----------------------------|-----------|------------|-----------|
| Head | 1 (6.7%) | 5 (14.3%) | 6 (12%) |
| Mid | 5 (33.3%) | 22 (62.9%) | 27 (54%) |
| Caudal | 3 (20%) | 3 (8.6%) | 6 (12%) |
| All (Head, Mid and Caudal) | 4 (26.7%) | 1 (2.9%) | 5 (10%) |
| Head and mid | 1 (6.7%) | 4 (11.4%) | 5 (10%) |
| Mid and Caudal | 1 (6.7%) | 0 (0.0%) | 1 (2%) |
| Total | 15 (100%) | 35 (100%) | 50 (100%) |

($\chi^2 = 11.869$, $df = 5$, $N = 50$ p -value = 0.037)

Table 5. Consumption of small fish wholly (i.e. with the head) among respondents

| Small fish consumed wholly | Sunyani | Fiapre | Total |
|----------------------------|-----------|-----------|-----------|
| Yes | 8 (53.3%) | 21 (60%) | 29 (58%) |
| No | 7 (46.7%) | 14 (40%) | 21 (42%) |
| Total | 15 (100%) | 35 (100%) | 50 (100%) |

$$(X^2 = 0.192, df = 1, N = 50 \text{ p-value} = 0.662)$$

3.1.2.4 Size of fish consumed

The majority of the respondents (54%) reported that they consume both small and large-sized fish products, while a minority (7%) indicated that they consume small-fish products. Chi-square test did not show any significant difference regarding the size of fish products (small, big or both) consumed by respondents (Table 6). The consumption of either small or big sized fish or both relies on many factors. These factors include the amount of flesh on the fish, the economic power, the type of dish and the wholesomeness of fish when used in cooking. Some respondents indicated that small fish when used in cooking 'loses its wholesomeness hence the reason for preferring big sized fishes. The kind of dish also influences the size of the fish used. For instance, the preparation of local dishes like sauce mostly involved the use of small-sized fish species.

3.1.2.5 Fish species

The number of fishes encountered from the current study was eleven (11). These fishes consisted of three (3) freshwater species and seven (8) marine species (Fig. 2). The number of fish types obtained in the current study was far lower than reported by Alhassan et al. [20]. Probably due to distance to the source of fish, leading to the limited choices of fish types by consumers in the Sunyani Municipality. *Scomber japonicus* was the most consumed finfish species (17%) in the Municipality, whereas *Sierathrissa leonensis*, *Trichurus lepturus* and *Sphyraena sphyraena* were the least consumed fish species (6%), as shown in Fig. 2. The consumption of certain fish species may be linked to factors such

as taste, appearance and perceived health benefits. [21] found that health-related concerns (fish is healthy, meat is unsafe) are significantly associated with fish consumption. [22] also documented that the preferences for the type of fish species rely on the taste and other socio-economic factors. Surprisingly, *Engraulis encrasicolus* was not the most consumed fish species in the Municipality, despite its low price. This observation buttresses the fact that fish consumption does not depend on the price or size alone but on other socio-economic factors.

3.1.2.6 Fish products consumed

From Fig. 3, smoked fish was the most preferred form of fish products (41.0%), with dried fish as the least form of fish product consumed (12.0%). The preference for smoked fish products may be due to the long shelf life of smoked fish products, especially considering the distance from the processing centers to consumer markets. Other potential influencing factors for smoked fish products was the flavor, taste and wholesomeness in stews and soups. Reasons identified for the consumption of smoked fish products conformed to findings by Alhassan et al. [20] and [23].

Also, the cost is known to be an essential factor in choosing a particular fish product by consumers. For instance, smoked fish products were reported to be priced higher compared to salted, fried and dried fish products. Such a high cost may be a result of the additional operational cost incurred during smoking (fuelwood and labour). Hence, consumers with relatively higher purchasing power may opt for smoked fish products.

Table 6. Size of fish consumed among respondents

| Fish size | Sunyani | Fiapre | Total |
|-----------|-----------|-----------|----------|
| Big | 8 (53.3%) | 8 (22.9%) | 16 (32%) |
| Small | 1 (6.7%) | 6 (17.1%) | 7 (14%) |
| Both | 6(40%) | 21 (60%) | 27 (54%) |
| Total | 15 (100%) | 35(100%) | 50(100%) |

$$(X^2 = 4.649, df = 2, N = 50 \text{ p-value} = 0.098)$$

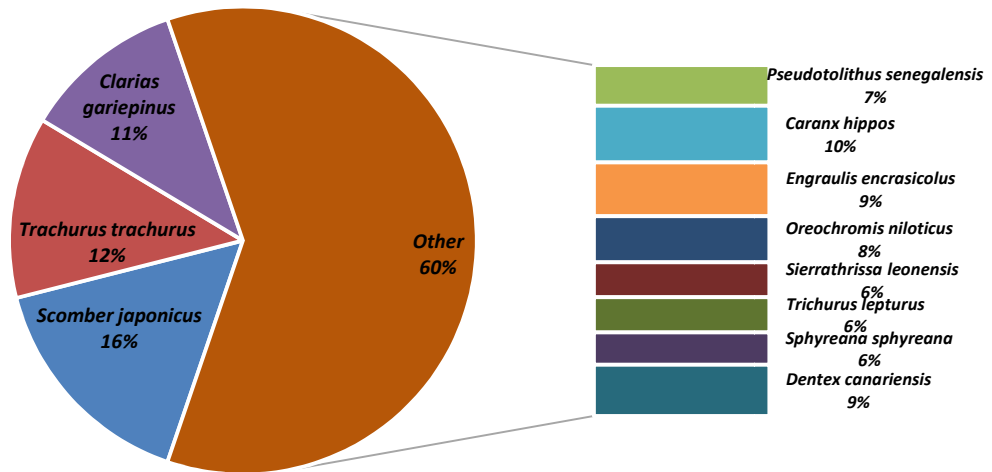


Fig. 2. Species consumed

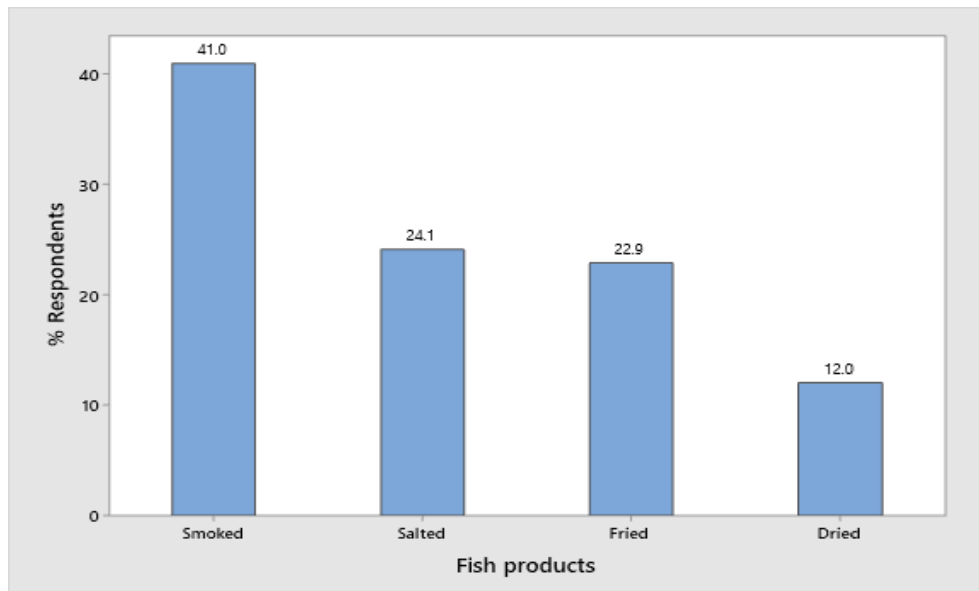


Fig. 3. Processed form of fish products consumed

3.1.3 Binary logistic regression model

From Table 7, the odds ratio indicated that respondents without education are more likely to consume fishbone. Most educated consumers prefer to consume more of the fleshy part of the fish than the bone and are also more conscious of the fact the fishbone could choke them as well as they can obtain calcium from other supplementary sources. However, for the uneducated consumers, the fishbone could be their only source of calcium as they lack the financial ability to get a calcium supplement from other sources. Also, respondents with ages less

than 20 years were less likely to consume fishbone. The less likelihood of consuming fishbone among respondents less than 20 years may be as a result of the perceived choking characteristics of fishbone. However, for the respondents above 20 years, the need for robust bones and the ability to overcome the perception that fishbone may choke them when swallowed could be a reason for the high likelihood of consuming fishbone. Respondents who are less likely to consume fishbone may be vulnerable to calcium-deficient diseases, especially when there are no other sources of calcium for the human system.

Table 7. BLRM for consumption of fishbone among respondents

| Indicators | B | S.E. | Wald | Df | Sig. | Exp(B) | 95% C.I. for EXP(B) | |
|---------------|--------|-------|-------|----|-------|--------|---------------------|--------|
| | | | | | | | Lower | Upper |
| Age range (1) | -0.094 | 0.656 | 0.02 | 1 | 0.887 | 0.911 | 0.252 | 3.297 |
| Education (1) | 0.118 | 1.25 | 0.009 | 1 | 0.925 | 1.125 | 0.097 | 13.036 |
| Constant | 0.981 | 0.479 | 4.198 | 1 | 0.04 | 2.667 | | |

Model: $\text{Log}(p/1-p) = 0.981 + 0.118 (\text{Education}) - 0.094 (\text{Age range})$

3.2 Fish Traders

3.2.1 Demographic

Table 8 shows the summary of the respondents' demographic characteristics. Most of the respondents (58%) were between 31 and 50 years, while only 8% above 60 years (Table 8). Concerning education, the results showed that the majority of the respondents had some form of formal education, with few having no formal education (Table 8). For those having a formal education, most of the respondents had senior high school (SHS) education, while few had tertiary education (Table 8). The majority (42%) of the respondents were married while the minority (10%) were widows (Table 8). There was no significant difference between the age groups. The majority (43%) of the respondents having a household size of 4-6 persons and only 8% of the respondents had a household size of 10 and above. The Chi-square test did not reveal

any significant difference for the variables used in the demographic study between Fiapre and Sunyani markets (Table 8).

3.2.2 Fish source

The current study revealed that fish traders in the Sunyani municipality obtain fish from four main market outlets, namely Sunyani, Yeji, Cape Coast, Techiman, and Buipe (Fig. 4). The majority of fish traders within the Sunyani Municipality (60%) obtain fish products from Sunyani markets whereas, a minority of the fish traders (4%) source their fish products from Cape Coast and Buipe markets (Fig. 4). From the study, most of the traders sourced their fish products from Sunyani due to a myriad of factors. For instance, most of the fish traders within the Municipality are not economically empowered, hence the inability to finance operational expenses to the processing areas such as Cape Coast or Yeji for fish and fish products.

Table 8. Frequency table showing the demographics of respondents

| Variables | | Fiapre | | Sunyani | | Total | | Chi-square p-value |
|--------------------------|--------------|--------|-------|---------|-------|--------|-----|--------------------|
| | | Number | % | Number | % | Number | % | |
| Age (years) | 18-30 | 3 | 37.5 | 5 | 62.5 | 8 | 100 | 10.859 (0.210) |
| | 31-40 | 4 | 23.5 | 13 | 76.5 | 17 | 100 | |
| | 41-50 | 5 | 27.8 | 13 | 72.2 | 18 | 100 | |
| | 51-60 | 0 | 0.0 | 4 | 100 | 4 | 100 | |
| | 60+ | 3 | 100.0 | 0 | 0.0 | 3 | 100 | |
| Marital status | Married | 8 | 26.7 | 22 | 73.3 | 30 | 100 | 4.837 (0.565) |
| | Single | 3 | 37.5 | 5 | 62.5 | 8 | 100 | |
| | Divorce | 1 | 14.3 | 6 | 85.7 | 7 | 100 | |
| | Widow | 3 | 60.0 | 2 | 40.0 | 5 | 100 | |
| Household size (persons) | 1-3 | 3 | 37.5 | 5 | 62.5 | 8 | 100 | 4.927 (0.553) |
| | 4-6 | 4 | 18.2 | 18 | 81.8 | 22 | 100 | |
| | 7-9 | 6 | 40.0 | 9 | 60.0 | 15 | 100 | |
| | 10+ | 2 | 40.0 | 3 | 60.0 | 5 | 100 | |
| Education | No schooling | 5 | 45.5 | 6 | 54.5 | 11 | 100 | 13.194 (0.105) |
| | Primary | 1 | 12.5 | 7 | 87.5 | 8 | 100 | |
| | JHS | 5 | 38.5 | 8 | 61.5 | 13 | 100 | |
| | SHS | 4 | 25.0 | 12 | 75.0 | 16 | 100 | |
| | Tertiary | 0 | 0.0 | 2 | 100.0 | 2 | 100 | |

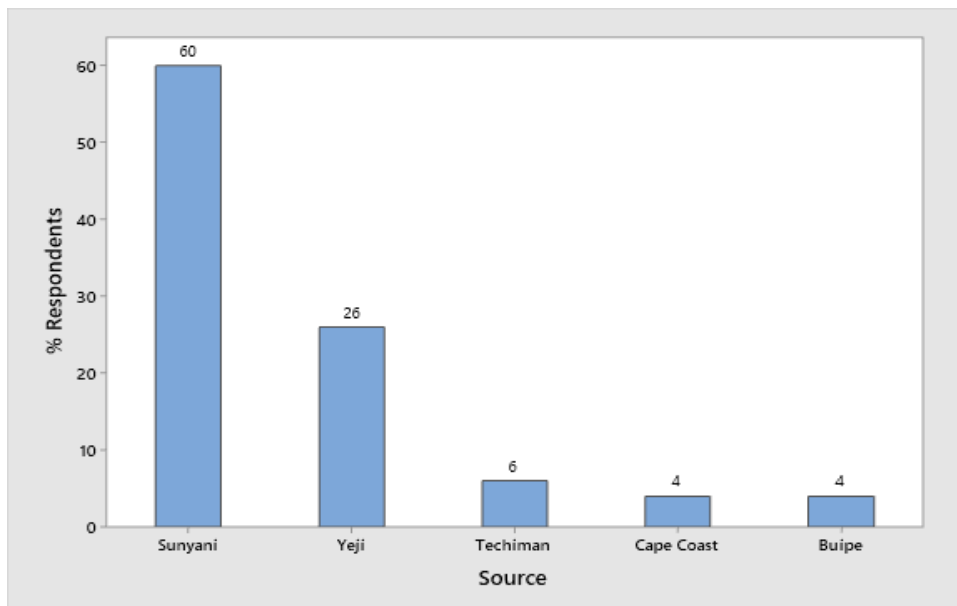


Fig. 4. Source of fish products for fish traders within Sunyani municipality

3.2.3 Preservation strategies

Fig. 5 shows preservation methods for unsold fish products by fish traders in the Sunyani municipality to preserve them for the next day. From Fig. 5, most of the traders (44%) refrigerate unsold fish products for the next day. However, 20% of them prefer to keep the fish products in baskets lined with brown paper for the next day (Fig. 5). Fish products at the various markets are not entirely sold out mostly because of the volume or quantity brought to the market. As a result, most of the traders employ two main

methods – keeping them in baskets lined with papers or refrigerating and re-smoking. Mostly properly smoked-dried fish products are preferably stored in baskets lined with paper. Such products are unsusceptible to spoilage because the moisture content is below the level for fungal infestation. For traders engaged in the trade of smoked mackerels, the preferred preservation method was refrigerating and re-smoking for the next day, which is because the oil content makes it vulnerable to spoilage hence the need to keep in refrigerators and smoke the next day for trading activities.

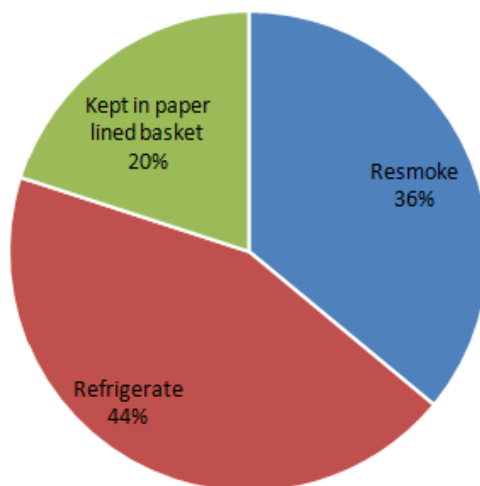


Fig. 5. Preservation methods of unsold fish products

3.2.4 Fish distribution channels in the municipality

Fig. 6 shows the marketing channels of fish from the fisherman to the final consumer in the Sunyani municipality for both smoked and frozen fish. The most prominent marketing channel for smoked fish was that linking the fishermen, fishmongers and the consumers while, for frozen fish products, it was between the fishermen, wholesalers, retailers and consumers. The most prominent marketing channel of fish observed in this study was between the wholesalers, retailers and consumers, which is in line with the findings by Alhassan et al. [20]. They reported that fish and fish products pass through direct or indirect media before reaching the final consumer. The channel of marketing of fish observed in this study was slightly complicated because they have to deal with a chain of operatives from the source through various market outlets before reaching the consumer. Findings by Engler [24] affirmed the observation from the current study. He documented that the route by which seafood gets to the consumer may be direct or highly complicated with a variety of exchanges. Most individual consumers, restaurants, chop bars, and other food vendors purchase frozen fish within the Sunyani Municipality directly from the nearby wholesalers. Potentially due to the lower price compared to that of retailers. To buttress this finding, Slack et al. [25] documented that wholesale cold-stores sell at lower prices to attract more customers than retail cold-stores.

3.3 Challenges in Fish Consumption and Distribution

Table 9 presents the challenges facing fish consumers within the Sunyani municipality, namely shortage of fish, distance to wholesalers, fish spoilage and high fish price. Dominant

among these challenges was the shortage of fish (28%), with the least being fish spoilage (20%). From the study, the rate of fish consumption among consumers was affected by factors such as shortage of fish, distance to wholesalers, fish spoilage and high fish price. [26] reported that the consumption of fish becomes less when the price is above the economic power of consumers. [27] put forward that fish consumption frequency is affected by some factors such as household income, preference, price, safety, and favourable fish species. Some authors reported that the cost of fish is the most imperative factor for fish consumption [28]. Therefore, it implies that the high price of fish in conjunction with the low economic power of consumers hinders the consumption of fish and fish products. Also, the shortage of fish for consumption could be attributed to already declining fish stocks in Ghana's coastal and inland waters.

From Table 9, the four (4) main challenges identified among fish traders in the Sunyani Municipality included unstable pricing, power fluctuations, low fish demand and spoilage of fish with, the dominant problem being fluctuating pricing from the source of purchase (49% respondents). For respondents engaged in the trading of fish products, the most reported challenge in fish marketing was the unstable fish price, potentially due to the irregular availability of fish to wholesalers. Power fluctuation as a challenge to fish marketers could be due to the already existing 'dumsor' in Ghana, which is known to facilitate spoilage of frozen fish products. The possible reason for the low rate of demand for fish products was the high preference for red animal protein. The relatively high interest in red animal protein mostly occurs when consumers gain enough economic power.

Table 9. Problems faced by fish consumers and traders in the Sunyani municipality

| Respondents | Problems | Number | % |
|-------------|-------------------------|--------|-----|
| Consumers | Shortage of fish | 20 | 28% |
| | Distance to wholesalers | 18 | 26% |
| | High fish price | 18 | 26% |
| | Fish spoilage | 14 | 20% |
| Traders | Unstable pricing | 19 | 49% |
| | Power fluctuations | 9 | 23% |
| | Low fish demand | 6 | 15% |
| | Spoilage of fish | 5 | 13% |

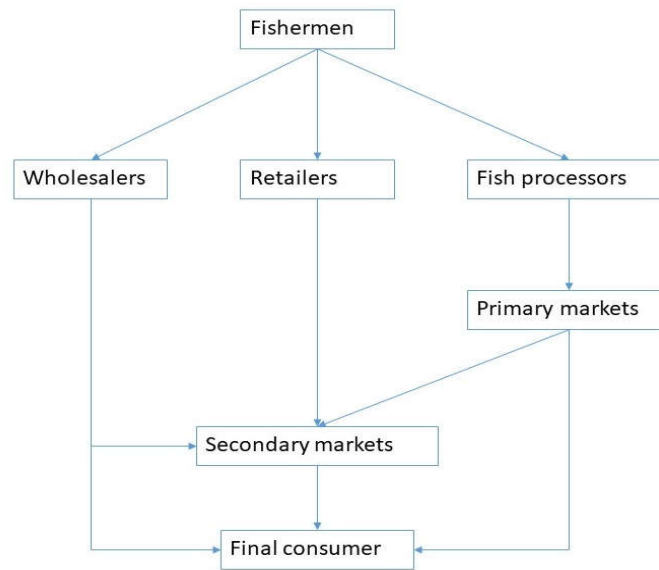


Fig. 6. Fish distribution channels in Sunyani municipality

4. CONCLUSION

The majority of the consumers in the municipality preferred smoked fish products to other fish products. The most consumed fish species in the municipality were *Scomber japonicus*, *Trachurus trachurus* and *Clarias gariepinus*. The shift from low to relatively high economic class affects the rate of fish consumption among respondents. The distribution channel of fish products in the Sunyani Municipality involved the fisherman, wholesalers, retailers and consumers that occur at both the primary and secondary markets. The main challenges faced in the distribution and marketing of fish within the Sunyani Municipality included unstable pricing and power fluctuations.

CONSENT

As per international standard or university standard guideline, participant consent has been collected and preserved by the authors. Interviews were done face to face with information recorded on audio recorders with the consent of respondents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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