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## Perceived consumer preferences of fisheries products retailed in Kenyan markets

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Fish consumption in Africa is still low below the FAO recommended levels due to low production of fish compared to China and other Asian countries and Europe. The consumer food purchasing behavior is also highly affected by the low disposable income which makes fish products relatively expensive compared to other food products. This study was conducted to investigate consumers' preferences and perceptions of fishery products sold in Kenyan markets and the associated factors. Face-to-face interviews were conducted to collect data from 120 respondents in three counties. Majority of the consumers reported buying fish at least once per month. Tilapia and African catfish were the most consumed fish species in the counties while the most preferred source of fish was Lake Victoria followed by farmed fish. Education levels and age of the respondents did not significantly affect fish consumption. The fish consumers had diverse perceptions and preferences towards purchase and consumption of fish driven by different factors. Fish nutritional value, affordability and health concerns were ranked as the major factors that influenced fish consumers' purchasing behaviors. Fish consumption levels were significantly and positively correlated with the increase in households' monthly income and the number of individuals per household. The logit model also revealed that an increase in fish prices reduced the likelihood of respondents to consume fish. The study recommended the need for the appropriate authorities, policymakers and other stakeholders to monitor fish quality, market price, availability and health safety to promote consumer perception and preferences.

**Keywords:** Fish and fish products, consumer preference, Logit model

### INTRODUCTION

The world annual food fish consumption has increased at a rate (1.5%) significantly outpacing the world population growth (1.7%) (FAO, 2020). In Kenya, the fisheries sector plays an important role in the national economy contributing about 0.5% to the GDP (KNBS, 2020). Fish and fishery products are high in protein and essential minerals in the human diet (Mohanty et al. 2019)

and therefore the demand for food fish is expected to increase. Previous studies on fish source preferences have indicated a preference to capture fisheries than aquaculture products with consumers viewing farmed fish as fish of low quality and unsafe for human consumption (Meas and Hu, 2014). Given this, the future preference of fish and fishery products especially in the developing countries would be determined by

quality assurance, food safety, freshness, diversity and convenience (FAO, 2012).

Demand for aquaculture food fish products is increasing due to rapid population growth, increased awareness of the health benefits of fish consumption, changes in lifestyles and consumer preferences and the declining catches from capture fisheries (Githukia et al. 2014; Clavelle et al. 2019; FAO, 2020). The main freshwater fish species available in the markets for consumption include Nile tilapia (*Oreochromis niloticus*), African catfish (*Clarias gariepinus*), Omena (*Rastrineobola argentea*) and Nile perch (*Lates niloticus*). Tilapia and African catfish are the main cultured species in the country with the supply of the other fish species coming from inland capture fisheries. Owing to its high perishability and shorter shelf life, fresh fish is of little significance in the international trade (Pradhan et al. 2019). The ever increasing demand for fish products that have a longer shelf life cater for consumer taste and diversity of products has placed pressure on fish value addition (FAO, 2012).

According to Polanco and Luna (2010), fish preferences and purchasing behaviors of consumers are influenced by different attributes of food purchasing such as cultural beliefs, psychology, lifestyles, culinary trends and diet restrictions. Socio-demographic characteristics of respondents such as age, sex, marital status, family size, income levels and household size are explanatory variables in previous fish preferences and market research. Studies carried out by Yoo et al. (2019) have indicated that attitude affects the choice of a given product, quantity and quality. Recent studies have further brought in other attributes influencing consumer purchasing decisions for fish and fishery value-added products such as the product form, package size, method of cooking, price, smell, appearance, taste, size, quality, color, nutritional value, availability and the source of fish (Kyule et al. 2016).

Kenya is endowed with several freshwater lakes, rivers, dams and the Ocean that produce fish and a suitable climate for farmed fish production. However, despite the diverse sources of fish in the country, fish consumption has remained far much below 4.1 kg per capita in 2018 compared with global fish consumption, which is nearing 20 kg per capita (Obiero et al. 2019; Poblete et al. 2019). To promote maximum utilization of fishery products, it is important to study the patterns of fish consumption in the

region and factors that affect its consumption. Therefore, this study aimed at assessing the status of fish consumption in Kenya, investigating the factors influencing fish consumers' purchasing behavior and examining the interrelationships between consumer preferences and their socioeconomic characteristics.

## MATERIALS AND METHODS

The study was conducted in three Kenya Counties namely Machakos, Tharaka Nithi and Laikipia. The study areas were selected because aquaculture production has borne huge benefits besides the fact that the inhabitants are not historically fish-eating communities. A total of 120 respondents were interviewed based on random sampling technique. The survey used a structured five-point Likert scale questionnaire with scales ranging from 1 = *not preferred* to 5 = *most preferred*, to collect the data. Prior to the main survey, the questionnaire was pretested with 8 respondents in the three counties in order to test various aspects of the survey such as data collection instrument, methodology and field logistics. The questionnaire was administered to randomly selected consumers from the fish markets. Among the information collected included socio-demographic variables such as age, sex, occupation, income, education level, family size, and marital status since they are perceived to influence preferences for fish and fish products. The secondary data was obtained from sources such as handouts, scientific reports and publications which were used to compare the study findings.

### Data analysis

Data analysis comprised the combination of descriptive (means, percentages, sum, figures) and inferential statistics. The data strength, appropriateness and validity were tested using statistical inferences of multicollinearity, autocorrelation and normality in IDM SPSS (Version 22.0). Likert scale (from 1 = *not preferred* to 5 = *most preferred*) was used to evaluate consumer perception for the factors affecting fish preference and consumption (Uddin et al. 2019). Each response was assigned a weight from 1, 2, 3, 4, and 5 respectively. The 5-point scale was summed to obtain Total Weighted Score (TWS) for each factor while the Weighted Average Score (WAS) was computed by dividing TWS with a total number of samples. The following formula was used to determine the Likert scale rank for each factor:

$$\text{WAS} = \frac{\text{TWS}(5 \times \text{MP}) + (4 \times \text{P}) + (3 \times \text{N}) + (2 \times \text{LP}) + (1 \times \text{NP})}{\text{Total Number of respondents}}$$

Where;

WAS = Weighted Average Score

TWS = Total Weighted Score

N = Neutral

NP = Not preferred

MP = Most preferred

P = Preferred

LP = Least preferred

During the study, the logit model was used to determine factors that affect consumer perception and preference for fish and fish products. The logit model was carried out in R Studio version 3.6 software. The value 1 was assigned as a dependent variable if the consumer preferred fish and fish products and 0 if otherwise. The Logit model was carried out as described by Gujerati, (2009).

$$P_i = \text{Ln} \left( \frac{P_i}{1 - P_i} \right) = X_i \beta$$

Where:  $\beta$  refers to coefficients vector,  $X_i$  denotes independent variable vectors while  $P_i$  represent the coefficients for logarithmic rate to fish preference.

Besides, the logit model was used to estimate key determinants' marginal probabilities of consumer perception and preferences in purchasing fish and fish products based on expressions from marginal effect. The model for marginal effects was computed as follows;

$$dZ/dX = \beta_i \{P_i (1 - P_i)\}$$

Where;

Where;

$dZ/dX$  = slope of the function or differentials where  $ds$  is the rise and  $dx$  is the run.

$\beta_i$  = regression coefficient of estimated logit in relation to the  $i$ th factor of fish preference.

$P_i$  = Consumer preference estimated probability.

## RESULTS

### Social-demographic characteristics of the consumers

The social-demographic status of the sampled consumers is represented in Table 1. Majority of the respondents (57%) were females while 43% were males. In terms of age group, the age group 26-35 years represented the highest percentage (37%) of the respondents followed by 35% representing the age group of 36-60 (Table 1). Respondents in the survey had different levels of monthly income. The highest percentage of the

respondents earned a maximum of Kshs. 10,000 (65%) while the lowest percentage of the consumers (2%), earned a monthly income of Kshs. 40,001-50,000 (Table 1). Majority of the consumers were engaged in business and farming as a source of livelihood followed by those in employment (27%, 27% and 23% respectively).

### Frequency of fish consumption per household

All of the respondents from Machakos, Tharaka Nithi and Laikipia counties stated that fish formed part of their diets. 45% of the respondents stated that they consumed fish once per week although none consumed fish daily. The respondents who consumed fish once per two weeks and once per month stood at 25% and 17% respectively. Those who consumed fish periodically stood at 8%. (Figure 1).

### Fish preference by species

In Kenya, there are common fish species consumed by the population with most of them being from wild sources and a fraction from cultured systems. This is especially so for tilapia and the African catfish. Tilapia was the most dominant fish consumed by the majority of consumers across the three counties standing at 93%. The African Catfish was the second most preferred type of fish consumed by the respondents (62%). Omena and Labeo were least preferred and only a small percentage reported to purchase them (Figure 1). Based on the Venn diagram, Tilapia was present in all the three counties involved in the study (Figure 2).

### Source of fish consumed in the counties

About 42% of fish consumers purchased fish from the local market places, 23% of the consumers bought fish from the fish shops, 17% obtained their fish supply from the supermarkets while 10% acquired fish from door-to-door fish sellers (Figure 1)

### Preference for value-added products

Preference of value-added fish products varied among the consumers. Fish fillets were the most preferred fish products by majority of the consumers followed by fish samosas and fish balls were also prominent among the consumers while the least preferred fish product was fish fingers (Figure 1). Majority of the respondents (59%) preferred medium to big size whole fish, about 35% of the respondents preferred fresh fish fillets, and a few respondents (3.3%) preferred

the fish cut into pieces (Table 2).

#### Effect of social demographic factors on consumer preferences on fish consumption

The data revealed significant relationships between biophysical factors and factors associated with consumer fish perception. For instance, there was strong positive correlation between family size and the amount of money spent on fish per month ( $\rho = 0.633$ ,  $p < 0.05$ ,  $n = 120$ ) and also monthly household income and average fish quantity consumed per month ( $\rho = 0.703$ ,  $p < 0.05$ ,  $n = 110$ ). Increase in monthly household income levels had a significant positive influence on education ( $\rho = 0.555$ ,  $p < 0.05$ ,  $n = 120$ ). However, some factors such as the age of the respondents had no significant effect on fish preferences among the consumers (Table 3).

#### Factors affecting consumer preference on fish consumption

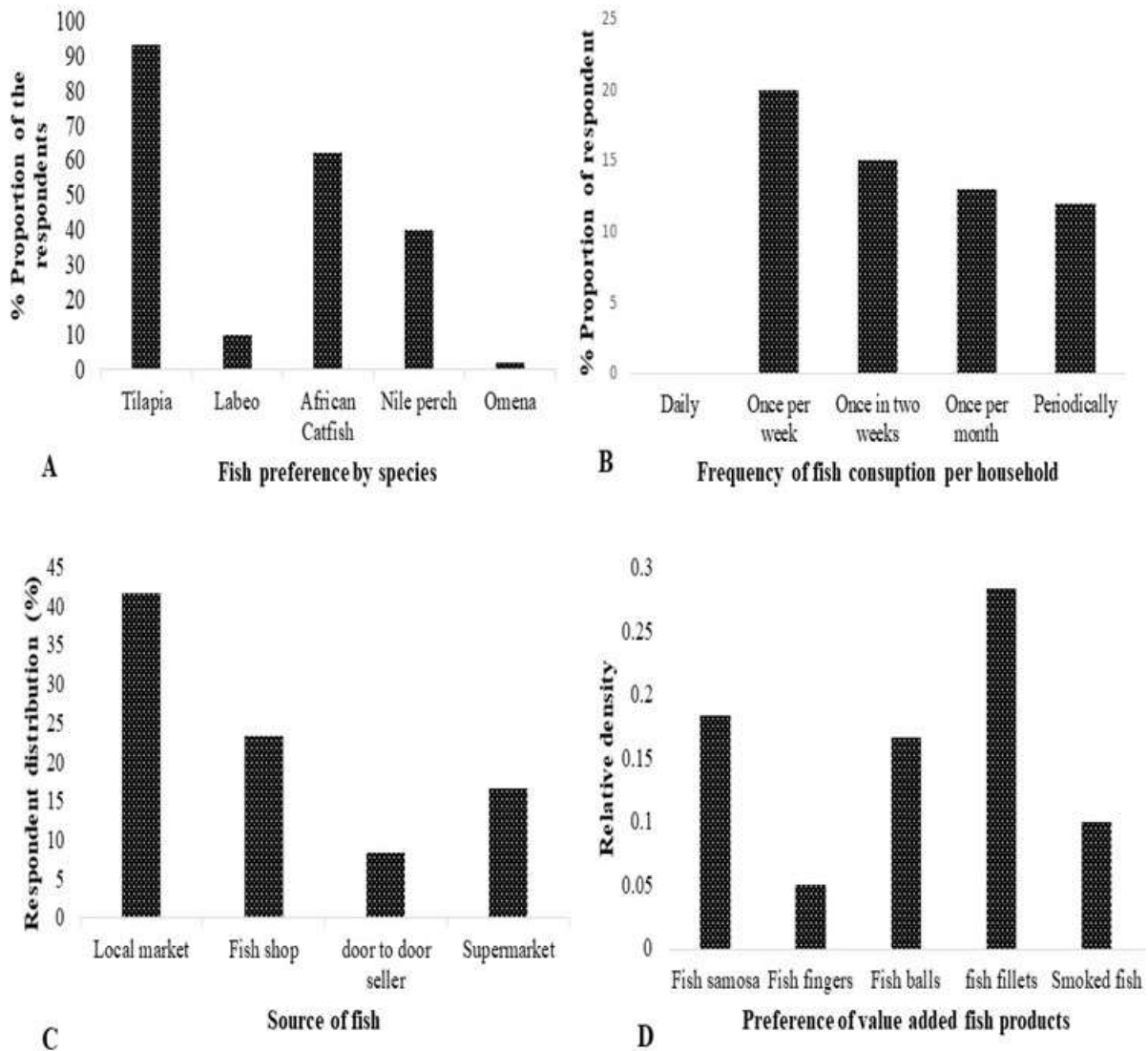
A 5-point Likert scale that is a psychometric response scale ranked different factors based on consumer preference (Table 4). Nutrition was ranked as the most important factor influencing fish consumer preference. Other factors such as taste, health concerns, and price were also ranked as the major factors influencing consumer preference. On the other hand, the fish appearance was the least ranked factor in influencing fish consumption. Source of fish, size and form of fish were also ranked as the least factors influencing consumer preferences (Table 4).

**Table 1: Social-demographic characteristics of the study population**

| Social Demographic characteristic          |                     | N=120 | %  |
|--|---------------------|-------|----|
| Gender                                     | Male                | 52    | 43 |
|  | Female              | 68    | 57 |
| Marital status                             | Single              | 32    | 27 |
|  | Married             | 86    | 72 |
|  | Widowed             | 2     | 1  |
|  | Divorced            | 0     | 0  |
| Education Level                            | No formal education | 4     | 3  |
|  | Primary             | 30    | 25 |
|  | Secondary           | 34    | 28 |
|  | Diploma             | 34    | 28 |
|  | Degree              | 16    | 13 |
|  | Postgraduate        | 2     | 2  |
| Occupation                                 | Farmer              | 32    | 27 |
|  | Business            | 32    | 27 |
|  | Employed            | 28    | 23 |
|  | Casual Laborer      | 16    | 13 |
|  | Student             | 12    | 10 |
| No of household members                    | 1                   | 22    | 18 |
|  | 2                   | 14    | 12 |
|  | 3-4                 | 52    | 43 |
|  | 5 and above         | 32    | 27 |
| Monthly Household income (Kenya shillings) | 0-10000             | 78    | 65 |
|  | 10001-20000         | 22    | 18 |
|  | 20001-30000         | 8     | 7  |
|  | 30001-40000         | 10    | 8  |
|  | 40001-50000         | 2     | 2  |
| Age (years)                                | 18-25               | 20    | 17 |
|  | 26-35               | 44    | 37 |
|  | 36-60               | 42    | 35 |
|  | Above 60            | 14    | 12 |

**Table 2: Size preference by consumers**

| Preferred Size              |                 |           |         |
|-----------------------------|-----------------|-----------|---------|
|                             |                 | Responses |         |
|                             |                 | N         | Percent |
| Preferred Size <sup>a</sup> | Big size        | 28        | 30.8%   |
|                             | Medium size     | 25        | 27.5%   |
|                             | Small size      | 3         | 3.3%    |
|                             | Fresh fillets   | 32        | 35.2%   |
|                             | Cut into Pieces | 3         | 3.3%    |
| Total                       |                 | 91        | 100.0%  |



**Figure 1: Fish consumption patterns. A, type of fish preferred by the consumers; B, frequency of fish consumption per household; C, source of fish consumed in the households; D, type of value-added fish preferred by the consumers.**

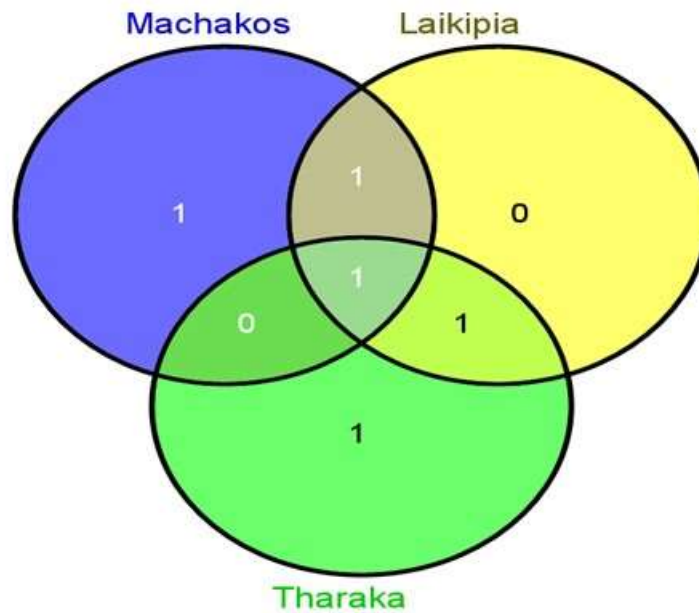


Figure 2: Venn diagram showing the distribution of fish species among the consumers in the three regions. The Venn diagram numerals denote the number of fish species distributed across the counties. Tharaka = Tharaka-Nithi

Table 3: Spearman's correlation coefficient (R) for factors affecting fish consumption

|                                     |      | Age of respondent | Education level | Average quantity consumed per month | how much spent on fish per month | Monthly household income | Regular Fish consumption | Family size |
|-------------------------------------|------|-------------------|-----------------|-------------------------------------|----------------------------------|--------------------------|--------------------------|-------------|
| Age of respondent                   | rho  | 1                 |                 |                                     |                                  |                          |                          |             |
|                                     | Sig. |                   |                 |                                     |                                  |                          |                          |             |
|                                     | N    | 120               |                 |                                     |                                  |                          |                          |             |
| Education level                     | rho  | -.495**           | 1               |                                     |                                  |                          |                          |             |
|                                     | Sig. | .000              |                 |                                     |                                  |                          |                          |             |
|                                     | N    | 120               | 120             |                                     |                                  |                          |                          |             |
| Average quantity consumed per month | rho  | .018              | .111            | 1                                   |                                  |                          |                          |             |
|                                     | Sig. | .893              | .400            |                                     |                                  |                          |                          |             |
|                                     | N    | 120               | 120             | 120                                 |                                  |                          |                          |             |
| How much spent on fish per a month  | rho  | .133              | .032            | .244                                | 1                                |                          |                          |             |
|                                     | Sig. | .312              | .810            | .060                                |                                  |                          |                          |             |
|                                     | N    | 120               | 120             | 120                                 | 120                              |                          |                          |             |
| monthly household income            | rho  | -.108             | .555**          | .703**                              | .236                             | 1                        |                          |             |
|                                     | Sig. | .454              | .001            | .000                                | .100                             |                          |                          |             |
|                                     | N    | 110               | 110             | 110                                 | 110                              | 110                      |                          |             |
| Regular fish consumption            | rho  | .022              | -.136           | .198                                | -.053                            | -.118                    | 1                        |             |
|                                     | Sig. | .866              | .301            | .130                                | .689                             | .415                     |                          |             |
|                                     | N    | 120               | 120             | 120                                 | 120                              | 120                      | 120                      |             |
| Family size                         | rho  | .372**            | -.240           | .367**                              | .633**                           | .207                     | .127                     | 1           |
|                                     | Sig. | .003              | .065            | .004                                | .001                             | .150                     | .334                     |             |
|                                     | N    | 120               | 120             | 120                                 | 120                              | 120                      | 120                      | 120         |

\*\* . Correlation is significant at the 0.01 level (2-tailed).  
rho = correlation coefficient

**Table 4: Likert scale indicating factors affecting fish consumer preferences**

| Factors         | MP | P  | N  | LP | NP | TWS | WAS  | Rank |
|-----------------|----|----|----|----|----|-----|------|------|
| Price           | 10 | 18 | 5  | 23 | 4  | 187 | 3.12 | 4    |
| Size            | 6  | 18 | 9  | 5  | 22 | 161 | 2.68 | 7    |
| Form            | 2  | 12 | 24 | 9  | 13 | 159 | 2.51 | 9    |
| Source          | 7  | 11 | 5  | 25 | 12 | 156 | 2.64 | 8    |
| Taste           | 22 | 19 | 7  | 5  | 7  | 224 | 3.73 | 2    |
| Availability    | 8  | 12 | 15 | 7  | 18 | 172 | 2.91 | 6    |
| Nutrition       | 36 | 11 | 6  | 6  | 1  | 255 | 4.25 | 1    |
| Health concerns | 12 | 23 | 17 | 5  | 3  | 216 | 3.6  | 3    |
| Appearance      | 2  | 3  | 6  | 22 | 27 | 111 | 1.85 | 10   |
| Freshness       | 16 | 16 | 10 | 5  | 13 | 185 | 3.01 | 5    |

Key: **WAS** = Weighted Average Score; **TWS**, Total Weighted Score; **N**, Neutral; **NP**, Not preferred; **MP**, Most preferred; **P**, Preferred; **LP**, Least preferred

**Table 5: Coefficient estimates and marginal effects of Logit models**

|                      | Coefficients | STD Error | DZ/DX     | STD Error |
|----------------------|--------------|-----------|-----------|-----------|
| County               | -1.496       | 0.168     | -0.307    | 0.122     |
| Gender               | 1.812        | 0.132     | -0.361*** | 0.015     |
| Form                 | -0.583       | 0.045     | -0.109    | 0.085     |
| Source               | -0.274       | 0.086     | -0.622    | 0.055     |
| Taste                | -0.184       | 0.021     | -0.035    | 0.065     |
| Nutrition            | -0.592       | 0.211     | -0.531    | 0.084     |
| Income               | 0.688***     | 0.016     | 0.433**   | 0.012     |
| Availability         | 0.032        | 0.084     | -0.045    | 0.057     |
| Health               | 0.456        | 0.213     | 0.011     | 0.083     |
| Appearance           | -0.865       | 0.154     | -0.411    | 0.081     |
| Freshness            | 0.385**      | 0.027     | 0.438**   | 0.552     |
| Amount spent on fish | -0.106       | 0.002     | -0.002    | 0.001     |
| Price                | 0.847***     | 0.088     | -0.711*** | 0.046     |
| Size                 | -0.806       | 0.215     | 0.149     | 0.092     |
| Quantity             | 0.988        | 0.184     | -0.447    | 0.034     |
| Family size          | 0.589***     | 0.255     | 0.605***  | 0.053     |
| Education level      | 0.624        | 0.139     | 0.526***  | 0.063     |

Significance codes: 0.001, \*, 0.01, \*\*, 0.05, \*\*\*

DZ/DX, marginal effects coefficients; STD Error, standard error.

### Determinants of consumer perception and preferences

The regression outcomes derived from the marginal effects of different factors were varied. The price of fish had a significant negative effect on fish consumption (Table 5). The family income influenced fish preferences positively based on the marginal effects where families with more income were likely to buy fish. The study also revealed that consumers with higher education levels were more likely to consume fish as compared to consumers with low education or none. The number of household members affected the consumption of fish (61%) with households having more members recording a higher consumption of fish as compared to families with few members (Table 5). Similarly,

fish freshness recorded a significant positive value on the marginal effects of 0.438.

### DISCUSSION

The demand for food fish in Kenya is 181, 227 tonnes whereas fish production is at 146,543 tonnes creating a demand supply gap. The deficit is accounted for by imports from Uganda, Tanzania, China and other Asian countries (Awuor et al., 2019; KNBS, 2020). Kenya can export 70,000 metric tons of fish implying that the bulk of the fish is sold and consumed locally. From this study, the most preferred fish species were Tilapia, Nile perch and African Catfish and according to Ngwili et al. (2015), these are the most dominant fish species consumed in Kenya. Tilapia has been shown to contribute a higher

share of the fish market supply accounting to 70% as compared to the African catfish at 21% (Kyule et al. 2016). The higher consumption of tilapia from this study could be linked to the higher production, being the most farmed species in Kenya and is readily available in all counties (Opiyo et al., 2018). Tilapia was the most preferred fish for consumption and this could be attributed to its taste compared to other fish species (Omasaki et al. 2016). The frequency of consumption by the respondents revealed that majority of respondents consumed fish periodically and contributes to the low consumption frequencies in these regions. This finding is in line with studies by Obiero et al. 2014 and Claret et al. 2016 where the majority of the fish consumers consumed fish once per week with minimal daily consumption. Low frequencies of fish consumption could also be attributed to the fact that majority of the respondents had a low monthly income of up to 100 USD implying that consumers in the low-income group are limited to consuming fish more often since they have low disposable income (Tacon and Meitan, 2018b).

Consumers reported that they preferred fish and fish products because of their nutritional value. Fish are rich in protein and have the best oils and hence the best replacement of red meat. Oken et al. (2012) documented that fish are the primary source of vitamin D and polyunsaturated fatty acids in the diet. Additionally fish plays an important role in the diet especially in causing an anti-inflammatory effect to consumers due to the presence of eicosapentaenoic and docosahexaenoic acid (Mori 2017; Tortosa-Caparrós et al. 2017; Tan et al., 2018). Taste and safety of the fish were among the major factors that influenced consumer-purchasing behavior and is coherent with the finding by Awuor et al. (2019). Fish tissue is much vulnerable to bacterial contamination that leads to spoilage and an outbreak of fish foodborne diseases (Lahel et al., 2020). According to Uddin et al. (2019), fish consumer purchasing behavior and perception are highly affected by the food safety risks involved. On the other hand, the preference of one fish species against the others is majorly due to taste as reported by the respondents. In addition, a reasonable price is an important factor affecting consumer perception of fish (Lee and Nam 2019). Fish should be affordable to majority of the consumers with a competitive price over other substitutes (Kappel and Schröder, 2016). The affordability of fish may account for the fact that only a few consumers reported to be consuming

once weekly.

The evaluation of marginal effects on fish consumption showed that an increase in fish prices had negative impacts on fish consumption. The respondents in this study, therefore, were likely to have consumed fish at affordable prices. Majority of the respondents reported to earn less than 100 USD per month hence the affordability of fish is a major consideration. Despite high fish nutrition value, the cost should be within the capability of the consumers (Kappel and Schröder, 2016). According to Genschick et al. (2018), an increase in fish prices tends to shift consumer preferences to other fish species or food products that are affordable. On the other hand, an increase in education levels increased the likelihood of households to consume fish. The effect of education on fish perception and preference could be due to the awareness of the nutritional value and other benefits by individuals with higher education (Smith et al. 2017). In developing countries, there is a possibility of people who are educated to earn more income than uneducated hence more finances to spend on fish (Melesse et al. 2019). An increase in family income increased the probability of households to purchase fish. Family income increases the capacity of the households to seek high nutritious food like fish and hence the positive shift on fish due to an increase in income (Charlton et al. 2016).

Similarly, households with fewer members had a high consumption preference as compared to households with more members. An increase in family size leads to an increase in the quantity of fish required to feed the family shifting the preference. Additionally, the cost of learning a household with many members has high maintenance cost which may end up reducing the expenses on fishery products. Similarly, Mottaleb et al. (2018) documented that an increase in family members leads to a decrease in the consumption of fish. Our study on marginal effects showed that fish freshness had a significant positive outcome of marginal effects. This demonstrates that fish consumers are likely to prefer fish that appear fresh in the market. Consumers in the markets are keen to observe characteristics of fresh fish such as color, moist flesh and mild scent as compared with purchasing fish products with a fishy and strong odor. Akuffo et al. (2020) also reported that majority of fish consumers preferred fresh fish than processed fish products. However, fish processing is recommended to enhance shelf life and fish safety



because different processing methods reduce microbial contamination (Mahendran et al. 2019; Gokoglu, 2020).

## CONCLUSION

This study has revealed that the consumption of fish products was diversified based on sociodemographic characteristics. Fish consumers purchasing behavior was influenced by fish affordability, nutritional value and health safety concerns. However, fish consumption was reported to be higher among the respondents with more monthly income as compared to low-income earners. The consumers consider fishery products to be very nutritious but expensive and therefore, the study recommends that the price of fish should be reasonable to promote consumption. Also, fish vendors, fish farms and relevant authorities should monitor fish safety and quality to satisfy the consumer needs and preferences.

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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## AUTHOR CONTRIBUTIONS

All data generated or analyzed during this study are available from the corresponding author on request.

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