



Research article

Consumer fish consumption preferences and contributing factors: empirical evidence from Rangpur city corporation, Bangladesh

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ABSTRACT

Background: Fish is the important source of animal protein and regarded as the second food after rice in Bangladesh. Fish consumption is influenced by consumer socioeconomic characteristics.**Objective:** The specific objectives of the current study are (i) to find information on consumers' fish consumption levels; (ii) to assess the relationships between consumer's preferences and their socioeconomic characteristics; and (iii) to investigate the factors affecting consumer fish consumption.**Method:** We surveyed a total of 128 randomly selected respondents from the Rangpur city corporation (RPCC), Bangladesh in 2019 using a semi-structural questionnaire.**Main findings:** The average consumption level of fish per quarterly was 1.45 kg/person. Rui (*Labeo rohita*), Pangas (Pangasius), Hilsha (*Tenualosa ilsha*) and Tilapia (*Oreochromis mossambicus*) were the most frequently consumed fish species. Significant differences in consumption level were observed among the age categories, profession, gender, education, and income levels ($p < 0.05$). Most participants consumed fish more than once a week throughout the year and there was no seasonal impact on fish consumption. Fish consumption level was significantly and positively associated with education and income levels and negatively associated with age categories ($p < 0.01$). The stepwise multiple regression method elucidated 53.7% of the variance ($p < 0.05$) for fish consumption.**Conclusion:** Fish consumption in the RPCC is lower than the average consumption level in Bangladesh particularly for lower income people. Lack of proper knowledge on fish consumption value and high price appeared as the important barrier to increase the fish consumption.

1. Introduction

Fish is one of the vital animal proteins in Bangladesh, which comprises 63% of protein supply in the national diet (DoF, 2018; Haque et al., 2019). It is rich in unsaturated fats, amino acids, vitamins, and trace elements (Roos et al., 2003). Besides, fish is easy to digest because of the absence of conjunctive tissue (Burger et al., 1999; Kızılaslan and Nalinci, 2013). Several research scholars have explored the fish's dietary value and its paramount significance in human food from different aspects. Many recent studies reported that fish consumption aids in stopping various health diseases, including bacterial infections, Alzheimer's disease, metabolic disorder, protein-calorie malnutrition, high blood pressure, cardiovascular and coronary heart diseases (Hansen and Grung, 2016; Bogard et al., 2017a; Samoggia and Castellini, 2018; Balamı et al.,

2020; Li et al., 2020). Because of various human health benefits, it is essential to assess consumers' fish consumption for a healthy life.

It is a well-reported fact that the global fish's and fisheries production is about 154 million tons (MTs) annually, and their consumption rate is 1.5% per capita per annual (Can et al., 2015). Bangladesh has a critical potential in different perspectives of fish products and fisheries because of its ponds, reservoir, inland water, and wetlands and because this is a land of many rivers (Rahman and Islam, 2019). Moreover, recent cited works in Bangladesh also stated that fish consumption in Bangladesh is lower than the world average consumption (Bogard et al., 2017a; Islam et al., 2018; Ahmed et al., 2020; Ara et al., 2020). Bogard et al. (2017a) found that fish consumption in Bangladesh gradually increased by 30% from 1991 to 2010. Currently, fish production is around 2.56 million tons per year and consumption is approximately 37 g per capita (Bogard et al., 2017b; DoF, 2018; Akter et al., 2019; Ahmed et al., 2020). Furthermore,

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Halim et al. (2017) reported that a rise in fish consumption can increase fish production and have a significant positive impact on rural household employment. In addition, the fisheries sector plays a pivotal role in the country's economy, which contributes 3.69% to the GDP (Gross Domestic Product) of the nation and 22.60% to the farming GDP (Haque et al., 2019). Evidence shows that the geographical setting is well suited for aquaculture especially high fish production in the northern region of Bangladesh because water sources have increased from 1973 to 2805 hecter in recent decades (Rahman and Islam, 2019).

Fish consumption frequencies and their preferences are influenced by purchasers' geographic locations, and socio-cultural features (Pieniak et al., 2011; Can et al., 2015). Fish preference is also exaggerated by several factors, including sensory (freshness, taste, and smell) and non-sensory factors (personal behavior, views, risk perception, and so on) (Honkanen et al., 2005). For example, Feng et al. (2000) found that an increased population with an adequate supply of fish and fisheries products, income, education level can influence consumers' fish consumption in China. Boniface and Umberger (2012) recognized age and ethnicity significantly influenced the consumption of fish products on Malaysian consumers. Obiero et al. (2014) investigated factors affecting consumer preferences and selling trends in the demand for fish in Kenya and found overall quality, accessibility, and taste influencing consumer preferences. Can et al. (2015) performed research on fish consumption preferences in Antakya city of Turkey, and stated that most consumers ate fish in a month per year or only in the winter month. Few recent studies have shown that fish consumption depends on various risk factors (Lei et al., 2020; Rezaeizadeh et al., 2020; Ruffle et al., 2019; Wu et al., 2020). In Bangladesh, Haque et al. (2019) conducted a study on consumer behavior toward sea fish consumption in Dhaka City, Bangladesh, and reported that age, level of education, gender, annual income, and the religious view had the highest influence on household sea fish consumption. Another study by Uddin et al. (2019) observed that consumer fish preference was substantially affected by freshness, taste, color, and family income in the Mymensingh city of Bangladesh.

The aforementioned literature reviews revealed that several studies have been conducted to assess consumer preferences and behaviors toward fish consumption. However, fish consumption preferences may substantially differ from the coastal region to the inland area. Rangpur, the study region is a divisional city (the highest administrative unit) that echoes the socioeconomic, and cultural heritage of the northern part of Bangladesh, with its multi-cultural diversity, floodplain inland areas, and favorable geographic setting under the subtropical humid climate (Islam et al., 2020a). Unfortunately, there is no evidence in literature focused on the factor influencing consumer's fish consumption preferences in the Rangpur city corporation, Bangladesh. The specific objectives of the current study are (i) to find statistics on consumers' fish consumption levels; (ii) to assess the relationships between consumer's preferences and their socioeconomic characteristics; and (iii) to investigate the factors affecting consumer fish consumption. This study will help decision-makers for the production of fish, variation of products, policies for sale, and also it can contribute to nutritional policies at the local and regional levels.

2. Material and methods

2.1. Data collection

We surveyed between early December 2019 and mid-January 2020 through a semi-structured questionnaire responded by 128 randomly selected participants that have various socio-economic and cultural characteristics and are from Rangpur city corporation, located in the northern region of Bangladesh (between 2538' and 2552' North latitudes and 8905' and 8920' East longitudes). The least number of sample size for our research was computed based on the given assumptions such as likely fish consumption rate of 90%, acquired from the pre-tested survey; confidence interval of 95% and 5% sampling error, respectively (Oren

and Bickes, 2011; Rodriguez and Gonzalez-Ramirez, 2014; Aydın and Bashimov, 2020). Before the initiated of the field survey, the pre-tested survey was performed on respondents for proper changes if required (Wenaty et al., 2018).

2.2. Data evaluation

A total of 20 commonly consumed fish species were measured based on a pre-tested survey to compute the annual fish consumption rate for each respondent. Later, the questionnaire on the annual fish consumption was responded. A five-point Likert scale was employed to estimate fish consumption frequencies and coded in the following sequence (i) once a week, (ii) more than once a week, (iii) once a month, (iv) more than once a month, (v) more than once a year (Pieniak et al., 2011). Consumers' annual fish consumption level was demarcated into subcategories based on their age, sex, education, profession, marital status and income (Cantillo et al., 2020). Subcategory's fish consumption level was comparable with each other.

2.3. Statistical analyses

The Pearson correlation coefficient was employed to determine the associations between consumers' fish consumption level and socioeconomic changes (Rahman and Islam, 2019; Widihastuti and Arthathiani, 2020). Besides, the scatter diagram was used to examine the probable associations between variables. Chi-square (Fisher's exact test) test was employed to validate the probable relationships between fish consumption variables and determinants of consumer's habit (Can and Altug, 2014; Terin, 2019). Partial correlation was used to determine the relationship between consumers' fish consumption socioeconomic subcategory and total meat consumption except for fish (Abdikoglu et al., 2020; Temesi et al., 2020). Besides, consumers' meat consumption except for fish was selected as the dependent variable while the other socioeconomic subcategories were considered the dependent variable.

To investigate the factors influencing fish consumption, a multiple stepwise linear regression model was employed in this research. In our study, socioeconomic subcategories including age, education, income, and the number of fish species are chosen as an independent variable and consumers' fish consumption level was also chosen as the dependent variable for the model generation. The stepwise regression model has been extensively applied to detect solely the predictive feature that substantially improves the regression at a certain level. This model has elucidated as integration of forwarding chosen and backward deletion processes (Qiu et al., 2010; Islam et al., 2020b). The linear association between dependent and independent variables was studied using scatter diagram plots. Durbin-Watson (DW) statistical analysis and Variance Inflation Factors (VIF) were used to recognize any autocorrelation and multicollinearity problem in this study.

Therefore, the significance of the results is determined by the one-way ANOVA test (Qasim et al., 2020; Wang and Somogyi, 2020). The multiple linear regression model can be formulated in the following Eq. (1)

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_k x_k + \varepsilon \quad (1)$$

where Y is the dependent parameter, X and k are the independent parameters, β is the constant and resultant β are the coefficients, and ε is a fixed term that adds the impacts of unmodelled inconsistency that influence the dependent parameter. The ultimate dependent and independent parameters can be expressed by the Eq. (2)

$$\log_{10} Y = \beta_0 + \beta_1 \log_{10} x_1 + \beta_2 \log_{10} x_2 + \dots + \beta_k \log_{10} x_k + \varepsilon \quad (2)$$

where Y is the consumers' fish consumption rate (kg/quarterly), X1 is the numbers of fish species ate by each participant and X2 is the consumers' age (year).

2.4. Ethical statement

The permission of participants was taken prior to the questionnaire survey, and they keep on anonymous. All the participants were informed about the main objective of this research before starting to the survey. We confirm that informed consent was obtained from all respondents for this survey. Anonymity and confidentiality of the survey data were ensured accordingly. The formal ethical consent of this research was taken from the ethical committee of Department of Disaster Management, Begum Rokeya University, Rangpur, Bangladesh.

3. Results

In the present study, participants' total fish consumption in the study area was 1.45 ± 0.76 kg/quarterly. The consumers' fish consumption levels are shown in Table 1. According to the amounts and numbers, the most consumed fish species was Rui (*Labeo rohita*) with an average of 1.852 ± 0.978 kg/quarterly. After Rui (*Labeo rohita*), Magur, Pangas (*Pangasius*), Hilsha (*Tenualosa ilisha*) and Tilapia (*Oreochromis mossambicus*) were stated the four most consumed and preferred fish species, respectively in the RPCC. The six most regularly consumed fish species responsible for 40% of whole fish consumption. Based on the quantity, Hilsha (*Tenualosa ilisha*) had found the highest amount (2.688 ± 1.689 kg/quarterly).

Table 2 exhibits participants' quarterly fish consumption levels (kg/quarterly) based on different socioeconomic variables including gender, age, income, education and profession. The significant variations in consumers' fish consumption levels were observed between the gender, age, income and education categories. Consumption level in higher-level income people was two times higher than that of lower-level income category. Consumption level between middle-aged consumers and graduate individuals was nearly two times higher than that of the elderly people and the lower education level, respectively. Table 2 reveals that no substantial variations in consumption levels were observed between each professional sub-category ($p > 0.05$). However, males' quarterly fish consumption level was 0.878 kg greater than that of females' consumption level.

Table 3 demonstrates consumers preferences and habits for fish consumption. Based on the outcomes, it was found that health issues play a pivotal role for selecting fish consumption. Major fish type was mainly caught fish, which is mostly live fish. Local fish market was used for maximum consumer's fish product acquisition. Traditional way of cooking was found to be popular method of preparing fish. The most consumers ate fish more than once a week in the year. There was no seasonal impact on consumers' fish consumption in the RPCC.

Table 4 presents significant relationships between the consumers socioeconomic variables and consumer preferences. The significant associations were found between "the primary cause of fish consumption" and education level, "the process of fish preparation" and education as well as gender, "preferred type of fish" and level of income ($p < 0.01$). No relationships between "primary cause of fish consumption", "preferred type of fish", and "the process of fish preparation" with the other consumers preferences were observed using the Chi-square test.

Pearson correlation coefficient between consumers' characteristics and consumption levels is outlined in Table 5. A significant positive association was found between fish consumption level and income ($r = 0.336$, $p < 0.01$), and fish consumption level and education ($r = 0.756$, $p < 0.01$) while a significant negative association was found between fish consumption level and age of consumer ($r = -0.234$, $p < 0.01$). There was no association between the profession and fish consumption value ($r = 0.163$, $p > 0.05$). On the other hand, partial correlation was taken into consideration to find any significance association between meat consumption (except for fish consumption) and other fish consumption categories based on age, education, income and profession. There was only positive significant association between only age-based fish consumption and meat consumption ($r = 0.22$, $p < 0.05$).

To confirm the result of correlation analysis, regression models for level of fish consumption was performed which are shown in Table 6. This model does not exhibit autocorrelation using Durbin-Watson statistics (1.420) and multicollinearity problems based on VIF statistics (1.000 and 1.006). The results of regression model outcome indicated that 53.7% of the variance was elucidated by the regression method. The fish species consumed by the participants and the consumers' age were observed to be substantial predictors for fish consumption level.

Consumers' particular opinions regarding fish consumption, prices and also main problems identified at the fish market and the steps for improving fish consumption are illustrated in Figure 1. Most of the respondents answered that fish consumption is satisfactory with a combination of mixed fish consumption level (Figure 1a). More than half of the consumers responded that the expensive fish price should be reduced (Figure 1b). Similarly, 47% of respondents answered that fish consumption could be increased if price will be lower. Also, it was found that the supply of live fish can be increased to enhance fish consumption level. Furthermore, 44% of total participants revealed that fish storage and conservation are the major problems at the fish market (Figure 1c). In addition, field survey observation was also found similar opinion, as the most vital factor to be improved is hygiene and fresh environment for fish market (Figure 1d).

Table 1. Quarterly fish consumption concerning the common consumed fish species in the RPCC.

Species	Consumption Level			Species	Consumption Level		
	N	kg/quarterly	%		N	kg/quarterly	%
		Mean \pm SD				Mean \pm SD	
Rui	27	1.852 \pm 0.978	6	Magur	2	2 \pm 1.414	7
Mrigal	5	1.2 \pm 0.447	4	Karfu	2	1.75 \pm 1.060	6
Shing	6	1.67 \pm 1.633	6	Puti	5	0.65 \pm 0.335	2
Pokhimach	7	1.71 \pm 0.756	6	Bagda	4	1.125 \pm 0.629	4
Pangas	13	1.346 \pm 0.473	5	Tilapia	8	1.438 \pm 0.728	5
Hilsha	8	2.688 \pm 1.689	9	Tengra	4	1.125 \pm 0.629	4
Golda	4	1.25 \pm 0.5	4	Baata	7	1.214 \pm 0.393	4
Shorputi	3	1 \pm 0	3	Koi	6	1.33 \pm 0.516	5
Grasscarp	4	1.25 \pm 0.5	4	Baim	3	1.167 \pm 0.763	4
Catla	3	1.67 \pm 1.155	6	Silvercarp	7	1.57 \pm 0.535	5
				Total=	128	1.45 \pm 0.76	100

Source: Assessed Data from Field Survey 2019–2020

Table 2. Fish consumption rates based on socioeconomic characteristics in the RPCC.

Socioeconomic Characteristics	N	%	Fish Consumption	P-value
			Kg/Quarterly Mean \pm SD	
Age				
Young	48	38	1.573 \pm 0.635	<0.01
Middle-aged	57	45	1.772 \pm 0.866	
Elderly	23	18	0.847 \pm 0.424	
Gender				
Male	82	64	1.460 \pm 0.585	<0.01
Female	46	36	0.581 \pm 0.4218	
Profession				
Student	22	17	1.261 \pm 0.589	>0.05
Private Sector	32	25	1.297 \pm 0.505	
Public sector	39	30	1.577 \pm 0.519	
Self Employed	35	27	1.443 \pm 0.481	
Education				
Primary	30	23	0.433 \pm 0.226	<0.01
High School	38	30	1.263 \pm 0.566	
University Degree	27	21	1.740 \pm 0.306	
Graduate Degree	33	26	1.939 \pm 0.541	
Income (BDT*/month)				
<9999	24	19	0.552 \pm 0.312	<0.01
10000–19999	44	34	1.125 \pm 0.489	
20000–29999	37	29	1.419 \pm 0.464	
30000–39999	12	9	0.875 \pm 0.569	
>40000	11	9	1.318 \pm 0.462	

Source: Assessed Data from Field Survey 2019–2020, *85 BDT is equal to 1 \$US in the year 2020.

4. Discussion

Though Rangpur is an emerging city, its consumers' fish consumption level is lower than other food consumption. The main reason is that meat and chicken consumption play a pivotal role in dietary preferences in Bangladesh. It is well-known that public might prefer chicken, duck, and meat in Bangladesh (Toufique, 2015; Ara et al., 2020). Participants' average fish consumption was 12 gm/day as well as 1.85 kg/quarterly, which implies a consumed number of fish in the RPCC. This result also indicates a sign of homogeneity of the participants about their fish consumption level. Though, the fish consumption amount was medium as well as 12 gm/day, which is higher than that of 8.12 gm/day found by Can et al. (2015) in Antakya, Turkey but is quite lower than the average in Bangladesh (~13 gm/day) and the world (~36 gm/day). Studies reported in different cities of Bangladesh show that fish consumption in Rajshahi was 16 gm/day and in Khulna was 27 gm/day (Bogard et al., 2017a, b). A study conducted by Sarker et al. (2017) in Dinajpur city neighboring city to Rangpur found that 73% of the respondents preferred fish.

In this study, we found that Rui, Pangas and Tilapia are the most consumed fish species in the RPCC. Similar to our study, Shovon et al. (2017) reported that Rui (*Labeo rohita*), Pangas (*Pangasius*), and Catla (*Gibelion catla*) are the most common fish species in Bangladesh. The main causes behind respondent's preference for purchasing Rui, Pangas and Tilapia fish that have a cheaper price in comparison with other fish species, yearly available, and reasonably low price (Uddin et al., 2019; Alam and Alfnes, 2019). In Bangladesh, Hilsha is a standalone most preferable fish due to its taste and smell (Haque et al., 2019; Khan et al., 2020). Fish consumption is particularly high among rich people. However, Telapia consumption is safe in the study area, but it consumes continuously over 70 years, it can create health problems including cancer risk (Goutam et al., 2017).

Seasonal behavior plays a vital role in fish consumption, but in this study, 92.63 % of the participants answered that season has no impact on fish consumption (Table 3). We identified that participants consume fish all over the year which is good for a healthy and balanced diet. On the contrary, Wake and Geleto (2019) stated that fish demand relies on seasonal influence. Erdal and Esengün (2008) observed that fish

Table 3. Preferences and habits of Consumers Fish Consumption in RPCC.

Questions	Frequency for Each Preferences					
	Preferences	%	Preferences	%	Preferences	%
Primary reason for Fish consumption	Economic	17.2	Healthy	52.25	Tasty	30.55
Preferred Fish Type	Caught	77.63	Cultured	18.23	Frozen	4.14
Preferred Fish Market	Local Fish Market	71.00	Arat/Paikar Market	29.00	Super Shop/Online Shop	00
Preparation Method of Fish	Grilling	7.00	Frying	33.32	Traditional Cooking	59.68
Preferred Season for Fish Consumption	Summer	2.35	Winter	5.02	Season has no Impact on consumption	92.63
Consumption Frequency	Once a week	9.33	More than Once a week	35.25	Once a Month	4.12
	More than Once a Month	29.63	More than Once a year	21.67		

Source: Assessed Data from Field Survey 2019–2020

Table 4. Relationship between factors of socioeconomic variables and fish consumption preferences.

	Economic cause		Healthy cause		Taste		Total	
	N	%	N	%	N	%	N	%
Education Level								
Graduate Degree	0	0	24	73	9	27	33	100
University Degree	6	22	13	48	8	30	27	100
High School	0	0	17	45	21	55	38	100
Primary	4	13	13	43	13	43	30	100
Fisher's exact Chi-square $\chi^2 = 20.178$; $p < 0.01$								
Education Level	Grilling		Only Frying		Traditional Cooking		Total	
Graduate Degree	0	0	8	24	25	76	33	100
University Degree	5	19	0	0	22	81	27	100
High School	0	0	13	64	25	66	38	100
Primary	0	0	13	43	17	57	30	100
Fisher's exact Chi-square $\chi^2 = 27.061$; $p < 0.01$								
Gender	Grilling		Only Frying		Traditional Cooking		Total	
Female	6	13	10	22	30	65	46	100
Male	15	18	50	61	17	21	82	100
Fisher's exact Chi-square $\chi^2 = 25.908$; $p < 0.01$								
Income Class	Caught		Cultured				Total	
	N	%	N	%			N	%
<9999	17	71	7	29			24	100
10000–19999	11	25	33	75			44	100
20000–29999	15	41	22	59			37	100
30000–39999	8	67	4	33			12	100
>40000	7	64	4	36			11	100
Fisher's exact Chi-square $\chi^2 = 17.688$; $p < 0.01$								

Source: Assessed Data from Field Survey 2019–2020

consumption level rises in the winter season. Thirty-five % of the respondents in our study answered that respondents ate fish more than once a week, and 29.63 % stated they ate fish once a month. Pieniak et al. (2008) also found that 25 % of the consumers in Belgium, Denmark, and the Netherlands ate fish more than once a week which is quite similar in this work. Similarly, Milong et al. (2019) found 40 % of respondents who consumed fish 2–4 times a week.

It is acknowledged that education levels and income classes may have an impact on the fish eating level (Burger et al., 1999; Hicks et al., 2008).

The current study revealed that a significant positive association was observed between income and consumption, education and consumption as well as profession and consumption (Table 5). Some recent cited works (Can et al., 2015; Sari and Muflikhati, 2018; Uddin et al., 2019) have revealed relationships between education level and fish consumption. We found a meaningful relationship between consumption levels of middle-age people and public sector consumers, which constitute the majority of the respondents, are greater than that of other categories. This might have a positive sign of fish eating behavior in the

Table 5. Correlation between fish consumption level and characteristics of consumer.

Characteristics	Consumption Level (kg/Quarterly)	
	Coefficient*	p-value
Income Level of Consumer	0.336	<0.01
Age of Consumer	-0.234	<0.01
Education Level of Consumer	0.756	<0.01
Profession of Consumer	0.163	>0.05

The definition for the significance of "*" is the $p < 0.05$.

?, male condition.

Source: Assessed Data from Field Survey 2019–2020

Table 6. Stepwise regression models for the fish consumption value.

Models	B	Adjusted R ²	F	Sig F	B	P	Durbin-Watson (DW)	VIF
Model 1 Constant	.057	.535	147.046	0.000		0.0672		1.000
The Number of Species consumed					.734	0.000		
Model 2 Constant		.537	74.76	0.000			1.420	1.006
The Number of Species consumed	.991					0.000		
Age of Consumers	-0.100					0.001		

Source: Assessed data from field survey 2019–2020

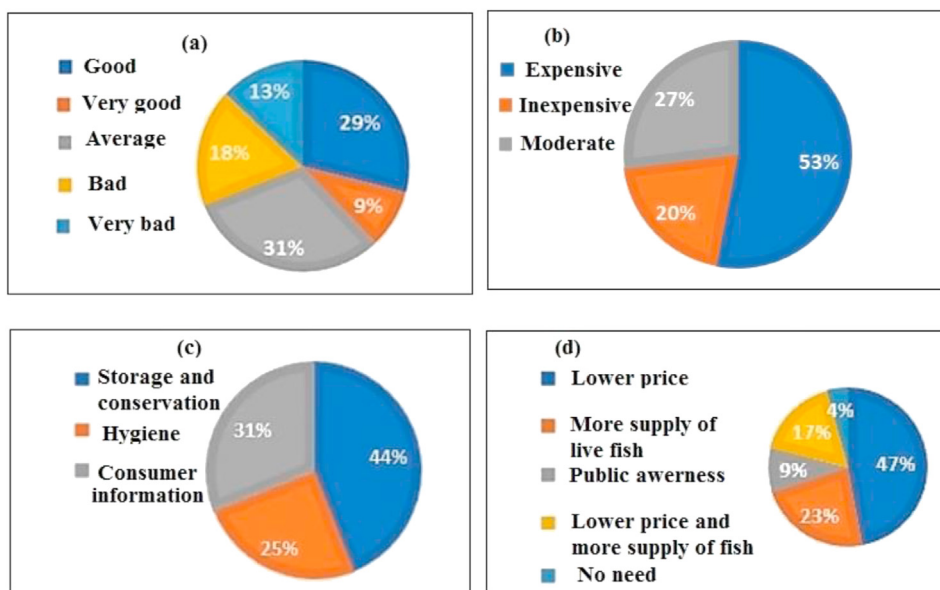


Figure 1. Consumers' response about fish consumption level and associated problems in the Rangpur City Corporation, Bangladesh (a) Consumers' opinion on fish consumption level, (b) Consumers' opinion on fish prices, (c) major problems in fish market and (d) steps need to be taken for increasing fish consumption based on consumers' opinion.

forthcoming period. Hansen and Grung (2016) showed that the quantity of fish consumed enhances with raise in income level. Interestingly, both low and high incomes categories occurred to have no noteworthy relationship with fish consumption. As for the low-level income consumers, it may be a consequence of financial hinders which limits their choices, whereas the high-level income consumers have many alternatives and capability to buy their choice.

On the contrary, this study clearly revealed a negative correlation between age and fish consumption level, which means with the increasing of age with fish consumption decreases gradually in the study area. This is possibly due to a decrease in knowledge level and an increase in diseases, and thus building an awareness program for achieving a healthy diet. Kaimakoudi et al. (2013) stated that higher fish consumers are a young age. Myrland et al. (2000) found that graduates ate more fish species than other categories. A study carried out in Bangladesh depicted that higher educated people are keener in fish-based diets than less educated people (Ahmed et al., 2020). Burger et al. (1999) reported that an inverse association was observed between fish eating and education and income classes in the USA, which is contradictory to our results. Çolakoğlu et al. (2006) found no relationship between education and fish consumption and frequency, which differs from this study. Similar to our study, Verbeke and Vackier (2005) stated that people with low-level income and young age tend to eat fewer fish in Belgium. Higher education and fish consumption tend to be increased in the RPCC which is contradictory to the earlier studies (Cardoso et al., 2013; Shapiro et al. (2019)). This is due to educated persons are more conscious about their health concerns than less educated persons. Only 6 % of the consumers stated that they did not eat fish due to the bone, spike, and small. Lucky et al. (2004) found that females consume more fish than males in Bangladesh. In contrast, we observed that males consume two times higher fish than females. This is because the male is mostly involved in purchasing fish and the household head ate usually more fish, while the female is involved only in preparing the fish for consumption (Dasgupta et al., 2017). This study also indicated a noteworthy variation in consumption between consumers of various genders and age levels. We observed that only a minor variance was elucidated by the regression method. Our method can be elucidated by adding other socio-demographic drivers that were disregarded in the current research. In addition to this, the logistic multinomial regression method might be more effective to elucidate fish consumption preferences. However, the

impacts of socio-cultural, economic, and demographic factors of fish consumption deserve further investigation.

Fish might be regarded as expensive by consumers in comparison with other types of food (Pieniak et al., 2008). For example, a recent study by Uddin et al. (2018) found that various species of fish is expensive in Bangladesh. Similarly, it was observed that 53% of respondents indicated that fish is much expensive in the RPCC. Haque et al. (2016) also found a higher price of fish in Bangladesh. By contrast, Chowdhury et al. (2016) reported that the affordable price of fish is available in Bangladesh. Although the fish price is vital and it is expensive by 47% of the respondent's opinion (Figure 1), fish consumption cannot be elevated by a price hike standalone. The key reason is that fish consumption habit is closely associated with the cultural and geographical distribution pattern. In addition, the majority of respondents believe that lower prices could make fish consumption higher in the RPCC. Approximately 90 % of produced fish is consuming by the local consumer due to the year-round availability of fish and affordable price in Bangladesh (Hernandez et al., 2018). Furthermore, Fisher's exact Chi-square result identified a close relationship between fish consumption and 'preferred type of fish. It is worth mentioning that the income and price elasticity of the demand for fish is relatively low..

Freshness is a vital determinant influencing fish consumption level. About 99 % of consumers noticed that they preferred fresh live fish than processed fish. Ali et al. (2010) stated that consumers preferred freshness, followed by price, quality, packaging, and non-seasonal availability in the case of purchasing products. Most of the respondents stated that they assess the fish quality based on their freshness (Uddin et al., 2019); however, it is quite tough for most respondents to make such an appraisal (Hicks et al., 2008). Thus, quality assurance plans should be implemented that can bring benefits to the fishery market and consumer levels (Bose and Brown, 2000). Most of the consumer reported that they judge the quality of fish by perceiving behavior (Altintozglou and Heide, 2016; Tomić et al., 2016). Other vital determinants influencing fish consumption are fishbone, taste, and nutrition (Pieniak et al., 2008). Uzundumlu (2017) found that fish consumption varies due to taste (38.4%), fishbone (16.7%), and nutrition (23.5%). Fishbones are a crucial factor to reduce eating frequency, and they included that fish bones trigger difficulties in cooking and preparation stages (Leek et al., 2000). On the other hand, Birch et al. (2018) stated that smell, taste, texture, and bone negatively affect fish consumption.

About 53% of participants consume fish for healthy and a balanced food (Table 3). The substantial association between education and “the main cause why respondents preferred fish” also in line with our results (Table 4). Besides, the preferred technique of preparation is traditional cooking, which can be linked to consumers’ need to eat fish in a balanced way (Table 3). It can be stated that healthy causes act a pivotal role in consumer decisions, particularly among those with high levels of education using the Chi-square test (Table 4). Çolakoğlu et al. (2006) found that fish is commonly bought from wholesale fish markets which is contradictory to this study, where fish is generally purchased from the local fish market. Most of the consumers claimed that the main issue in local fish markets is unhygienic (Figure 1), and they stated that the respective authority should be monitored on a routine basis. The health benefits of consuming fish should be elucidated by the fishery sector (Aydın et al., 2011). To enhance healthy fish consumption, proper awareness should be built through different public online programs and field level-training. For instance, a pregnant woman has a higher potentiality for consuming fish during pregnancy (Spiller et al., 2019). Malvandi and Alahabadi (2019) found no health risk of fish consumption. The benefit of consuming fish is that fatty fish consumption for 6 months does not increase metabolic risk as well as obesity or overweight. It can be concluded that major structural issues including packing, supplying, and transport in the fishery sector also detrimental influence fish consumption (Can et al., 2012). We suggest that the knowledge of fish as a dietary product could play a vital role in higher fish consumption levels. Additionally, it can be said that food safety, environment-friendly, and cleanness have a significant effect on consumers’ fish purchasing behavior (Santeramo et al., 2017). One of the major limitations is that a small number of participants were recruited from only one city in the survey, which may not represent the entire population. Further large-scale studies should require a large number of sample sizes to draw a meaningful conclusion in the study region.

5. Conclusion

In this study, we found that fish consumption in the RPCC is comparatively lower than the average fish consumption in Bangladesh as well as from the global perspective. Fish consumption should be continued throughout the year for healthy and balanced diets. Several constraints including prevailing traditional eating habits, high fish price, lack of knowledge for nutritious fish, and structural issues in the fishery sector significantly affect fish consumption. We also observed that if cultured fish production will increase, it may lower fish price in fishery industry, which may lead to higher fish consumption soon. Government, NGO sector, and respective authority can play a driving role in changing consumers’ consumption habits and preferences. Our regression method can be elucidated by adding other socio-demographic drivers that were disregarded in the current research. In addition to this, the logistic multinomial regression method might be more effective to elucidate fish consumption preferences. However, the impacts of socio-cultural, economic, and demographic factors of fish consumption deserve further investigation. Overall, priority must be set to training and campaign programs as a routine basis with different social organization involvements aiming to enhance consumption rate and improving hygiene level at the fish market. Hence, this study will offer valuable information about fish consumption preferences and the factor influencing it in Rangpur city, Bangladesh to increase fish production and fish consumption habit and preferences.

Declarations

Author contribution statement

Md. Naimur Rahman: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Abu Reza Md. Towfiqul Islam: Performed the experiments; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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