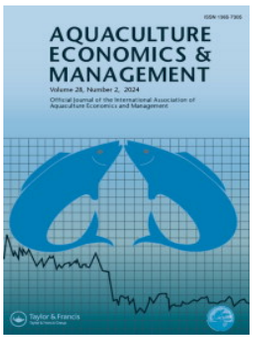

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REPORT

Consumers' willingness to pay for safer fish: Evidence from experimental auctions in Bangladesh

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ABSTRACT

Despite Bangladesh being the world's fifth-largest aquaculture producer, ensuring quality fish supply and food safety is a major challenge. Illegal practices and the presence of harmful microorganisms consistently compromise the integrity of food items throughout the value chain. To address this, a study was conducted in Bangladesh aimed to estimate consumer willingness to pay (WTP) for safer Tilapia, Pangasius, and Rohu fish using an experimental auction method. Results revealed that consumers' average willingness to pay was 29%, 10%, and 21% more for safer Tilapia, Pangasius, and Rohu, respectively, compared to less safe options despite being unaware of specific safety attributes or production practices. After getting information about the aquaculture practices used in fish production, bacterial pathogens, antibiotic levels, and heavy metal content, participants expressed their willingness to pay a higher premium of 52% for safer Tilapia, 39% for safer Pangasius, and 34% for safer Rohu fish. This dynamic illustrates that when consumers possess comprehensive product safety information, their willingness to pay becomes more rational and sensitive to minimize health risks. This WTP is more for safer fish, underscoring the critical role of safety certificates and labeling in meeting the needs of an increasingly health-conscious population.

KEYWORDS

Food safety; fish; Pangasius; Rohu; Tilapia; Vickrey Auction; willingness to pay

Introduction

Bangladesh has made remarkable progress in augmenting its fish production, ranking it the fifth-largest aquaculture fish-producing nation worldwide (FAO, 2022). Over the last two decades, total fish production increased by 152%, from 1.89 million MT in FY 2001–02 to 4.76 million

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MT in FY 2021–22 (DoF, 2002, 2022). During this period, fish production experienced an annual growth rate of 4.93%. In FY2021–22, the aquaculture/fisheries sector contributed 2.64% to the Gross Domestic Product (GDP) and 21.8% to the broader agriculture sector (BBS, 2022). Fish is one of the most consumed animal-source foods in Bangladesh (Belton & Thilsted, 2014; World Bank, 2006), and per capita fish consumption reached 22.85 kg annually in 2022 (HIES, 2023), marking a 49% increase from that of 2005 and surpassing the global average consumption of 20.5 kg (FAO, 2022). Approximately 60% of the animal protein consumed in Bangladesh comes from fish (Belton & Thilsted, 2014; Bogard et al., 2015), and fish serves as a valuable source of high-quality protein, essential fatty acids crucial for brain development, and various micronutrients (Tacon & Metian, 2013).

Despite significant advancements in the aquaculture industry, concerns persist regarding the quality and safety of fish products. Throughout every stage of the value chain, from production to consumption, fish quality and safety can be compromised by harmful microorganisms or chemicals (Khan et al., 2023). At the production level, the feed utilized in the aquaculture industry stands as a critical source of introducing hazardous elements into the food chain (Hezbullah et al., 2016; Islam et al., 2014). Antibiotics are frequently employed as growth promoters and for prevention or treatment in fish farming, as well as in animal feed and human or veterinary medicine (Mehdi et al., 2018). The indiscriminate and unethical use of antibiotics, primarily by farmers in aquaculture to manage diseases, significantly contributes to persistent antibiotic residues in fish (Diarra et al., 2007). Residues of heavy metals in fish pose a significant risk to human health, representing yet another source of foodborne contamination. Heavy metals, such as lead, mercury, chromium, and cadmium, present severe health risks (Sadeghi et al., 2015; Sharafi et al., 2019a, 2019b; Alam & Haque, 2021) and underscore the importance of monitoring and controlling their presence in fish to ensure food safety.

Foodborne illness is a severe problem in Bangladesh. Thirty million people in Bangladesh suffer at least one foodborne illness in a year (Khairuzzaman et al., 2014). Animal-source foods, such as meats, fish, and their products, are highly susceptible to foodborne diseases because they are an ideal growth medium for pathogens and other possible contaminants (Lekshmi et al., 2017). Bangladesh's seafood processing sectors, especially export-oriented large companies (e.g. frozen fish, shrimp), are well equipped to comply with international food safety standards and certifications, including HACCP certifications (Suman et al., 2021). However, fish sold in the domestic market suffer from harmful microorganisms, antibiotic residues, and heavy metals (Khan et al., 2023).

Researchers have been working on developing good aquaculture practices (GAP) for fish production, ensuring food safety. Fish produced using such cultural methods will deliver quality fish free from (or at least reduced levels of) food safety hazards, such as antibiotics, heavy metals, and harmful microorganisms. They are working to produce fish more safely without any antibiotic and growth-promoting agent (produced on hazardous element-free feed), maintaining a bio-secured system, using probiotics, phytobiotics, and other non-chemical feeds and inputs, which are safe for human health. However, the culture period might be longer to maintain a safer production system due to not using antibiotics, chemical growth hormones, or medicines.

Safe production methods using GAP might increase the per-unit costs of fish production compared to conventional ones. Therefore, the widespread adoption of food safety-compatible aquaculture production practices will depend primarily on the additional costs that can be transferred to consumers in the form of premium prices. To this end, an urgent need is to assess consumers' willingness to pay (WTP) for safer fish.

Measuring the consumer's WTP is one of the crucial aspects of promoting food safety-compatible good aquaculture practices in Bangladesh. Willingness to pay is the highest price at or below which a consumer will buy one unit of a product, and it is one of the critical components of consumer demand. Consumers' WTP for fish depends on many factors, such as the sources of fish (wild caught vs farmed fish) and the socioeconomic background of the individual consumer. Before adopting safe production practices, fish farmers would like to know the consequences of adopting such practices on their profitability and income from fish farming. Similarly, fish traders would like to know whether they can sell safe fish products at a premium price and earn more. Therefore, an accurate estimate of WTP for safe fish is crucial for the fish industry to develop and promote good aquaculture practices. Information on the consumer's WTP for safe fish is helpful to perform this challenging task. There is a lack of information on the demand for safe food and consumers' WTP for food safety in Bangladesh, especially for fish and fish products. This study quantified consumers' WTP for three fish species (Pangasius, Tilapia, and Rohu) produced using conventional production methods versus food-safety-compatible GAP. These three species together contribute 31.5% (Tilapia accounts for 10%, Pangasius has a share of 10.2%, and Rohu accounts for 11.3%) of total annual inland fish production in Bangladesh (DoF, 2022).

Materials and methods

Review of literature on willingness to pay

Determining consumers' willingness to pay (WTP) for a product is crucial in predicting its market demand. The WTP denotes the maximum amount

that a consumer is willing to spend to acquire a specific product (Wertenbroch & Skiera, 2002), and this willingness hinges on both the attributes of the product and the individual consumer's background. As per consumer economics theory, individuals strive to maximize their utility given their income constraints. Therefore, a higher WTP signifies a greater utility derived from the product.

Consumers' WTP can be measured in two ways: (1) stated preference method and (2) revealed preference method (Breidert et al., 2006). The stated preference (SP) method gathers data through direct or indirect consumer surveys. SP techniques, such as hedonic prices, contingent valuation (CV), and conjoint analysis-choice experiments, ask people questions intended to elicit their preferences for a good. However, these responses are nonbinding and hypothetical because no purchase is involved. Eliciting WTP information through surveys or SP methods is labeled as hypothetical willingness-to-pay (HWTP). On the other hand, the revealed preference (RP) method utilizes actual market data or data generated through experiments. The RP techniques exploit the fact that these consumer decisions reveal preferences for goods in both market and nonmarket contexts. The WTP measured through experimental auctions/RP method is sometimes called real willingness to pay (RWTP).

Many studies have used stated preference methods to estimate consumers' WTP for different fish species. Bronnmann and Asche (2017) measured the WTP for ecolabels of salmon consumers from northern Germany using a choice experiment. The authors found that introducing ecolables increased the consumers' willingness to pay. Bronnmann and Hoffmann (2018) examined northern German consumers' preferences and WTP for wild-caught, farmed and sustainably produced (ecolabeled and non-ecolabeled) turbot using a discrete choice experiment. The results indicated that respondents were WTP more for wild-caught fish than farmed fish. Weir et al. (2021) quantified the effect of market information on the demand for genetically modified (GM) salmon in the United States using a choice experiment. Their results indicated that participants not provided with GM information were WTP a premium for Verified Non-GM and Organic fillets but required a discount for Fed-GM and GM fillets. Tian et al. (2022) conducted a discrete choice experiment on 1,756 respondents to elicit respondents' WTP for Connecticut (the United States) aquaculture products relative to products from other states or countries. The study found that information about local economic benefits tended to increase WTP for Connecticut-grown and Connecticut-raised products. In contrast, information about health, safety, and the environment tended to decrease WTP for products from other regions. Yang et al. (2022) observed that Chinese consumers responded strongly to government restrictions during the COVID-

19 crisis. Phong et al. (2023) examined the effectiveness of sustainability labels on Vietnamese consumer preferences for sustainably farmed shrimp using a choice experiment. The study reported that Vietnamese consumers prefer sustainably farmed shrimp to conventionally farmed shrimp. It added that both food safety concerns and consumer knowledge vigorously promote sustainably farmed shrimp choices.

Limited studies explored the consumers' preference for sustainability and seafood safety attributes of Bangladesh consumers. Hoque (2021) measured consumers' perceived value of sustainability indicators (SIs) and their influence on consumers' fish purchase intent. The study analyzed data collected from 490 households in Bangladesh's Chittagong urban area. It revealed that a low level of water use and appropriate feeding in the production process (e.g. environmental and biological indicators) of farmed fish increase consumers' utility. It added that they are willing to pay a price premium for these attributes. Hoque and Myrland (2022) explored how consumers value food safety and their preferences for safety inspections of Rohu fish using the choice experiment method. The study analyzed survey data from 422 households in Dhaka and Chittagong city. The study reported that consumers' preferences for both wild and farmed fish were significantly positive. They added that consumers are most likely to reject frozen fish and be willing to pay less for it. It argued that wild-caught fish create utility for consumers without any food safety inspection, but this is not the case for farmed or frozen fish.

Mitra et al. (2021) investigated consumers' preferences and WTP for capture and culture fisheries by surveying 136 respondents in Bangladesh. Hoque et al. (2021) assessed the market potential for organically farmed shrimp in Bangladesh using relevant data generated from 660 sample households through the survey. Hossain et al. (2022) interviewed 292 fish consumers in Bangladesh and estimated their WTP for quality attributes of Pangasius using a hedonic price model. They showed that odor was the most influential attribute, and consumers wanted to pay 7% less for the Pangasius that smelled bad. The study added that quality attributes such as fish size, form, color, appearance, and abdomen were important in purchasing Pangasius fish. Hossain et al. (2023b) assessed consumers' preferences and WTP for the Hazard Analysis Critical Control Point (HACCP) of certified frozen farmed fish (major carps) in Bangladesh. Hossain et al. (2023a) surveyed 800 consumers and studied consumers' WTP for fish quality attributes in four farmed fish species (Pangasius, Tilapia, Rui, and Catla) in Bangladesh using hedonic price models.

Some research studies conducted experimental auctions to elicit or reveal consumers' WTP for food safety attributes, information, or quality certification (labeling). Gil and Soler (2006) conducted experimental auctions and

estimated consumers' WTP for organic food (virgin olive oil) in Spain. Olesen et al. (2010) used a non-hypothetical choice experiment to elicit Norwegian consumers' willingness to pay a premium for organic and animal welfare-labeled salmon. Akaichi et al. (2012) measured WTP for high-value white beans in Spain using an experimental auction. Shi et al. (2012) measured consumers' WTP for organic and local blueberries in the United States using the Becker-DeGroot-Marschak (BDM) Auction. Adhikari et al. (2021) conducted experimental auctions and estimated consumers' WTP for ready-to-cook catfish products in Arkansas in the United States. Akaichi et al. (2019) assessed the use of animal welfare and nutritional information to increase the demand for and the competitive power of organic foods using a non-hypothetical experimental auction. Hou et al. (2019) examined consumers' WTP for traceability information in Wuxi, China, by combining the multiple Price Lists method and the BDM experimental auction.

McCallum et al. (2022) conducted economic experiments following the BDM Auction and the Shenandoah Valley Produce Auction (SVPA) protocols to measure whether consumers were willing to pay a premium to avoid food fraud and purchase an authentic fish product. Ruggeri et al. (2021) used a BDM experimental auction to investigate the effect of providing additional information about Fairtrade on consumers' WTP for homegrown products (white refined cane sugar packs) in Milan (Italy) associated with Fairtrade certification. Herrington et al. (2022) conducted an experimental auction to reveal rural Bangladeshi consumers' WTP for low-milled Zinc bio-fortified rice.

Schmidt and Bijmolt (2020) conducted a meta-analysis of 77 studies reported in 47 papers measuring consumers' WTP using RP and SP methods. The study revealed that SP methods overestimate the consumers' WTP.

Our extensive literature review revealed that limited research has been conducted in Bangladesh to assess consumers' WTP for safely produced farmed fish, fish quality, and certification of quality attributes of fish. As reported earlier, several studies (Hoque et al., 2021; Hoque, 2021; Hoque & Myrland, 2022; Hossain et al., 2022, 2023a, 2023b) have focused on consumer behavior regarding fish food safety and related issues using stated preference methods. However, no studies in Bangladesh examined the fish consumers' WTP for food safety and safe fish using an experimental auction setup. Therefore, the present research will have a unique and original contribution to the existing literature.

Experimental auction methods

Participants in an experimental auction receive complete information about the product auctioned (Fox et al., 2018); thus, they realize the actual

monetary consequences of their bidding. In this auction mechanism, the participants learn that revealing true preferences is their dominant strategy (Cox et al., 1982); thus, it is incentive compatible. Because experimental auctions are based on actual behavior involving real products and real money, they produce more accurate estimates of WTP than other techniques (Akaichi et al., 2012; Lee & Hatcher, 2001).

Several auction methods are available to elicit the consumers' price behavior. These include (1) English Auction, (2) Dutch Auction, (3) Vickrey Auction, (4) Becker-DeGroot-Marschak (BDM) Auction, (5) n^{th} Price Auction, and (6) Random n^{th} Price Auction. An English auction is an open outcry ascending dynamic auction (Wikipedia, 2024). The auctioneer calls out a low price and raises it as long as there are at least two interested bidders. A Dutch auction (also called a descending price auction) is an auction method in which an auctioneer starts with a very high price, incrementally lowering the price until someone places a bid (Investopedia, 2024). That first bid wins the auction (assuming the price is above the reserve price), avoiding any bidding wars. A Vickrey auction (VA) is a sealed-bid auction where bidders submit bids without knowing other people's bids (Vickrey, 1961). The highest bidder wins the bid but pays the second-highest bid price. In the Becker-DeGroot-Marschak (BDM) auction, a person submits a bid and purchases the good if it exceeds a randomly drawn price. The difference between the BDM and the VA is that players compete against other human players in the VA, whereas in the BDM, a single player bids against a random number generator (Becker et al., 1964).

Some studies followed third-price auctions, fourth-price auctions, fifth-price auctions, and so on. The n^{th} price auction is a generalization of such auction mechanisms. In the n^{th} price auction, the auctioneer ranks the bids from highest to the lowest and arbitrarily decides the rank which will be chosen (for example, $n = 3$ from k number of bidders). In this case, the number of winners will be (n-1), who will pay the n^{th} price. In this example, the two highest bidders will win and pay the 3^{rd} highest bid.

The random n^{th} price auction combines elements of the Vickrey auction and the Becker–DeGroot–Marschak (BDM) mechanism (Shogren et al., 2001). The random n^{th} price auction mechanism works similarly to the classic second-price auction except for the endogenously determined market-clearing price. The random n^{th} price auction works as follows: each bidder submits a bid; each bid is rank-ordered from highest to lowest; the monitor selects a random number—the n in the n^{th} price auction, uniformly distributed between 2 and k (k bidders); and the monitor sells one unit of the good to each of the $(n - 1)$ highest bidders at the n^{th} price. For example, if the monitor randomly selected $n = 5$, the four highest bidders each purchase one unit priced at the fifth-highest bid.

Vickrey auctions perform better than the n^{th} price auction for on-margin or high-value products (Lusk & Rousu, 2006; Parkhurst et al., 2004; Shogren et al., 2001). Several studies (Cho et al., 2004; Lusk & Shogren, 2007; Noussair et al., 2004; Rutström, 1998) found that the Vickrey auctions approach is demand revealing and generates more accurate bids than the Becker, DeGroot, Marschak (BDM) auctions. Canavari et al. (2019) and Parkhurst et al. (2004) criticized the Vickrey auction as being precise but biased by overbidding due to the on-spot provision of 'house money'. However, Depositario et al. (2014) found no 'house money' effect on overbidding in developing countries. There has been an incentive to submit a zero-bid due to cooperative behavior, but this is not true for a larger group containing four (4) persons or more (Bonacich et al., 1976; Canavari et al., 2019; Cox et al., 1982; Huck et al., 2004; Marwell & Schmitt, 1972; Nosenzo et al., 2015). The Vickrey auction is also the most popular mechanism in researchers' toolkits, followed by the BDM mechanism (Canavari et al., 2019).

Random n^{th} price auctions performed better than Vickrey auctions for off-margin (low-value) products (Lusk & Rousu, 2006; Parkhurst et al., 2004; Shogren et al., 2001). Also, it can perform better than the BDM auction (Lusk & Rousu, 2006; Shogren et al., 2001). The BDM auction procedure can elicit valuations individually (Canavari et al., 2019), meaning there is no need for a group of people. However, Banerji and Gupta (2014), Cason and Plott (2014), and Rosato and Tymula (2019) criticized the fact that the BDM mechanism may not be incentive-compatible.

Considering the pros and cons of each auction mechanism and the popularity of Vickrey's auction, we have conducted an experimental auction following Vickrey's auction, also known as the second price sealed-bid auction. It is theoretically incentive-compatible, i.e. it is in the participant's best interest to bid their true value (Vickrey, 1961). In a second-price auction, subjects submit sealed bids; the high bidder wins and pays the second-highest bid amount for an item (Lusk & Shogren, 2007). In this method, it is critical to select the consumer panels to set up consumer acceptance or preference tests (McDermott, 1990).

Data

We have gathered consumers' WTP for three types of fish (Pangasius, Tilapia, and Rohu) produced under conventional practices and GAP. Fish produced following the GAP are considered safer fish in this study. Aquaculture specialists have been researching to develop standard practices to follow as GAP in Bangladesh. For this study, we have considered the following as part of GAP: (1) Fish farmers dried the bottom of the pond

properly and applied lime to disinfect and pest control; (2) They maintained appropriate stocking density; (3) No pollution of water from external sources/activities were allowed; (4) Regular check and maintained p^H level; (5) Maintained optimum level of water in the ponds; (6) Antibiotic free feed; (7) Maintained recommended protein percentage in feed; (8) No growth hormone or feed additives in feed; (9) Fish feed stored in a dry, cool and elevated place with adequate ventilation; (10) Use of protective cloths like face mask, gloves, etc. during feed application and handling; (11) Frequent cleaning & sanitizing of fish-producing equipment; (12) Avoid farm activities if the employees were suffering from diseases like diarrhea, dysentery, etc., or having any wounds; (13) Farmers properly managed garbage, carcasses, and waste to keep the environment pollution-free.

Experimental auctions hold consumer demand principles, and bidding prices in the auctions can relate to the real market scenario (Umberger & Feuz, 2004). Therefore, we conducted experimental auctions to generate consumers' WTP for fish produced under good aquaculture practices and conventional practices. We adopted the purposive sampling method to select the auction location and to recruit panelists for experimental auctions. The auction venues were in Mymensingh, Narayanganj, and Patuakhali districts. Mymensingh was chosen as an auction venue because it produces the highest fish species (DoF, 2022). As an auction location, Dhaka, the capital city, seemed inappropriate because gathering the required number of consumers representing rural and urban fish consumers as auction participants at a specific time in a city location might be troublesome. Hence, Narayanganj, adjacent to Dhaka city and an industrial area, was another auction venue as it is a periphery of the capital. Patuakhali district was chosen as an auction site to represent the coastal region's consumers' willingness to pay for fish that is produced safely. We have selected the auction participants (panelists) who regularly consumed Tilapia, Pangasius, and Rohu fish. All auction participants regularly buy these (Tilapia, Pangasius, and Rohu) fish from local markets and know the retail market price of these fish. During the sample selection process, we ensured the inclusion of participants from diverse socioeconomic backgrounds (gender, age, education, occupation, income, rural-urban, etc.).

To evaluate the consumers' acceptance of safer fish attributes and to reveal the consumers' WTP for those safer attributes, we raised three fish species, Tilapia, Pangasius, and Rohu, by safer means of production following GAP. We cultured fish in a farm setting at Phulpur and Muktagacha Upazila (sub-district, an administrative division in Bangladesh, functioning as a sub-unit of a district) of Mymensingh district by providing controlled feeds with no antibiotics and feed additives, as recommended by the

Bangladesh Fisheries Research Institute (BFRI) scientists. The research team harvested GAP-produced (trial) fish from the trial ponds on auction day and transported live fish to the auction venues in big water containers. On the other hand, control fish were supplied to the auction venues by the local wet market fish traders who purchased traditionally grown fish harvested from local ponds on the auction day morning and transported live fish to the auction venues in big containers. This was possible because we had contracts with the local fish market sellers beforehand. In other words, both trial and control fish were harvested on the auction day, and live fish were transported to the auction venues in big containers following the same protocols. Both trial and control fish passed through the same type of marketing channel. The only difference was in the production methods. Therefore, there is no comparability problem and attendant issues. In the past, fish traders in Bangladesh had innovated such live fish transportation in water containers to attain fish consumers' confidence that fish is free from formalin or any other preservative. Transporting live fish in big water containers to the market and selling them live is seen in many urban markets in Bangladesh. Therefore, it was not a big hassle for the research team and local market fish traders.

Before the auctions, the research team placed both types of fish in a transparent bowl with little water. The participants saw live fish during the bidding process, but fish died shortly after that. The research team analyzed the presence of microbial loads, antibiotic residues, and heavy metals in both fish samples.

Experimental auction protocols

The auction took place in two phases. In the first phase, auctions were for Tilapia and Pangasius species, and events were held in Mymensingh, Patuakhali, and Narayanganj on June 11, 2022, July 3, 2022, and July 30, 2022, respectively. The second phase centered on Rohu fish and occurred in Mymensingh on April 1, 2023, and in Narayanganj on April 4, 2023. To encourage participation, we conducted outreach activities near the auction locations, reaching out to nearby wet markets, grocery stores, and shopping centers. We distributed flyers, sent emails, and used social media platforms like Facebook for participant recruitment. The selected respondents regularly consume Tilapia, Pangasius, and Rohu fish. They were also experienced in purchasing these fish from local markets, which ensured they were well-known about the market retail price of the mentioned fish. Individuals hailed from nearby areas, traveling up to 10 kilometers to attend these events. Each participant received BDT (Bangladesh Taka) 800 to offset their transportation and other related expenses in attending the

auctions. In the first phase, 135 consumers took part, comprising 44 from Mymensingh, 46 from Patuakhali, and 45 from Narayanganj. In the second phase, 94 consumers participated, comprising 50 from Mymensingh and 44 from Narayanganj district. Participants in the experimental auctions represent various income categories, male and female fish buyers, and rural and urban fish consumers.

Upon arrival, all participants completed registration. During the registration, socioeconomic data from the participants were gathered through a semi-structured questionnaire. However, personal details like participants' names, addresses, or phone numbers were not collected. Instead, each participant received a unique identification number. This process helped us to ensure their anonymity. To acquaint participants with Vickrey's second-price auction mechanism, we conducted a brief training session for all participants at the auction venue before the actual auction with fish. During the training session, they bid for candy bars and learned about the auction process.

Two rounds of auctions were conducted for each fish species during each auction session. Four separate auction rooms were set up for each fish species. Two transparent glass bowls on two tables showcased each species' trial fish (cultivated using GAP) and the control fish (acquired from local retail markets). The tables were positioned in such a way that participants could only view one product at a time, maintaining a fair and isolated viewing experience. Fish used in the auctions (i.e. trial and control fish) were identical in size and weight. We used identification codes to differentiate between the control and trial fish.

Following the training session, participants were divided into four groups. Each participant moved from one table to another to bid on a fish species. Only one person at a time was allowed to enter a table. This arrangement facilitated the accomplishment of two auction rounds during each session. Typically, each auction session accommodated 10 to 12 participants, and the duration of each auction session averaged around 60 minutes.

During the first round of bidding for each fish, bidders were unaware of the distinction between trial and control fish. In the first round, bidders did not know the production practices (whether fish were cultivated with better management practices or cultured using traditional practices). They were asked to visually assess key attributes such as size, color, appearance, and the colors of the fish gills. Subsequently, they entered the auction rooms to quote their bidding prices per kilogram for both control and trial fish, submitting their bids in sealed envelopes provided. The second round of bidding for each fish category followed a similar process but included additional information on the source of fish (whether coming from trial ponds cultivated with good aquaculture practices or from ponds cultured using traditional practices) and laboratory test information on the safety

parameters credence attribute. Before the second round of bidding, we displayed detailed information regarding the fish production method (GAP or conventional method) and the presence of harmful microorganisms (pathogenic bacteria), antibiotic residues, and heavy metals (Pb, Cr, Cd, As) near each table where the trial and control fish were displayed. This information allowed participants to instantly compare fish production environment and safety attributes while offering bids for each species in a sealed envelope. Throughout the auction, the research team promptly addressed any queries raised by participants. We evaluated the bids for both rounds at the end of the second round. Following the bid evaluations, winners were announced and instructed to pay the second-highest price to complete the transaction.

In this study, we have estimated consumers' WTP for safer fish produced using GAP. A combination of descriptive statistics, i.e. sum, averages, percentages, etc., was used to analyze the data. We performed t-tests to estimate whether there was a significant difference in WTP for the safer fish, compared to regular fish.

Results and discussion

Socioeconomic characteristics of the consumers

The socioeconomic profile of the participants in experimental auctions is presented in Table 1. All the auction participants were Tilapia, Pangasius, and Rohu fish consumers, and they were personally involved in purchasing fish from their local markets or supershops. Auction participants have fish on their food menus on average four days a week. Thirty percent of the participants hailed from rural areas, while 70% lived in urban settings. The average family size of respondents was 4.8, slightly higher than the national average of 4.1 (HIES, 2016). Among the respondents, 68% were male and 32% were female. Most respondents (83%) fell within the 15–55 age range, commonly recognized as an active working demographic (Uddin et al., 2018). Education-wise, 58% of consumers held bachelor's (honors) degrees or higher qualifications, 23% possessed high school or higher education, and only 6% did not receive any formal education. The result indicates that most respondents were well-educated, and 50% of the bidders were service holders.

To assess the participants' response to safer fish consumption, we categorized and selected the respondents based on gender and income differentials. Fish consumers had different levels of monthly income. We purposively selected 23% of consumers from the high-income group, 29% from the middle-income group, and 48% from the low-income group. Sixty-seven percent of the female respondents were homemakers, and 75%

Table 1. Socio-demographic characteristics of the auction participants.

	Information on particulars	
Particulars	Number (No.)	Percentage (%)
Residential area		
Rural	60	30
Urban	137	70
Income-wise classification		
Male	134	68
High income (> Tk. 80,000)	43	32
Middle income (≥ Tk. 40,000 to ≤ Tk. 80,000)	44	33
Low income (< Tk. 40,000)	47	35
Female	63	32
High income (≥ Tk. 80,000)	3	5
Middle income (≥ Tk. 40,000 to ≤ Tk. 80,000)	13	21
Low income (< Tk. 40,000)	47	74
Family size	4.8	–
Education level		
Higher education (Bachelor, Hons. and above)	113	58
H.S.C.	27	14
S.S.C.	17	9
Elementary schooling	29	15
No formal education	11	6
Main occupation		
Service	99	50
Agriculture	8	4
Business	26	13
Housewife	41	21
Others	23	12
Frequency of fish consumption (days in a week)	4.4	–
Food safety training		
Yes	44	22
No	153	78
Having contact with the local food safety authority (FSA)		
Yes	38	19
No	159	81
Risk of illness due to consumption of unsafe food		
Yes	135	100
No	0	0

of the female consumers who participated in the auctions were classified as low-income background, representing 24% of the total participants. All the respondents agreed that eating contaminated or unsafe food, including fish, poses a risk of long-term health hazards. However, only 22% had food safety training regarding preparing and consuming safe foods, and 81% of consumers had no contact with the local food safety authorities or had no knowledge of such organizations or services.

Fish consumption habits of the respondents

The frequency and quantity of fish consumption among participants increase with income, and their consumption choices are closely linked to the price. The price elasticities for all fish categories in Bangladesh tend to be highest for lower-income groups, implying that poorer consumers buy cheaper species (Belton et al., 2011; Dey et al., 2010). Tilapia and Pangasius

are more affordable than other fish species, and thus, these are preferred mainly by poor and middle-class people (Uddin et al., 2019). Belton et al. (2011) reported that Tilapia and Pangasius account for 48% of total fish consumption (23% and 25%, respectively) in Dhaka, of which most of the respondents are extremely poor, poor, and middle-class consumers. The present study supported the findings of Belton et al. (2011), Dey et al. (2010), and Uddin et al. (2019). It revealed that the poor (low-income people) and middle-income people spend more on purchasing Tilapia (29% and 18% of total spending, respectively) and Pangasius (24% and 17% of total expenditure, respectively) and less on Rohu fish (13% and 10% of total expenditure on fish purchase, respectively) than the high-income group.

Willingness to pay (WTP) for safer Tilapia, Pangasius and Rohu

This section describes the consumer's WTP for safer fish based on species, income, gender, and geographical variation. The experimental auctions showed that consumers strongly preferred Tilapia, produced under good aquaculture practices, despite being unaware of specific safety attributes or production methodologies. During Round 1 of bidding, on average, consumers bid BDT 161 per kg (equivalent to $1.47 per kilogram) for safer Tilapia (i.e. Tilapia produced with GAP and referred to as trial Tilapia), marking a 29% increase compared to the BDT 125 ($1.15) for a kilogram of the wet market (control) Tilapia produced through conventional methods (Figure 1 and Table 2). It indicates a significant consumer preference for Tilapia raised in controlled environments with GAP, emphasizing different attributes like color, freshness, size, appearance, etc., over traditionally cultivated Tilapia. It is pertinent to note that during Round 1 of the bidding, participants were unaware or "blind" to the specific production practices employed for both the trial and control fish. In Round 2 of bidding, when consumers were informed about the safety measures and quality differences between Tilapia produced in controlled feed environments with GAP versus traditionally cultured ones, their willingness to pay a price premium became more sensible and health conscious. We found that consumers were willing to pay a 52% premium price per kilogram (BDT 182 or $1.70) for safer Tilapia (Figure 2). This amount was 48% higher than the auction day control price (BDT 125 or $1.14 per kg) based on appearance and 16% higher than their bid in Round 1 for the safer Tilapia (BDT 161 or $1.47 per kg). The results indicated a significant effect of safety attributes on consumers' WTP for safer fish, influencing them to place a higher value on food safety and pay less for fish lacking such safety assurances.

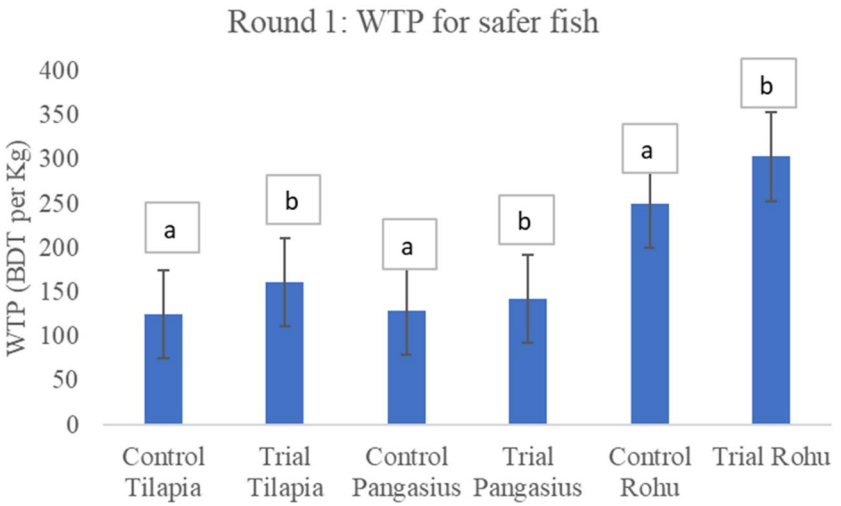

Figure 1. Average bids (BDT per kg) submitted by participants in Round 1 for different fish species grown under trial (safer) and control (conventional) production practices. Different letters in the graph indicate significant difference ($p \leq 0.05$) between WTP for trial (safer) and control fish for the same species.

In Round 1, without knowing the production environment and laboratory test results, participants' bid, on average, was 10% higher (BDT 142 or $1.30 per kg) for the safer Pangasius (i.e. trial Pangasius) compared to the relatively unsafe (control) Pangasius found in local wet markets, presumably due to its superior visible characteristics such as size, color, appearance, and the colors of the fish gills (Figure 1 and Table 2). In Round 2, when the research team disclosed the fish production methods (GAP versus conventional method) and laboratory test results, a familiar bidding pattern emerged akin to that observed with Tilapia fish. Consumers assigned a higher value in Round 2 bidding to the safer Pangasius fish produced under GAP than traditionally cultured Pangasius. On average, consumers demonstrated a willingness to pay BDT 166 ($1.52) per kilogram, representing a substantial (39%) price premium for safer fish (Figure 2). This amount stood 17% higher than their previous bid of BDT 142 ($1.30) in Round 1, which was based on the physical attributes of the Pangasius fish.

Consumers expressed higher WTP for Rohu fish produced under GAP (trial) in Round 1 when they were unaware of specific safety attributes or production methodologies. In Round 1, on average, consumers were willing to pay 21% more for Rohu fish produced under a trial production environment following GAP than control (BDT 303 or $2.76 per kg). However, the WTP increased by 34% in Round 2 when they were informed about the production method (GAP versus conventional method) and the laboratory test results (Figure 2 and Table 2). In Round 1, when consumers were unaware of laboratory test results and the production environment, they

Table 2. Consumers' WTP for per kg Tilapia, Pangasius and Rohu.

	Round 1: Based on appearance				Round 2: Based on the production environment and lab test information			
	Bid price (BDT)		Mean difference (t-value)	Price premium for safer fish (%)	Bid price (BDT)		Mean difference (t-value)	Price premium for safer fish (%)
Fish species	Control (SE)	Trial (SE)			Control (SE)	Trial (SE)		
Tilapia (135)	125 (3.10)	161 (3.91)	36 (7.20***)	29	122 (1.94)	186 (2.52)	64 (20.12***)	52
Pangasius (135)	129 (2.70)	142 (3.01)	13 (3.21***)	10	119 (1.55)	166 (2.01)	47 (19.02***)	39
Rohu (94)	250 (3.24)	303 (4.00)	53 (10.30***)	21	237 (3.24)	317 (4.19)	80 (15.12***)	34

Note: $ 1 = BDT 109.5 (Bangladesh Bank, 2023).
*** and ** indicate statistically significant at 1% and 5% significance levels, respectively.

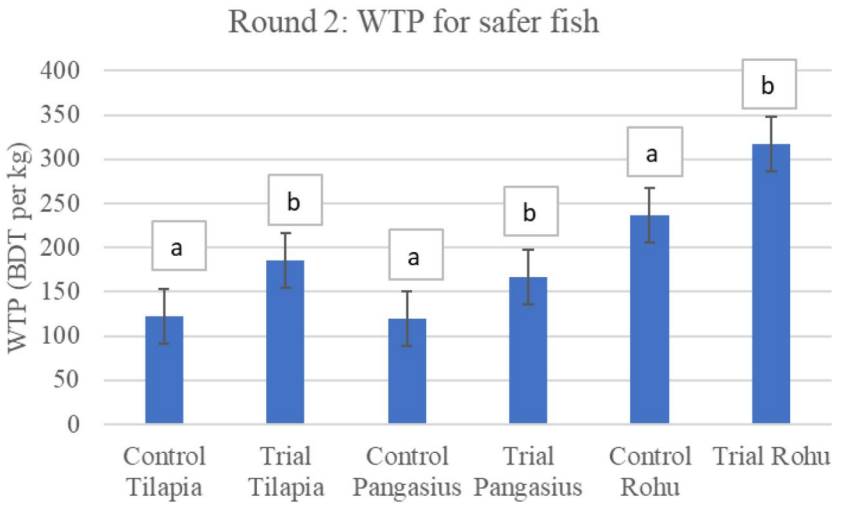

Figure 2. Average bids (BDT per kg) submitted by participants in Round 2 for different fish species grown under trial (safer) and control (conventional) production practices. Different letters in the graph indicate a significant difference ($p \leq 0.05$) between WTP for trial (safer) and control fish for the same species.

bided 6% higher for fish originating from the trial pond. In Round 2, after the disclosure of safety information, participants displayed rational buying behavior by bidding 5% less than their earlier offer (Round 1) for the control fish.

As shown in Table 2, WTP for control fish did not decrease much even after participants were informed about the production method and the quality of the control fish. The most probable reason for this is that they were well aware of the current retail market price, and their quoted price reflected the current market price for conventionally produced fish. Therefore, they did not reduce their WTP for conventionally produced fish because if their WTP is less than the current market price, they will not be able to buy it. Another probable reason might be that lab test results for both trial and control fish were within the acceptable limit in most cases. However, the test parameter values for trial fish were lower than those for control fish. Hence, we didn't tag the control fish as unsafe, but we did tag them as less safe than the trial fish.

Regional differences in WTP

Regional differences in WTP for Tilapia are reported in Table 3. As noted earlier, in Round 1, participants were bidding without information about the fish production method (GAP versus conventional production method) and the laboratory test results. In Round 2, they were informed about the production method (GAP versus conventional production method) and the

Table 3. Consumers' WTP per kilogram of safer Tilapia (bids BDT per kg).

Auction location	Round 1: Based on appearance				Round 2: Based on the production environment and lab test information			
	Bid price (BDT)		Mean difference (t-value)	Price premium for safer fish (%)	Bid price (BDT)		Mean difference (t-value)	Price premium for safer fish (%)
Fish species	Control (SE)	Trial (SE)			Control (SE)	Trial (SE)		
Mymensingh	137	159	22	16	136	184	48	35
	(4.85)	(5.40)	(8.58***)		(1.36)	(3.66)	(13.67***)	
Patuakhali	103	148	45	44	100	174	74	74
	(5.31)	(7.44)	(9.54***)		(1.33)	(4.08)	(16.72***)	
Narayanganj	137	177	40	29	131	200	69	53
	(4.28)	(6.62)	(8.87***)		(3.57)	(4.51)	(16.66***)	
Average	125	161	36	29	122	186	64	52
	(3.10)	(3.91)	(14.41***)		(1.94)	(2.52)	(25.20***)	

Note: $ 1 = BDT 109.5 (Bangladesh Bank, 2023).
*** and ** indicate statistically significant at 1% and 5% significance levels, respectively.

lab test results. Auction participants in all locations expressed a higher WTP for safer Tilapia. In Round 1, the average WTP for safer Tilapia (i.e. trial Tilapia) in Patuakhali was BDT 147 ($134) per kg, which was 44% higher than their WTP for control Tilapia. On the other hand, their WTP for trial Tilapia was 29% higher in Narayanganj and 16% higher in Mymensingh. In Round 2, following the disclosure of information, their WTP for trial or safer Tilapia increased further. In Round 2, on average, Patuakhali consumers opted to pay BDT 174 ($1.59) per kg (74% higher) for trial Tilapia rather than control Tilapia. During this round, consumers of Narayanganj and Mymensingh wanted to pay 53% and 35% premiums for safer Tilapia, respectively.

We found that the WTP for safer Pangasius was significantly higher in all locations than the control Pangasius (Table 4). In Round 1, Patuakhali consumers, on average, expressed that they were WTP a 31% premium for safer (trial) Pangasius than control Pangasius. However, Mymensingh participants expressed their interest in paying only a 2% price premium, and Narayanganj participants agreed to pay 1% more for trial Pangasius. This distinct difference in bidding behavior in Patuakhali can be attributed to the local consumers' preference for wild-caught Pangasius fish sourced from the lower part of the Meghna River—an inland open water body—rather than farmed Pangasius grown in inland closed water bodies like ponds. The river-caught Pangasius tends to possess a less pungent odor and a more appealing appearance than those cultured in ponds. Interestingly, the color and appearance of the Pangasius fish we cultivated with GAP closely resembled the river-caught fish available in Patuakhali.

In Round 2, after the disclosure of the production environment and lab test results, consumers' WTP increased significantly for trial Pangasius than control Pangasius. Their offered premium price for safer Pangasius was 52% in Patuakhali, 40% in Narayanganj, and 28% in Mymensingh. Additionally, consumers offered an 8% lower price for the control fish than their initial bid in Round 1, based solely on appearance. This downward adjustment suggests a reduced demand among consumers for traditionally cultured Pangasius, underscoring their preference for fish with assured safety attributes produced through GAP.

Auctions for Rohu fish revealed a similar bidding pattern for Tilapia and Pangasius. In Round 1, Mymensingh consumers offered a 22% price premium for a trial (safer) Rohu fish than control Rohu fish (Table 5). On the other hand, Narayanganj consumers expressed their desire to pay a 20% price premium for safer fish. After disclosing information in Round 2, consumers of both Mymensingh and Narayanganj increased their WTP for safer (trial) Rohu fish and decreased their WTP for control (conventionally produced) Rohu fish. In Round 2, consumers of Narayanganj wanted to

Table 4. Consumers' WTP per kilogram of safer Pangasius (bids BDT per kg).

Auction location	Round 1: Based on appearance				Round 2: Based on the production environment and lab test information			
	Bid Price (BDT)		Mean difference	Price premium for	Bid price (BDT)		Mean difference	Price premium for
Fish species	Control (SE)	Trial (SE)	(t-value)	safer fish (%)	Control (SE)	Trial (SE)	(t-value)	safer fish (%)
Mymensingh	133	135	2	2	129	165	36	28
	(3.14)	(2.89)	(0.95)		(1.37)	(3.12)	(14.05***)	
Patuakhali	111	145	34	31	105	160	55	52
	(5.02)	(7.76)	(6.83***)		(2.43)	(4.20)	(15.55***)	
Narayanganj	145	146	1	1	124	173	49	40
	(4.21)	(3.15)	(0.37)		(2.55)	(2.64)	(15.07***)	
Average	129	142	13	10	119	166	47	39
	(2.70)	(3.01)	(4.82***)		(1.55)	(2.01)	(24.20***)	

Note: $ 1 = BDT 109.5 (Bangladesh Bank, 2023).
*** and ** indicate statistically significant at 1% and 5% significance levels, respectively.

Table 5. Consumers' WTP per kg. of safer Rohu fish (bids BDT per kg).

Auction location	Round 1: Based on appearance				Round 2: Based on the production environment and lab test information			
	Bid price (BDT)		Mean difference	Price premium for	Bid price (BDT)		Mean difference	Price premium for
Fish species	Control (SE)	Trial (SE)	(t-value)	safer fish (%)	Control (SE)	Trial (SE)	(t-value)	safer fish (%)
Mymensingh	258	314	56	22	248	327	79	32
	(4.80)	(4.94)	(9.74***)		(4.81)	(5.52)	(10.08***)	
Narayanganj	240	289	49	20	224	307	83	37
	(3.81)	(5.88)	(10.52***)		(3.34)	(6.04)	(16.21***)	
Average	249	302	53	21	236	317	81	34
	(3.24)	(4.00)	(10.05***)		(3.24)	(4.19)	(16.88***)	

Note: $ 1 = BDT 109.5 (Bangladesh Bank, September 4, 2023).
*** and ** indicate statistically significant at 1% and 5% significance levels, respectively.

pay 37% more for safer Rohu, while Mymensingh consumers expressed 32% extra for safer Rohu fish than conventionally produced Rohu fish. The study results suggest consumers might alter their purchasing behavior when provided with more detailed information about fish production methods (GAP versus traditional methods) and product safety features.

Our study results corroborate the findings of other studies. Hossain et al. (2022) showed that odor was the most influential attribute, as consumers were found to pay 7% less if the Pangasius smelled bad. Hossain et al. (2023b) reported that, on average, consumers of wet markets in Dhaka are ready to pay a premium of 24.62% more for HACCP-certified frozen major carps. Hoque et al. (2021) observed that consumers were willing to pay more for safe shrimp than for organic shrimp. Hoque et al. (2023) demonstrated that consumers perceived the production method as the more influential attribute in choosing safe fish, and their WTP for the production method is higher than for safety claims. Tran et al. (2022) reported that Nigerian consumers were willing to pay between 3.1% and 18.8% more for fish certified as safe compared to uncertified fish. One study in Turkey (Seçer et al., 2019) reported that even though consumers were aware of food safety issues, 61.5% of them were not willing to pay a premium for a labeled fish with food safety. Menozzi et al. (2020) found positive premiums for a sustainability label and nutrition and health claims in five European countries (France, Germany, Italy, Spain, and the UK), with high heterogeneity across countries and species. The study suggested that with consumers' preferences and WTP being largely country- and fish-dependent, businesses (fish companies, retailers, and others) should consider the specific market context and adapt their labeling strategies accordingly. Using a meta-analysis of 80 worldwide studies, Li and Kallas (2021) claimed that the overall WTP premium for sustainability (in percentage terms) was 29.5% on average.

Relationship between participants' income, gender and their WTP

We have analyzed consumers' WTP and its relationship with income and gender. Table 6 revealed that consumers of all income categories were willing to pay a significantly higher price for safer fish produced through GAP than traditional methods for all species. High-income and middle-income participants made a higher bid for Tilapia and Pangasius fish than lower-income participants. This trend might stem from the financial capacity of high and middle-income consumers to afford safer food options, coupled with a potentially reduced inclination or necessity to engage in bargaining. It may be noted that female participants, constituting 84% of the low-income group, exhibited a higher willingness to pay for safer fish compared

Table 6. Consumers' WTP for safer fish by income and gender categories.

	Round 1: Appearance alone				Round 2: Information treatment			
	Bid price (BDT/Kg)				Bid price (BDT/ Kg)			
Participant	Control (SE)	Trial (SE)	Mean difference (t-value)	% Price premium (t-value)	Control (SE)	Trial (SE)	Mean difference (t-value)	% Price premium (t-value)
Tilapia								
Male								
High income	129	164	35	27	122	188	66	54
	(5.99)	(7.23)	(7.45***)		(4.55)	(5.04)	(10.51***)	
Middle income	131	164	33	28	126	190	64	51
	(7.78)	(9.45)	(7.82***)		(4.17)	(4.81)	(13.04***)	
Low income	123	158	35	27	119	178	59	49
	(5.77)	(6.07)	(7.98***)		(2.99)	(3.91)	(13.40***)	
Female	119	160	41	29	123	188	65	54
	(5.14)	(8.47)	(6.32***)		(3.77)	(6.11)	(14.44***)	
All	125	161	36	29	122	186	64	52
	(3.10)	(3.91)	(14.41***)		(1.94)	(2.52)	(25.20***)	
Pangasius								
Male								
High income	136	146	10	8	119	169	50	43
	(4.96)	(5.51)	(2.29**)		(2.79)	(4.32)	(11.78***)	
Middle income	130	142	12	8	123	170	47	37
	(6.57)	(8.79)	(1.75*)		(4.14)	(4.26)	(14.48***)	
Low income	130	140	10	8	115	157	42	36
	(5.12)	(4.63)	(2.08**)		(2.81)	(2.92)	(11.88***)	
Female	121	141	20	10	119	168	49	41
	(4.77)	(4.82)	(3.62***)		(2.44)	(4.17)	(11.39***)	
All	129	142	13	10	119	166	47	39
	(2.70)	(3.01)	(4.82***)		(1.55)	(2.01)	(24.20***)	
Rohu								
Male								
High income	253	288	35	14	249	295	46	18
	(6.75)	(7.44)	(11.63***)		(7.35)	(6.96)	(9.56***)	
Middle income	248	301	53	22	238	315	77	33
	(5.72)	(9.57)	(6.56***)		(4.82)	(9.59)	(8.17***)	
Low income	255	313	65	22	244	326	82	33
	(5.75)	(6.61)	(7.59***)		(5.29)	(4.53)	(13.04***)	
Female	243	310	67	27	215	335	120	56
	(7.64)	(7.48)	(7.36***)		(7.35)	(6.96)	(9.56***)	
All	250	303	53	21	237	317	80	34
	(4.00)	(3.24)	(14.05***)		(4.19)	(3.24)	(16.88***)	

to the low-income male counterparts. Female buyers were more sensitive to lab test information, indicating they were more health-conscious than male participants when consuming unsafe fish. The trial fish had a significantly better appearance than the control fish, leading the respondents to purchase the trial fish at a higher price (29% more on average), even though they were unaware of the source and production method of the trial fish. This inclination could be attributed to a heightened concern for the well-being of their family members, particularly children under 14 years old, aiming to protect them from potential foodborne illnesses. However, in the case of Rohu fish, an intriguing shift occurred where the low to middle-income groups, including female buyers, bid a relatively higher premium than the high-income group. This divergence in bidding behavior might be linked to lower- and middle-income consumers being less accustomed to frequent Rohu fish purchases. As a result, they might possess incomplete information regarding prevailing prices, making them susceptible to being identified by experienced sellers who could charge higher prices.

A community meeting was convened during the auction results announcement to gauge attendees' opinions on promoting safer fish at the local retail market. Most participants suggested that a quality assurance certificate with certification authority details would instill confidence in buyers and encourage them to purchase safer products. Additionally, they recommended organizing regular food safety awareness campaigns at the community level and leveraging media advertisements to promote the initiative. Following the auction sessions, we sold the safer fish to the winners and other interested participants at the winning price. Once the fish was cooked and consumed, we asked the consumers for feedback regarding its taste and smell. Consumers noted the fish's enhanced taste and aroma, specifically Pangasius, raised in a safer environment. However, conducting a quantitative analysis to measure the statistical difference in taste and smell across the treatments is beyond the scope of this study.

Conclusions and policy implications

The study depicts the consumer perception regarding safer Tilapia, Pangasius, and Rohu fish consumption and elicits the consumers' WTP for safer attributes in Bangladesh. The analysis of consumer behavior supports the producer and the marketer in recognizing the psychology of consumers, which is of enormous help in satisfying consumer needs. Moreover, studying consumer preference is indispensable to understanding how consumers choose specific produce. Due to their availability and affordability, Tilapia and Pangasius fish have become favorites for fish consumers, especially among Bangladesh's poor and middle-class consumers. However, the use of

feed additives, antibiotics as a growth promoter, and heavy metal contents and bacterial pathogens in these popular fish items pose a health risk to the consumers in the long run. This study finds that auction participants liked the appearance and color of Tilapia, Pangasius, and Rohu fish produced under GAP than those produced through conventional methods. Our analysis revealed that consumers' average willingness to pay in the first round was 29%, 10%, and 21% more for safer (GAP) Tilapia, Pangasius, and Rohu, respectively, compared to conventionally produced (less safe options) despite being unaware of specific safety attributes or production practices. After getting information about the aquaculture practices used in fish production, bacterial pathogens, antibiotic levels, and heavy metal content, participants expressed their willingness to pay a higher premium of 52% for safer Tilapia, 39% for safer Pangasius, and 34% for safer Rohu fish in the Round 2 of auctions. Our research illustrates that when consumers possess comprehensive product safety information, their willingness to pay becomes more rational and sensitive to minimize health risks. The higher WTP for safer fish underscores the critical role of safety certificates and labeling in meeting the needs of an increasingly health-conscious population. To this end, the Bangladesh Food Safety Authority (BFSA) and relevant organizations like DoF and BFRI can play a pivotal role in promoting best production practices, issuing certificates, and strengthening food safety monitoring activities.

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Ethical approval

This study followed all necessary ethics approvals since human participation was used in the experimental auction process. The ethical declaration was approved by the Ethics Review Committee (ERC), Bureau of Socioeconomics Research and Training (BSERT), Bangladesh Agricultural University, Bangladesh. Moreover, all human involvement was ensured following local legislation and institutional concerns. Besides, all procedures of this study were conducted as per the Helsinki Declaration principles of the human subject survey. No animal or human being was harmed during the auction process and verbal consent was taken from each respondent before conducting the auction.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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