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Research Article

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Consumer perceptions and willingness to pay for safe fish in Bangladesh: empirical evidence from Mymensingh district

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A B S T R A C T

Ensuring food safety in aquaculture has become critical in Bangladesh, where fish is a vital source of protein. This study explored consumer perceptions and willingness to pay for safe Pangasius in Mymensingh district of Bangladesh. Data were collected from 80 consumers through a structured survey utilizing random sampling and analyzed using perception indexing and an Ordinary Least Squares regression model. The analysis revealed that 89 percent of consumers were willing to pay a premium for safe fish. Willingness to pay increased significantly with higher education, income, and profession of the consumers. Specifically, higher education levels were associated with an incremental willingness to pay of Tk. 22.02 per kilogram, while consumers with monthly incomes exceeding Tk. 50,000 were prepared to pay a premium of Tk. 26.67 per kilogram. Notably, teachers demonstrated the highest willingness to pay, with a premium of Tk. 29.38 per kilogram. The primary factors influencing consumer perceptions were health concerns, labeling and certification (index value of 0.82), and accessibility (index value of 0.7956). Among the reasons for avoiding Pangasius, 22.5 percent of consumers cited concerns over low-quality feed, followed by apprehensions about water quality and fat content, each at 17.5 percent. If safe aquaculture practices were adopted, the consumption of Pangasius could increase from 65 percent to 87 percent, reflecting heightened consumer confidence. The findings suggest that promoting certified safe aquaculture practices and transparent labeling could improve public health and enhance the profitability of the fisheries sector in Bangladesh.

INTRODUCTION

In Bangladesh, fish is the second most valuable agricultural product and a vital source of livelihood, contributing significantly to national income and food security. As the fifth-largest aquaculture producer globally (DoF, 2022), the country's per capita fish consumption stands at approximately 23 kg annually, surpassing the global average. Fish provides around 60% of national animal protein intake (Rifat *et al.*, 2023), with per capita consumption exceeding the daily protein requirement (MoFL, 2023a; 2023b; Mamun *et al.*, 2024). In the fiscal year 2023–24, the fisheries sector contributed 2.53% to national GDP, 22.26% to agricultural GDP, and 0.91% to foreign exchange earnings (DoF, 2024). Bangladesh produced approximately 5.18 million metric tons of fish, ranking third in global inland fish production, with aquaculture dominating output. The sector also employs nearly 12% of the population (DoF, 2024).

Fish is a crucial source of high-quality protein, omega-3 fatty acids, and micronutrients in the Bangladeshi diet (FAO, 2020). However, food safety concerns have increased due to risks of contamination from pathogens, heavy metals, and chemical residues (Hoque, 2020; Khan *et al.*, 2023). Public perception of farmed fish as unsafe, driven by media coverage of harmful farming practices, has intensified

consumer concerns (Hoque *et al.*, 2022). The rapid growth of commercial aquaculture, coupled with poor water quality, excessive input use, and weak regulation, has compromised fish quality and public health (Belton *et al.*, 2012). Further challenges include post-harvest losses from inadequate infrastructure (Acharjee *et al.*, 2021) and contamination with heavy metals such as arsenic and mercury (Islam *et al.*, 2020). Although production has expanded, ensuring food safety remains a pressing challenge, and rebuilding consumer trust in farmed fish requires urgent improvements in safety standards and transparency.

Among farmed species, Pangasius (Pangasius hypothalamus) has become dominant in pond aquaculture, with production reaching 3.92 million metric tons in 2022–23, surpassing tilapia (3.42 million metric tons) and rohu (3.31 million metric tons) (DoF, 2023). Pangasius is widely consumed due to its affordability, fast growth, and palatability, and it offers a favorable nutritional profile, including 18–20 g protein per 100 g, moderate fat, and essential micronutrients such as vitamin B12, selenium, and phosphorus (FAO, 2018; WHO, 2022). Despite these benefits, the species faces negative perceptions related to poor feed quality, use of synthetic inputs, muddy taste, and lack of transparency in farming practices (Hoque, 2020). This paradox highlights a key challenge: Pangasius plays an essential role in meeting national protein needs, yet its safety and quality are questioned by consumers.

Understanding consumer behavior in this context requires attention to two core constructs: willingness to pay (WTP) and consumer perception. WTP reflects the maximum amount a consumer is willing to pay beyond the market price for additional value such as safety, quality, or certification (Hanemann, 1991; Lusk and Schroeder, 2004). In food safety research, WTP quantifies the economic value consumers assign to safer production practices, traceability, or labeling (Hoque and Myrland, 2022). Perception, by contrast, refers to how consumers interpret and evaluate food quality and safety, shaped by socio-demographic factors, risk awareness, and situational cues such as certification and labeling (Claret *et al.*, 2014; Tomić *et al.*, 2017; Zanetta *et al.*, 2022). In aquaculture, perceptions are strongly influenced by concerns over water quality, antibiotic use, and feed safety (Verbeke *et al.*, 2007).

Several methods have been employed to measure consumer perceptions, including Likert scales, perception indexing, semantic differential scales (Osgood *et al.*, 1964), ranking/rating methods, conjoint analysis and best–worst scaling (Louviere and Carson, 2010; Louviere *et al.*, 2013), and structural equation modeling. For exploratory research, focus groups and interviews provide qualitative insights (Krueger and Casey, 2015). Among these, the perception index method is widely used for its simplicity, interpretability, and suitability for large-scale surveys, enabling statistical analysis of health, certification, and accessibility domains (Kotler and Keller, 2016; Mitra *et al.*, 2021). Its application in food safety research in Bangladesh further reinforces its contextual relevance.

Extensive literature has examined consumer WTP and perceptions across contexts. A scoping review in BRICS countries highlighted education, income, and risk perception as key drivers of food safety concerns (Zanetta *et al.*, 2022). In Bangladesh, consumers valued certified farmed fish but were less willing to pay premiums for frozen products (Hoque and Myrland, 2022). Studies by Saha *et al.* (2022) and Mitra *et al.* (2021) emphasized that income, education, and health consciousness strongly influence demand for safer food, while consumers perceive captured fish as safer than cultured fish. Broader studies have revealed gaps in social and environmental practices in Pangasius farming (Haque *et al.*, 2021) and identified barriers such as weak certification systems. International research has shown that health beliefs, risk perception, affordability, and cultural norms consistently influence WTP for safer or organic food products (Annunziata and Vecchio, 2011; Claret *et al.*, 2016; Haghjou *et al.*, 2013; Nguyen *et al.*, 2015; Pieniak *et al.*, 2008; Wu *et al.*, 2012; Xu and Wu, 2010). Similar findings were reported by Islam *et al.* (2020) in Bangladesh. Importantly, despite extensive global research on WTP for certified products, few studies have focused on consumer valuation of safer fish in Bangladesh, particularly Pangasius.

This study addresses this research gap by examining consumer perceptions and WTP for safe Pangasius in Mymensingh, a key aquaculture hub in Bangladesh. Using a perception index and regression modeling, it identifies the socio-economic, attitudinal, and behavioral factors influencing consumer preferences. By integrating insights from consumer perception and valuation, the study contributes to the literature on food safety in developing countries while offering policy-relevant recommendations for promoting safe aquaculture practices, certification systems, and awareness campaigns.

MATERIALS AND METHODS

Study area and data collection

This study employed a cross-sectional survey to assess consumers' perceptions and willingness to pay (WTP) for safe Pangasius in the Mymensingh district of Bangladesh. The survey design, which combined both qualitative and quantitative approaches, was carefully constructed to adhere to best practices in consumer behavior and food safety valuation research.

Primary data were collected in August 2024 through structured, face-to-face interviews with 80 randomly selected fish consumers from the BAU campus, Charpara, and Notunbazar. These sites were chosen for their active fish markets, accessibility, and anticipated cooperation from respondents, ensuring the reliability of the data. Secondary data were obtained from the Department of Fisheries (DoF), Bangladesh Bureau of Statistics (BBS), Ministry of Fisheries and Livestock (MoFL), published journal articles, and government reports, providing a comprehensive background on fish production, safety issues, and Pangasius consumption trends.

Data were cleaned, coded, and tabulated in Microsoft Excel, then analyzed using STATA 17. Descriptive statistics profiled respondents, perception index scores quantified attitudes, and Ordinary Least Squares (OLS) regression identified the socio-economic factors influencing WTP. This combination allowed systematic testing of hypotheses on consumer behavior and economic valuation.

Analytical tools

A combination of descriptive statistics and regression techniques was used to achieve the objectives and to get meaningful results. The analysis was organized around two core components.

Consumer perception index

Consumer perceptions regarding their willingness to pay for safe fish include several key factors: health perception, taste and nutrition, labeling and certification, perceived expense, and environmental concerns. These factors explain why consumers may be willing to pay more for safe fish and also reflect their overall level of satisfaction. The consumer perception of factors influencing willingness to pay for safe fish was measured using a ranked five-point Likert scale (strongly agree-5, agree-4, neutral-3, disagree-2, strongly disagree-1) (Likert, 1932). For the measurement of consumer perception of safe fish, the study estimated the rank by gaining the total average score, maximum, and minimum score for the statements or questions. This method, widely used in consumer behavior and food safety studies, allows comparison across multiple perception dimensions (e.g., labeling, nutrition, health concerns). Similar perception indexing approaches have been used by Hossain *et al.* (2020) and Ali *et al.* (2022) in assessing consumer attitudes toward food safety, aquaculture products, and labeling systems in Bangladesh and other developing countries. The measurement of the estimated equation was followed as:

$$Index = \frac{(S - S_{min})}{(S_{max} - S_{min})}$$

Here, S= Average score of the statement

S_{min} = Minimum score of the statement

S_{max} = Maximum score of the statement

In this study, index values ranged from 0 to 1, and were classified into three categories, as follows:

- Lower index value = 0.00-0.50
- Medium index value = 0.51-0.80
- Higher index value = >0.80

Factors affecting consumers' WTP

To identify the determinants of consumers' willingness to pay (WTP) for safe Pangasius fish, the study employed an Ordinary Least Squares (OLS) regression model. OLS is a widely used method in consumer behavior and valuation studies to estimate linear relationships between a continuous dependent variable and multiple explanatory variables. OLS regression has been effectively applied in similar food safety valuation studies in Bangladesh and other developing countries (Hoque and Myrland, 2022; Saha *et al.*, 2022) to estimate consumer preferences and economic behavior. The general form of the OLS model is:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\cdots+\beta_kX_k+\epsilon \quad \text{.....(i)}$$

Where, Y represents the dependent variable (maximum WTP in Tk.), β_0 is the intercept, $\beta_1,\ldots,\beta_k$ are the coefficients of explanatory variables $X_1,\ldots, X_k$, and ϵ is the error term. The specific model for this study includes the following variables:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11}X_{11}+\beta_{12}X_{12}+\beta_{13}X_{13}+\beta_{14}X_{14}+\beta_{15}X_{15}+\beta_{16}X_{16}+\varepsilon \quad \text{.....(ii)}$$

Where,

Dependent variable:

Y= Maximum willingness to pay (Tk.)

Independent variables:

X_1=Age, X_2=Education, X_3= Gender, X_4=Occupation, X_5=Household size, X_6=Monthly income, X_7= No. of child below 14, X_8= location, X_9= Pangasius preferences, X_{10}= Training on food safety, X_{11}= Food safety awareness, X_{12}= High level of omega-3, X_{13}= Health risk perception, X_{14}= Consumer tastes, X_{15}= Perception on Nutrition, X_{16}= Labeling and certification, ε= random error.

Variables description (Table 1):

Table 1: Descriptions of OLS Regression Model Variables for Safe Fish

Variables	Variable type	Description	Expected Sign
Gender	Binary	0=Male, 1=Female	+/-
Age	Continuous	The number of years	+
Education	Continuous	Years of schooling	+
Gender	Binary	0=Male, 1=Female	+/-
Occupation	Categorical	Banker=1, Farmer=2, Retired person=3, Student=4, Govt. employee=5, Teacher=6, Private service=7, Housewife=8, Businessman=9, Shopkeeper=10, Others=11	+
Household size	Continuous	The number of people in household	-
Monthly Income	Continuous	Monthly family income	+
No of the child below 14	Binary	Yes=1, No=0	-
Location	Continuous	Distance of nearer market from home	+/-
Pangasius Preferences	Binary	Whether consumers eat pangasius or not (Yes=1, No=0).	+/-
Training on Food Safety	Binary	Whether consumers receive food safety-related training or not (Yes=1, No=0).	+/-
Food safety Awareness	Binary	Consumers' knowledge about food safety. Yes=1, No=0	+/-
High level of omega-3	Binary	Do consumers know that pangasius has a high level of omega-3? Yes=1, No=0	+/-
Health risk perception	Binary	It measures a consumer's perception that consuming unsafe fish can cause	+/-

Variables	Variable type	Description	Expected Sign
		health risks/disease. No=0 (strongly disagree=0, disagree=1, and neutral=3 were valued as 0); Yes=1 (agree=4, and strongly agree were valued as 1).	
Consumer tastes	Binary	It measures a consumer's perception that safe fish will have a better taste compared to conventional fish. No=0 (strongly disagree=0, disagree=1, and neutral=3 were valued as 0); Yes=1 (agree=4, and strongly agree were valued as 1).	+/-
Perception on Nutrition	Binary	It measures a consumer's perception of whether safer fish will be more nutritious. No=0 (strongly disagree=0, disagree=1, and neutral=3 were valued as 0); Yes=1 (agree=4, and strongly agree were valued as 1).	+/-
Labeling and certification	Binary	It measures a consumer's perception that labeling and certification will affect willingness to pay for safer fish. No=0 (strongly disagree=0, disagree=1, and neutral=3 were valued as 0); Yes=1 (agree=4, and strongly agree were valued as 1).	+/-

RESULTS AND DISCUSSION

Socio-demographic illustrations

The socioeconomic profile of the respondents (Table 2) shows that 52.6% are aged between 18 and 36 years, indicating a youthful consumer base. Occupation-wise, private service holders (16.25%) form the largest group, followed by businessmen (13.75%) and government employees and housewives (11.25%).

The gender distribution reveals a male-dominated sample, with 60% male and 40% female respondents. Educationally, the majority (58.75%) have completed higher education, with an average of 15.77 years of schooling, reflecting an informed consumer base. Regarding marital and religious status, 72.5% are married, and 91.25% are Muslim, which may influence shared cultural values and perceptions. Income distribution shows that 26.25% of respondents earn more than Tk. 51,000 per month, while 22.5% earn between Tk. 30,001 and 40,000, indicating a diverse economic profile that may impact willingness to pay for safer fish.

Table 2: Socio-demographic characteristics of consumers

Particulars	Information on particulars	
	Number (No.)	Percentage (%)
Age (years)		
Less than 18	1	1.25
18-36	42	52.60
37-51	17	21.25
>51	20	25
Gender		
Male	48	60
Female	32	40
Marital Status		
Married	58	72.5
Single	22	27.5
Education level		
Primary	6	7.50
Secondary	16	20.00
Higher secondary	11	13.75
Graduate or above	47	58.75
Occupation		
Banker	6	7.50
Farmer	6	7.50
Retired person	5	6.25
Student	6	7.50
Govt. employee	9	11.25
Teacher	8	10.00
Private service	13	16.25
Housewife	9	11.25
Businessman	11	13.75
Shopkeeper	2	2.50
Others	5	6.25
Religious status		
Muslim	73	91.25
Hindu	7	8.75
Income (Tk. Per month)		
<10000	7	8.75
10000-20000	8	10.00
20001-30000	14	17.50
30001-40000	18	22.50
40001-50000	12	15.00
>50000	21	26.25

Consumers' perception of safe fish

In this study, consumers demonstrated the strongest perception score for knowledge of safe fish, with an index value of 0.89, indicating widespread awareness that safe fish are produced in controlled environments free from contaminants (Table 3). This aligns with Grunert (2005), who emphasized that increased consumer knowledge leads to greater confidence in food safety, and with Verbeke (2008), who found that informed consumers are more likely to differentiate between conventionally and safely farmed fish.

Similarly, Nayga (1999) observed that health-conscious individuals are more receptive to information about food safety, reinforcing our result. For the health perception, the index value was 0.85, showing that most respondents were aware of the potential risks from formalin, antibiotics, and unhygienic practices in conventional fish. These concerns mirror findings from Loureiro and Umberger (2007), who noted that perceived health risks strongly influence the willingness to pay for safer alternatives. Tonsor *et al.* (2009) also reported that consumers who perceive greater food safety risks are more likely to demand certified safe products.

The environmental perception index was also very high, at 0.83, suggesting that consumers are aware of the environmental implications of conventional aquaculture and value sustainability in fish farming. This supports the conclusions of Belton *et al.* (2012), who observed that urban consumers in Bangladesh increasingly prefer sustainably sourced fish. Verbeke *et al.* (2007) and Olesen *et al.* (2011) likewise confirmed that consumer concern for environmental sustainability positively influences purchase decisions, particularly in seafood.

Regarding taste and nutrition, the study reported an index value of 0.75, indicating moderate but positive beliefs about the nutritional superiority of safe fish, although perceptions of taste were less intense. Alfnes *et al.* (2006) and Brunsø *et al.* (2009) found that nutrition is a stronger motivator than taste when consumers consider premium food products. Carlucci *et al.* (2015) also noted that safety and nutrition attributes are often prioritized over sensory traits like taste, which supports our findings.

The availability index stood at 0.80, showing that consumers actively seek out safe fish and prefer its widespread accessibility, a finding consistent with Birch and Lawley (2012) and Lawley *et al.* (2012), who reported that consumers are more likely to pay a premium when safe food is easily accessible. Geng *et al.* (2022) also emphasized that accessibility significantly influences both willingness to pay and long-term consumption habits.

For pricing, the perception index was 0.78, reflecting moderate concern about affordability, particularly for lower-income consumers. This agrees with findings from Lusk and Schroeder (2004) and Loureiro and Hine (2002), who observed that while consumers often value safety, price can act as a barrier to actual purchase. Akaichi *et al.* (2012) further confirmed that consumers weigh perceived benefits against price premiums, influencing final purchase decisions.

Table 3: Consumers' perceptions regarding safe fish in different categories

Category	Perception level (out of 5)	Index
Knowledge		
Safe fish refers to fish produced in a controlled environment that is free from poisonous, harmful, or disease-causing substances	4.56	0.91
Conventional fish, typically purchased from local markets, may contain pathogenic bacteria, parasites, and chemical substances, leading to various diseases	4.34	0.87
Overall perception / index	4.45	0.89
Health		
Formalin, heavy-metal, antibiotics used in conventional fish farming	4.09	0.82
Consuming unsafe fish can cause health risk/disease	4.33	0.87
Consuming safe fish is healthier than consuming conventional fish	4.33	0.87
Unhygienic practices during fish production, selling, processing, cooking, and consumption are the source of cross-contamination	4.21	0.84
Overall perception / index	4.24	0.85
Environment		
The current fish farming process is damaging to the environment	3.95	0.79
The production of safer fish is more sustainable for the environment	4.19	0.84
Consumers will prefer fish more if produced in a safer environment	4.35	0.87
Overall perception / index	4.16	0.83
Taste and Nutrition		
Safer fish will be more nutritious	4.18	0.84
Safer fish will have a better taste compared to conventional fish	3.61	0.72
If the external appearance of a safe fish, such as the color and size of the fish and its gills, is poor, you would still buy it	3.51	0.70
Overall perception / index	3.77	0.75
Availability		
You search safe fish for consumption	4.05	0.81
Consumers should pay a premium for safe fish if available	3.98	0.80
Safe fish should be available in all stores	4.14	0.83
If the market is far from your location, you will still buy the safe fish	3.75	0.75
Overall perception / index	3.98	0.80
Pricing		
Safer fish will be more expensive than conventional fish	4.00	0.80
Only people with higher incomes can afford safer fish	3.64	0.79
You will buy more fish if you can get safer fish in your market	4.04	0.81
Overall perception / index	3.89	0.78
Labeling and Certification		
Labeling and Certification is helpful to recognize safe fish	4.08	0.82
Labeling will affect your WTP for safe fish	4.01	0.80
You are willing to improve food safety knowledge via training and workshops	3.79	0.76
Overall perception / index	3.96	0.79

Finally, labeling and certification score was 0.79, reflecting consumer trust in official markers of safety and their influence on willingness to pay. Janssen and Hamm (2012) found that certification plays a crucial role in building credibility and justifying price differentials. Ortega *et al.* (2011) and Resano *et al.* (2011) also showed that credible labeling systems significantly increase consumer trust and product selection, particularly in emerging markets.

Overall, the study's findings align well with the existing literature, reinforcing the notion that multidimensional consumer perceptions rooted in safety, knowledge, trust, and affordability jointly determine market acceptance of safe fish.

Consumers' WTP for safe pangasius

The study found that 89% of respondents were willing to pay a premium for safe fish, reflecting a growing awareness of food safety risks associated with conventional fish farming. This finding is consistent with previous studies, where consumer awareness and food safety concerns significantly increased demand for certified food products (Dey *et al.*,

2024; Loureiro and Umberger, 2007; Tonsor *et al.*, 2009). Most respondents (27.5%) were willing to pay Tk. 20 per kg, with the majority favoring moderate premiums for safe fish, while only 3.75% were willing to pay Tk. 40 per kg, indicating that price sensitivity is still a factor. This aligns with Akaichi *et al.* (2012) and Loureiro and Hine (2002), who observed that while consumers prioritize safety, price often limits their willingness to pay.

Further analysis revealed that male respondents were willing to pay more (since male buy it more), with an average WTP of Tk. 18.23 per kg, compared to Tk. 17.18 per kg for females (Table 4). This gender-based difference in willingness to pay supports the findings of Lusk and Schroeder (2004), who noted that males are often more inclined to pay for quality food attributes. Similarly, Loureiro and Hine (2002) and Akaichi *et al.* (2012) found that males tend to place more value on food safety when purchasing decisions are involved. In terms of age, younger respondents (18–36 years) showed a lower WTP (Tk. 16.39 per kg) compared to older respondents (51+ years), who were willing to pay Tk. 20.00 per kg. This pattern aligns with Brunsø *et al.* (2009), who found that older consumers tend to show greater willingness to invest in healthier food options due to increased health concerns, a sentiment also supported by Alfnes *et al.* (2006).

In terms of education, consumers with graduate degrees or higher were willing to pay Tk. 22.02 per kg for safe fish, while primary education consumers were willing to pay only Tk. 6.67 per kg. This finding is consistent with Haghjou *et al.* (2013), who found that higher education positively influences WTP for safe food, as educated consumers are more informed about food safety and more likely to invest in premium food options.

Profession was a significant determinant of WTP, with teachers (Tk. 29.38 per kg) showing the highest WTP, followed by private service providers (Tk. 21.92) and businessmen (Tk. 20.45). This suggests that educated professionals are more likely to prioritize paying for food safety. Solgaard and Yang (2011) noted that individuals with higher education and income often perceive greater value in paying extra for health and safety aspects in food.

Income also played a significant role, with higher-income respondents (earning Tk. 51,000+ monthly) willing to pay Tk. 26.67 per kg on average, while lower-income respondents (earning Tk. 10,000–20,000) were willing to pay only Tk. 8.13 per kg. This suggests that income directly affects WTP, as consumers with higher incomes have greater financial flexibility to prioritize food safety. This finding aligns with Lusk and Schroeder (2004) and Loureiro and Hine (2002), who concluded that higher-income consumers are more willing to pay for quality and safe food, while lower-income consumers face barriers due to affordability. Alfnes *et al.* (2006) and Loureiro and Hine (2002) also found that professionals with higher disposable incomes are more willing to spend in premium food products, particularly when health and safety are prioritized. Although, Akaichi *et al.* (2012) further highlighted that price remains a barrier even when consumers are aware of the safety benefits of premium products.

Table 4: Consumers' WTP premium for safe fish

Particulars	WTP premium for safe pangasius (Tk./kg)
Age (years)	
18-36	16.39
37-51	18.82
>51	20.00
Gender	
Male	18.23
Female	17.18
Education level	
Primary	6.67
Secondary	11.56
Higher secondary	15
Graduate or above	22.02
Occupation	
Banker	18.33
Farmer	6.67
Retired person	15
Student	15
Govt. employee	17.22
Teacher	29.38
Private service	21.92
Housewife	13.89
Businessman	20.45
Shopkeeper	5
Others	15
Income (Tk. Per month)	
<10000	11.43
10000-20000	8.13
20001-30000	10
30001-40000	19.17
40001-50000	19.58
>50000	26.67

When consumers were asked about the reasons for avoiding Pangasius, 22.5% of respondents cited concerns over low-quality feed, followed by water quality and fat content (17.5% each), consistent with Verbeke *et al.* (2007), who noted that consumer skepticism about fish quality is often linked to production practices. Sensory issues such as taste and smell were also significant deterrents, as reported by 15% and 16.25% of respondents, respectively. Taste and smell have long been identified as critical factors in food acceptance (Alfnes *et al.*, 2006), further emphasizing the importance of sensory qualities in fish consumption.

The introduction of safe Pangasius would increase average consumption from 4.08 kg to 5.38 kg per consumer, and Pangasius consumption rates rose from 65% to 87%. This increase in consumption suggests that addressing safety concerns, including improved farming practices and quality control, can significantly boost consumer confidence, leading to higher demand. These findings are consistent with Ramnauth *et al.* (2008), who noted that food safety interventions improve consumer trust and enhance product adoption. Similarly, Veisten (2010) found that clear communication of food safety measures is crucial for increasing consumer acceptance and consumption.

Factors affecting consumers' WTP for safe fish

The study identified several socioeconomic factors influencing consumers' willingness to pay (WTP) for safe Pangasius fish, including education, occupation, monthly income, pangasius preference, and labeling and certification

(Table 5). Education was found to be a significant factor, with the regression analysis showing a positive relationship between education level and WTP for safe fish (coefficient = 1.069, $p < 0.01$). This indicates that for every additional year of education, consumers were willing to pay Tk. 1.069 more for safe fish. This result is consistent with Haghjou *et al.* (2013), who found that higher education significantly influences WTP for safe food, as educated individuals tend to have more awareness and concern about food safety. Loureiro and Umberger (2007) also concluded that educated consumers are more informed and, therefore, more likely to invest in premium food products, especially those perceived as safer and healthier.

Table 5: Factors affecting WTP for safe fish

Max WTP	Coefficient	Std. errs.	t	P>t
Constant	-2.427	9.062	-0.27	0.790
Age	0.036	0.086	0.41	0.681
Education	1.069***	0.342	3.12	0.003
Gender	-0.090	2.267	-0.04	0.968
Occupation	0.975*	0.518	1.88	0.065
Household size	-1.124	0.984	-1.14	0.258
Monthly income	0.00009**	0.00004	2.42	0.019
No of the child below 14	1.349	1.388	0.97	0.335
Location	0.412	4.405	0.09	0.926
Pangasius preferences	6.471***	2.348	2.76	0.008
Training on food safety	3.452	2.538	1.36	0.179
Food safety awareness	0.412	2.993	0.14	0.891
High level of omega3	1.152	2.617	0.44	0.661
Health risk perception	-3.147	4.062	-0.77	0.441
Consumer tastes	1.147	3.081	0.37	0.711
Perception on nutrition	-1.788	2.113	-0.85	0.401
Labeling and certification	4.837*	2.762	-1.75	0.085
Prob > F		0.000		
R-squared		0.505		
Adj R-squared		0.380		

Occupation was another key factor influencing WTP. The results revealed a positive relationship between occupation type and WTP, with a coefficient of 0.975 ($p = 0.065$). This suggests that consumers in professions with higher disposable income or greater food safety awareness (e.g., teachers, private service providers) were more likely to pay a premium for safe fish. Though the p-value for occupation was slightly above the 0.05 significance level, the positive coefficient implies that consumers in higher-income occupations are more inclined to prioritize food safety. Solgaard and Yang (2011) noted similar findings, suggesting that professionals with higher education and income tend to place greater value on food safety, making them more likely to pay extra for certified, safe products.

Monthly income had a significant positive relationship with WTP for safe fish (coefficient = 0.00009, $p < 0.05$). This result indicates that higher-income consumers are more willing to pay for safe fish, as they have greater financial flexibility. This finding is consistent with the results of Lusk and Schroeder (2004) and Loureiro and Hine (2002), who observed that higher-income groups are more likely to invest in food safety, as they prioritize quality and health over cost. Similarly, Akaichi *et al.* (2012) confirmed that income directly impacts WTP for food safety, especially when higher-quality food options are available.

Pangasius preference was a significant determinant of WTP in this study, with a coefficient of 6.471 ($p < 0.01$), indicating that consumers who preferred Pangasius fish were willing to pay Tk. 6.471 more per kg for safe Pangasius. This reflects a strong product-specific preference, where consumers who value Pangasius are more concerned about its safety and quality. This finding is supported by Verbeke *et al.* (2007), who observed that consumer preferences for specific food types strongly influence their purchasing behavior, particularly when the product is popular but associated with health or safety concerns. By emphasizing safety in Pangasius farming, marketing efforts could boost consumer demand within this segment.

Labeling and certification emerged as another important factor, with a coefficient of 4.837 ($p = 0.085$), suggesting that consumers are more willing to pay an additional Tk. 4.837 for fish when it is labeled and certified as safe. This finding aligns with Janssen and Hamm (2012), who concluded that labeling and certification significantly enhance consumer trust and can justify a price premium, especially for products where food safety is a concern. Ortega *et al.* (2011) also found that traceability and certification are critical in increasing consumers' confidence in food safety, thereby increasing their WTP for certified products. Moreover, Resano *et al.* (2011) emphasized that trustworthy certification schemes foster consumer confidence and improve the marketability of safe food products.

CONCLUSION

This study revealed strong consumer demand for safe Pangasius in Mymensingh of Bangladesh. Education, income, occupation, gender, and product preferences significantly shaped willingness to pay, highlighting growing health consciousness and food safety concerns. These results suggest that safer aquaculture practices, coupled with transparent labeling and certification, can enhance consumer trust while improving producer profitability.

Policy measures should focus on clear labeling standards, certification of fish farms, and awareness campaigns to promote safe fish consumption. Strengthening regulatory enforcement, providing training and financial support for sustainable practices, and ensuring affordability across markets will be essential to expand access. Incentives for both producers and consumers, along with collaboration with international bodies, can further align Bangladesh's fisheries sector with global standards. Together, these actions will enhance public health, food security, and the competitiveness of the aquaculture industry.

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