

Factors determining consumer preferences for pangasius and tilapia fish in Bangladesh

MD. TAJ UDDIN, MEHEDI HASAN RASEL¹, AURUP RATAN DHAR,
BADIUZZAMAN² AND MD. SAZEDUL HOQUE³

Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh, Bangladesh

¹Institute of Agribusiness and Development Studies, Bangladesh Agricultural University, Mymensingh

²Department of Economics and Sociology, Patuakhali Science and Technology University, Bangladesh

³Department of Fisheries Technology, Patuakhali Science and Technology University, Bangladesh

*E-mail: tajbau@yahoo.com

Abstract. The study was conducted to identify the factors affecting consumer preferences for pangasius and tilapia fish in Bangladesh considering consumers' fish consumption habit. A total of 150 respondents were interviewed following random sampling technique from three upazilas of Mymensingh district. Data were analyzed with a combination of descriptive statistics and mathematical and statistical techniques. Majority of the consumers purchased pangasius and tilapia fish 1-5 times in a month. Consumers of medium income level bought the highest amount of pangasius and tilapia fish in a month. The study revealed that consumers' expenditure on pangasius and tilapia would be decreased by 6.1% with an increase in their income by 10%. Consumers preferred pangasius and tilapia fish mostly due to cheaper price than other fish, availability round the year and reasonable price (ranked as 1st, 2nd and 3rd, respectively). Freshness of fish, color of fish and family income; and price of fish, freshness of fish and taste of fish had significant effect on consumer preferences in purchasing pangasius and tilapia fish, respectively. The study recommends that proper authority should monitor fish farms and check the fish quality as well as control fish sales price in the market to enhance consumer preferences.

Keywords: Consumer preference, Pangasius, Tilapia

Introduction

Consumption of fish is a paramount importance in human diet in various aspects. Being particularly valuable and having specific unique nutritive values, fish occupy a special position in a human diet (Burger and Gochfeld 2009). Consumption of fresh fish has a positive impact on human health when included at least twice a week in a normal diet (Mozaffarian and Rimm 2006). The country has high potential for pangasius and tilapia production as they can be grown in a wide range of culture systems, including small-scale, low-input, rural ponds, semi-intensive, intensive and commercial operations. Pangasius and tilapia has strong market demand in the local market due to its taste and low price.

Consumer preference is defined as a set of assumptions that focus on consumer choices that result in different alternatives such as happiness, satisfaction, or utility that allows a consumer to rank different bundles of goods according to levels of utility or

total satisfaction of consuming a product or service (Lambardo 2018). Obiero *et al.* (2014) studied factors influencing consumer preferences and marketing trends in the demand for Nile tilapia and African catfish in Kirinyaga and Vihiga counties, Kenya and revealed that fish product attributes such as overall quality, ready availability and taste had the greatest influence on consumer preferences. Mukul *et al.* (2013) spotted the factors affecting consumers' perceptions about organic food and their prevalence in Bangladeshi organic preference, and showed that consumers' perceptions on quality sureness of organic food consumption was influenced by food safety, price, environmental friendly, nutrition and sensory attributes. Palash (2004) studied consumer behaviour towards fish and meat in Dhaka city, Bangladesh and observed that monthly per capita consumption of different types of fish and meat was increased with the increase in monthly income. However, little is known about the consumer preference for pangasius and tilapia, the two important aquaculture species in Bangladesh. Considering this research gap, the study on consumer preference of pangasius and tilapia fish would provide valuable information for pangasius and tilapia fish consumption in Bangladesh to take appropriate decision regarding further increase in production of such fishes and expansion of their farm. The study will also demonstrate the factors that influence the purchasing decision of consumers which will facilitate pangasius and tilapia fish traders in designing and marketing of the fish according to the expectation of the consumer and to reach the consumers at all levels.

Materials and Methods

Study areas and data collection: The study was conducted at three upazilas of Mymensingh district such as Mymensingh Sadar, Fulbaria and Trishal. A total of 150 respondents were interviewed following random sampling technique. Questionnaire survey was performed for collecting the primary data using a structured questionnaire. Secondary data sources like reports, publications, handouts, etc. relevant to this study were also examined.

Analytical techniques: For analyzing the data, a combination of descriptive statistics (i.e., sum, averages, percentages, figure, etc.), and mathematical and statistical techniques were used to achieve the objectives and to get the meaningful result.

Determination of expenditure: To measure the responsiveness of increase in respondents' income on their expenditure for pangasius and tilapia fish consumption, the following formula of expenditure elasticity was used (Hutchinson 2016):

$$E_{exp} = \frac{(Y_t - Y_2)}{(Y_t - Y_2)} \times \frac{I_t}{Y_t}$$

$$\text{or, } Y_x = \frac{Y_t I_t - [E_{exp} \times Y_t \times (I_t - I_2)]}{I_t}$$

Where,

E_{exp} = Expenditure elasticity; I_c = Respondents' current income; I_x = Respondents' increased income; Y_c = Respondents' current expenditure for pangasius and tilapia fish consumption; and Y_x = Respondents' expected expenditure for pangasius and tilapia fish consumption.

Likert scale: To examine consumers' preferences for pangasius and tilapia fish, a five point Likert scale technique was followed (Jannat and Uddin 2016) which is a psychometric response scale to obtain consumer preferences or degree of agreement with a set of statements where respondents were asked to indicate their level of agreement with a number of given statements by an ordinal scale (Bertram 2011). There were 9 statements against the 5 point scale. Each respondent was asked to indicate his/her perception of agreement or disagreement against each statement along a 5 point scale, i.e., 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree'. Weights assigned to these responses were 5, 4, 3, 2 and 1, respectively. Total weighted score of a statement was determined by summing up the weighted responses of the 5 point scale. Total weighted score of a statement was divided by the sample size (i.e., 150) to obtain weighted average score. Thus, the possible range of total weighted score for each statement could be 0 to 750 and possible range of weighted average score for a statement could range from 0 to 5. A Likert scale for each 9 selected statements was computed by using the following formula:

$$\text{Weighted average score} = \frac{\text{Total weighted score } (5 \times SA + 4 \times A + 3 \times N + 2 \times DA + 1 \times SDA)}{\text{Total number of respondents}}$$

Where,

SA = Total number of respondents expressing their preferences 'strongly agree' for the statement;

A = Total number of respondents expressing their preferences 'agree' for the statement;

N = Total number of respondents expressing their preferences 'neutral' for the statement;

DA = Total number of respondents expressing their preferences 'disagree' for the statement; and

SDA = Total number of respondents expressing their preferences 'strongly disagree' for the statement.

Logit model: In order to investigate the extent of influence of the determinants on decision making status or preference of consumer in purchasing pangasius and tilapia fish, logistic regression analysis (i.e., logit model) was used (Gujarati, 2003) as follows:

$$Z_i = \ln \left(\frac{P_i}{1-P_i} \right) = \beta_0 + \beta_1 Q_1 + \beta_2 Q_2 + \beta_3 Q_3 + \beta_4 Q_4 + \beta_5 Q_5 + \beta_6 Q_6 + \beta_7 Q_7 + \beta_8 Q_8 + v_i$$

Where,

P_i is the probability of preferring and not-preferring of pangasius/tilapia fish,

$P_i = 1$ indicates preferring pangasius/tilapia and $P_i = 0$ indicates not preferring pangasius/tilapia fish.

Dependent variable: Z_i = Probability of preferring pangasius/tilapia fish.

Independent variables: Q_1 = Price of fish (Tk./kg); Q_2 = Average price of other fish (Tk./kg); Q_3 = Size of fish (inch); Q_4 = Freshness of fish ($P_i = 1$ for presence of freshness in fish, and $P_i = 0$ otherwise); Q_5 = Color of fish ($P_i = 1$ for usual color of fish, and $P_i = 0$ otherwise); Q_6 = Taste of fish ($P_i = 1$ for tasty compared to other fish, and $P_i = 0$ otherwise); Q_7 = Family income (Tk./year); Q_8 = Family size (no.). β_0 = Intercept; β_1 to β_8 = Regression coefficients of the independent variables; and v_i = Error term.

CONSUMER PREFERENCES FOR PANGASIOUS AND TILAPIA FISH IN BANGLADESH

The marginal probabilities of the key determinants of consumer preferences in purchasing pangasius and tilapia fish were estimated based on expressions derived from the marginal effect of the logit model as follows:

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

Where,

β_i = Estimated logit regression coefficient with respect to the i^{th} factor for pangasius/tilapia fish; and

P_i = Estimated probability of consumers' preference for pangasius/tilapia fish.

Results and Discussion

Socioeconomic characteristics of the sample consumers: The socioeconomic status of the sample consumers is represented in Table I. It is seen that average family size of the consumers was 4.0, which was almost similar to the national average of 4.1 (HIES 2016) whereas 75.0% members of the households were male and 25.0% were female. In terms of respondents surveyed, 63.3% were male whereas 36.7% were female. Majority of them (54.7%) were under the age group of 15 to 55 years that are considered as active and working group (Uddin *et al.* 2018). In terms of living area, 66.7 and 33.3 percent consumers lived in rural and urban areas, respectively. Most of the respondents (35.3%) were engaged in agricultural activities which was followed by wage labour and business (24.7 and 17.3 percent respondents, respectively). Average monthly income and expenditure of the consumers were found to be Tk. 13356 and Tk. 10741, respectively in the study areas. Analyzing the wellbeing status of the consumers on the basis of six indicators like health, education, employment, housing, mobility and income (Uddin and Dhar 2018), it was observed that the proportions of deprived households was 22.7% and privileged households was 77.3% (Table I).

Table I. Socioeconomic characteristics of the consumers

Particulars about the consumers		Information on particulars
Family size (nos.)		4.0 (Male: 75.0%; Female: 25.0%)
Sex (% of respondents)	Male	63.3
	Female	36.7
Age (% of respondents)	Below 15 years	11.3
	15 to 55 years	54.7
	Above 55 years	34.0
Residential area (% of respondents)	Rural	66.7
	Urban	33.3
Occupational status (% of respondents)	Agriculture	35.3
	Service	12.7
	Business	17.3
	Wage labour	24.7
	Others (Van/rickshaw pulling, shop keeping, remittance, etc.)	10.0
Average monthly income (Tk.)		13356 ± 1243
Average monthly expenditure (Tk.)		10741 ± 570

Particulars about the consumers		Information on particulars
Wellbeing status (based on health, education, employment, housing, mobility and income) (% of respondents)	Deprived households	22.7
	Privileged households	77.3

Source: Field survey, 2018.

Consumers' fish consumption habits: The frequency of consumers' purchasing pangasius and tilapia fish is represented in Table II. It was found that majority of the consumers purchased pangasius and tilapia fish 1-5 times in a month (38.7 and 42.7 percent consumers, respectively); while 35.3 and 34.6 percent consumers purchased 1-3 times half-monthly; and 26.0 and 22.7 percent consumers purchased 1-3 times in a week, respectively.

Table II. Consumption frequency of pangasius and tilapia fish

Fish consumption period	Consumption frequency	Pangasius		Tilapia	
		Number of consumer	Percentage of consumer	Number of consumer	Percentage of consumer
Weekly	1-3times	39	26.0	34	22.7
Half monthly	1-3times	53	35.3	52	34.6
Monthly	1-5 times	58	38.7	64	42.7
Total		150	100.0	150	100.0

Source: Field survey, 2018.

In the study area the fish consumers had deferent levels of monthly income. In this study, monthly income of the consumers was divided into three groups which were: low (<Tk. 10000), medium (Tk. 10000 – Tk. 20000) and high (>Tk. 20000). Table III revealed that 20.7% consumers were in low income group, 46.0% were in medium income group and 33.3% were in high income group. It was experienced that consumers of medium income level bought the highest amount of pangasius and tilapia fish in a month (3 and 2 kg per month, respectively) where the amount was nearly 1 kg per month for both low and high income groups (Fig. 1). The finding is similar to the law of consumption described by Ernest Engel where the authors showed a concave shaped graph indicating relation between consumers' income and expenditure on food consumption (Chai and Moneta 2010). Gheyas *et al.* (2003) also revealed that the proportion of income spent on fish was greater than the proportion of increase in income for lower middle and upper middle income groups.

Table III. Effect of family income on pangasius and tilapia fish consumption

Monthly income level	Number of consumer	Percentage of consumer
Low (< Tk. 10000)	31	20.7
Medium (Tk. 10000 – Tk. 20000)	69	46.0
High (> Tk. 20000)	50	33.3

Source: Field survey, 2018.

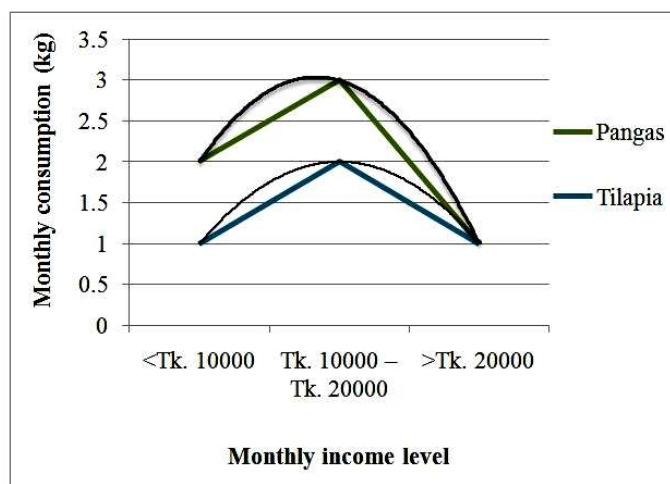


Fig. 1. Pangasius and tilapia fish consumption in relation to consumers' monthly expenditure.

It was found from field survey that average monthly income of the respondents was Tk. 13356 and average monthly expenditure on pangasius and tilapia fish consumption was Tk. 460. Assuming 60% expenditure elasticity for pangasius and tilapia fish (similar to Omezzine *et al.* 2003), it was found that if monthly income of the consumers were increased by 10%, their expenditure on pangasius and tilapia fish consumption would be decreased by 6.1% (Table IV). The reason behind the decrease in consumers' preference for buying pangasius and tilapia fish included fish purchasing option, taste variation, price negotiation, etc. The result is faintly supported by Dey (2000) where the author presented estimates of fish demand elasticities by fish type for Bangladesh using individual household expenditure data of 5667 households and revealed that income elasticities of all fish types consistently fell with increase in per capita expenditure level of households.

Table IV. Determination of expenditure on pangasius and tilapia fish consumption with 10% increase in income

Particulars	Value	Change in expenditure (Tk.)
Respondents' current monthly income (Tk.)	13356	
Income after increase by 10% (Tk)	14692	
Change in income (Tk)	1336	432
Respondents' current monthly expenditure for <i>pangasius</i> and <i>tilapia</i> fish consumption (Tk.)	460	(6.1% lower than current expenditure)
Expenditure elasticity	0.60	

Source: Authors' estimation, 2018.

Consumers' perceptions about purchasing pangasius and tilapia: Table V reveals the mathematical expression of Likert scale incorporating total weighted score (TWS), weighted average score (WAS) and the ranking of the statements based on the consumer preference. It is seen that pangasius and tilapia fish were preferred by the consumers mostly for cheaper price than other fish (ranked 1st with WAS 4.17), availability round the year (ranked 2nd with WAS 4.07) and reasonable price (ranked 3rd with WAS 4.03). The respondents also stated that they preferred pangasius and tilapia fish because of being tasty compared to other fish and good source of protein (ranked 4th and 5th with WAS 3.98 and 3.95, respectively). Other reasons that influenced the consumers to prefer pangasius and tilapia included freshness of fish, good packaging method (i.e., processed in the form of fillet), easy access to fish market, etc. (Table V).

Table V. Likert scale indicating consumers' responses about pangasius and tilapia

Statement	Nature of opinion					Total weighted Score (TWS)	Weighted average score (WAS)	Rank
	SA (5)	A (4)	N (3)	D (2)	SD (1)			
Good source of protein	50	59	25	16	0	593	3.95	5
Cheaper than other fish	50	75	25	0	0	625	4.17	1
Tasty compared to other fish	52	61	19	18	0	597	3.98	4
Easy access to fish market	0	18	33	65	44	345	2.30	8
Freshness of fish is good	32	60	22	20	16	522	3.48	6
Availability round the year	62	54	17	17	0	611	4.07	2
Good packaging method	21	49	55	25	0	516	3.44	7
Fish having bad smell	0	0	27	67	56	271	1.81	9
Reasonable price of fish	54	62	18	16	0	604	4.03	3

Source: Field survey, 2018. Note: Calculating procedure for the statement of good source of protein -

Total weighted score (TWS) = $50 \times 5 + 59 \times 4 + 25 \times 3 + 16 \times 2 + 0 \times 1 = 593$ Weighted average score (WAS) = $593 \div 150 = 3.95$; WAS for rest of the statements were computed accordingly.

CONSUMER PREFERENCES FOR PANGASIUUS AND TILAPIA FISH IN BANGLADESH

The findings are supported by a number of literatures. Aday and Yener (2014) identified packaging attributes and labels as the most important factors that might affect consumers' purchasing behaviors. Ali *et al.* (2010) found that consumers prefer cleanliness/freshness followed by price, quality, variety, packaging, and non-seasonal availability in case of buying food products. Yeung and Morris (2001) stated that consumer perception and purchase behavior was greatly influenced by food safety risk.

Determinants of consumer preferences in purchasing pangasius and tilapia: The logit models revealed that among eight independent variables included in the models, three of them were found to have significant influence on consumers' purchase preference in both cases of pangasius and tilapia (Table VI).

The estimated equation for pangasius fish was as follows:

$$Z_i = -0.249 - 0.037Q_1 + 0.007Q_2 + 0.586Q_3 + 3.264Q_4 + 4.595Q_5 + 1.109Q_6 + 0.983Q_7 - 0.001Q_8$$

The estimated equation for tilapia fish was as follows:

$$Z_i = -0.677 - 0.012Q_1 + 1.068Q_2 + 3.492Q_3 + 2.420Q_4 + 1.005Q_5 + 0.607Q_6 - 0.473Q_7 + 0.348Q_8$$

Price of fish: The results of marginal effect show that price of pangasius and tilapia fish had a negative value, and these were 0.004 and 0.340 (significant at 5% probability level), respectively. It indicated that if prices of pangasius and tilapia fish are increased by 1 unit, consumers' probability of preferring pangasius and tilapia fish will be decreased by 0.004 and 0.340 times, respectively (Table VI). The results are slightly similar with Lebieczińska *et al.* (2006) where the authors found price as a factor determining respondents' choice over both nutritive value and health impact of fish and seafood.

Table VI. Estimates of the coefficients and marginal effects of "Logit model"

Variables	Pangasius			Tilapia		
	Coefficient (β)	P> z	dZ/d Q	Coefficient (α)	P> z	dZ/d M
Constant	-0.249	0.971	-	-0.677	0.	-
Price of fish	-0.037	0.439	- 0.004	-0.012**	0.037	-0.340
Average price of other fish	0.007	0.881	0.007	1.068	0.356	0.010
Size of fish	0.586	0.233	0.573	3.492	0.710	0.008
Freshness of fish	3.264***	0.003	0.597	2.420***	0.001	0.041
Color of fish	4.595***	0.000	0.734	1.005	0.423	0.009
Taste of fish	1.109	0.349	0.148	0.607**	0.017	0.008
Family income	0.983***	0.004	0.002	-0.473	0.443	-0.455
Family size	-0.001	0.302	- 0.961	0.348	0.315	0.817

Source: Authors' estimation, 2018.

Note: *** and ** indicate significant at 1% and 5% probability level, respectively.

Average price of other fish: Average price of other fish had positive values of marginal effect which were 0.007 and 0.010 for pangasius and tilapia fish, respectively. It meant that if average price of other fish is increased by 1 unit, the probability of preferring pangasius and tilapia fish by the consumers will be increased by 0.007 and 0.010 times, respectively. In this regard, Kessuvan *et al.* (2015) identified price competition as the most critical factor affecting people's decision to purchase fishery products.

Size of fish: The results of marginal effect show that size of fish had positive values of marginal effect which were 0.573 and 0.008 in case of pangasius and tilapia fish, respectively. It implied that if size of pangasius and tilapia fish is increased by 1 unit, consumers' probability of preferring pangasius and tilapia fish will be increased by 0.573 and 0.008 times, respectively. The findings is little bit similar with Matiya *et al.* (2005) where the authors found length of fish as a factor that influence price of fish .

Freshness, color and taste of fish: The results of marginal effect show that freshness of fish had a positive value of marginal effect and these were 0.597 and 0.041 (significant at 1% probability level for both pangasius and tilapia fish, respectively). It indicated that consumers' probability of preferring pangasius and tilapia fish is higher for those fish which are fresh than other fish. Can *et al.* (2015) also found that 98% respondents preferred to consume fresh fish rather than consuming processed fish.

Color of fish had positive values of marginal effect which were 0.734 (significant at 1% probability level) and 0.009 for pangasius and tilapia fish, respectively. It revealed that the probability of preferring *pangasius* and *tilapia* fish by the consumers is higher for those fish which have appropriate color [usually silver belly with dark grey color on back for pangasius fish and light grey belly with dark grey color on back for *tilapia* (Freelancer 2015, Towers, 2005)] compared to other fish (Table VI). Hirimuthugoda *et al.* (2014) supported the findings where the authors also found color of fish as one of the main factors influencing people's dry fish purchasing decision. Taste of fish had positive values of marginal effect which were 0.148 and 0.008 in case of *pangasius* and *tilapia* fish, respectively. It meant that consumers' probability of preferring *pangasius* and *tilapia* fish is higher for those fish which have better taste than other fish (Table VI). Same as this finding, Pieniak *et al.* (2008) identified fish bones, smell and taste as important factors.

Family income and family size: The results of marginal effect show that family income had a positive value for pangasius fish and negative value for tilapia fish, and these were 0.002 (significant at 1% probability level) and 0.455, respectively. It indicates that if family income is increased by 1 unit, the probability of preferring pangasius fish by the consumers will be increased by 0.002 times and the probability of preferring *tilapia* fish will be decreased by 0.455 times. The findings are quite similar with Li *et al.* (2000) where the authors found family income having influence on

consumers' preference for fish consumption. The results of marginal effect show that family size had a negative value for pangasius fish which was 0.961, and a positive value for tiapia fish which was 0.817. It implied that if family size is increased by 1 unit, consumers' probability of preferring pangasius fish will be decreased by 0.961 times and probability of preferring tilapia fish will be increased by 0.817 times (Table VI). Onurlubas (2013) supported the study by stating that age, gender and the number of individuals in the family affect families' fish consumption amount statistically.

The study concludes that preference for pangasius and tilapia consumption is high in case of consumers belonging in the middle income groups. The study also exposes that pangasius and tilapia fish are preferred by the consumers mostly for cheaper price than other fish, availability round the year and reasonable price.

Acknowledgement: The authors express their gratitude to the Danish International Development Agency (DANIDA) for giving financial support to conduct this research. This research has been done in line with the objectives of the BANGFISH project.

Literature Cited

- Aday, M.C. and U. Yener, 2014. Understanding the buying behavior of young consumers regarding packaging attributes and labels. *Int. J. Consum. Stud.*, 38(4): 385-393.
- Ali, J., S. Kapoor and J. Moorthy, 2010. Buying behavior of consumers for food products in an emerging economy. *British Food J.*, 112(2): 109-124.
- Bertram, D., 2011. Likert Scales. [http://my.ilstu.edu/~eostewa/497/Likert%20topic-dane likert.pdf](http://my.ilstu.edu/~eostewa/497/Likert%20topic-dane%20likert.pdf).
- Burger, J. and M. Gochfeld, 2009. Perceptions of the risks and benefits of fish consumption: Individual choices to reduce risk and increase health benefits. *Environ. Res.*, 109(3): 343-349.
- Chai, A. and A. Moneta, 2010. Retrospectives: Engel curves. *J. Econ. Pers.*, 24(1): 225-240.
- Dey, M. M., 2000. Analysis of demand for fish in Bangladesh. *Aquac. Econ. Manage.*, 4(1&2): 63-81.
- Freelancer, 2015. Pangasius farming: An overview. The Fish Site. <https://thefishsite.com/articles/pangasius-farming-an-overview>.
- Gheyas, I.A., A.A. Gheyas and S.A. Sabur, 2003. Household consumption pattern and buying behavior for fish in an area Mymensingh, Bangladesh. *Bangladesh J. Fish. Res.*, 7(2): 169-178.
- Gujarati, D.N., 2003. Basic Econometrics, 4th Edition. McGraw-Hill, New York.
- HIES, 2016. Preliminary report on household income and expenditure survey, Bureau of Statistics Division, Ministry of Planning, GoB, Dhaka.
- Hirimuthugoda, N.Y., N.A. Pethiyagoda and S.T. Madusanka, 2014. Factors affecting the consumer preference and consumer buying behavior of dried fish: A case of Southern province in Sri Lanka. <https://www.cabdirect.org/cabdirect/abstract/20153384284>.
- Hutchinson, E., 2016. Principles of Microeconomics. University of Victoria, Victoria, Canada.
- Jannat, A. and M.T. Uddin, 2016. Farmers' perception about 'one house one farm' project and its impact on enterprise profitability in selected areas of Mymensingh district. *The Agricult.*, 14(1): 43-53.

- Kessuvan, A., P. Parthanadee and J. Buddhakulsomsiri, 2015. The study of consumption behaviors and factors affecting decision to purchase fishery products of consumers in the North and Northeast of Thailand. *Int. Food Res. J.*, 22(6): 2670-2678.
- Lambardo, J., 2018. Consumer preferences & choice in economics, Consumer behavior & microeconomics. Economics 101: Principles of microeconomics.
- Lebiedzińska, A., A. Kostrzewa, J. Ryśkiewicz, R. Żbikowski and P. Szefer, 2006. Preferences, consumption and choice factors of fish and seafood among university students. *Polish J. Food Nutri. Sci.*, 15/56(1): 91-96.
- Li, H.S., J.E. Houston, S.M. Wang and H.J. Lee, 2000. Factors affecting consumer preferences for fish in Taiwan. IIFET 2000 Proceedings.
- Matiya, G., Y. Wakabayashi and N. Takenouchi, 2005. Factors influencing the prices of fish in central region of Malawi and its implications on the development of aquaculture in Malawi. *J. Appl. Sci.*, 5(8): 1424-1429.
- Mozaffarian, D. and E.B. Rimm, 2006. Fish intake, contaminants, and human health evaluating the risks and the benefits. *J. Am. Med. Assoc.*, 296(15): 1885-1899.
- Mukul, A. Z.A., S. Afrin and M.M. Hassan, 2013. Factors affecting consumers' perceptions about organic food and their prevalence in Bangladeshi organic preference. *J. Business Manage. Sci.*, 1(5): 112-118.
- Obiero, K.O., M.A. Opiyo, J. Munguti, S. Orina, D. Kyule, E. Yongo, C. Muthoni and H. Charo-Karisa, 2014. Consumer preference and marketing of farmed Nile *Tilapia* (*Oreochromis niloticus*) and African Catfish (*Clarias gariepinus*) in Kenya: Case study of Kirinyaga and Vihiga Counties. *Int. J. Fish. Aquat. Stud.*, 1(5): 67-76.
- Omezzine, A., H. Boughanmi and H. Al-Oufi, 2003. Demand elasticities of fresh fish commodities: A case study. *Agric. Mar. Sci.*, 8(2): 55-61.
- Onurlubas, E., 2013. The factors affecting fish consumption of the consumers in Kesan township in Edirne. *Bulgarian J. Agric. Sc.*, 19(6): 1346-1350.
- Palash, M. S., 2004. An analysis of consumers' behavior towards fish and meat in Dhaka city. M.S. Thesis, Department of Agribusiness and Marketing, Bangladesh Agricultural University, Mymensingh, Bangladesh.
- Pieniak, Z., W. Verbeke, F. Perez-Cueto, K. Brunsø and S. De Henauw, 2008. Fish consumption and its motives in households with versus without self-reported medical history of CVD: A consumer survey from five European countries. *BMC Public Health*, 8(1): 306.
- Tower, L., 2005. Farming tilapia: life history and biology. The Fish Site.
- Uddin, M.T. and A.R. Dhar, 2018. Government input support on *aus* rice production in Bangladesh: Impact on farmers' food security and poverty situation. *Agric. Food Secur.*, 7: 1-15.
- Uddin, M.T., A.R. Dhar and N. Hossain, 2018. A socioeconomic study on farming practices and livelihood status of *haor* farmers in Kishoreganj district: Natural calamities perspective. *Bangladesh J. Exten. Educ.*, 30(1): 27-42.
- Wall, R., R.P. Ross, G.F. Fitzgerald and C. Stanton, 2010. Fatty acids from fish: The anti-inflammatory potential of long-chain omega-3 fatty acids. *Nutri. Rev.*, 68(5): 280- 289.
- Yeung, R.M.W. and J. Morris, 2001. Food safety risk: Consumer perception and purchase behaviour. *British Food J.*, 103(3): 170-187.