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RESEARCH ARTICLE ARAŞTIRMA MAKALESİ

Fish availability, market conditions, and livelihood status of traders in a dry fish market in northern Bangladesh

Kuzey Bangladeş'de bir kuru balık pazarında balık mevcudiyeti, pazar koşulları ve tüccarların geçim durumu

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Abstract: This study was conducted in a dry fish market (Saidpur City dry fish market) in northern Bangladesh from January 2023 to June 2023 to evaluate the marketing status, price variation of available dry fish species, and livelihood status of dry fish traders. A mixed-methods approach was used in this research, utilizing both qualitative interviews and quantitative surveys. Findings revealed that there were 17 different types of dry fish along with 5 types of semi-fermented and salted fish products in the market. The average price of dry fish in the market ranged from 3.67 to 4.59 USD/kg. Surma was the most expensive fish available in the Saidpur city dry fish market (4.59-9.17 USD/kg) while Baspata was the cheapest. The livelihood status of dry fish traders was found to be closely linked to market conditions. Their income levels varied significantly depending on the location and size of the market. It was found that 48% of the traders earned 1.83 to 4.59 USD/day, while 44% of retailers earned 4.59 to 9.17 USD per day. Only 8% of the traders had a daily income above 9.17 USD. In the present study, it was observed that 62% of retailers did not take any loans, while others borrowed from banks and non-governmental organizations (NGOs). About 58.33% of retailers did not have any alternative source of income and more than 50% of dry fish traders could not pass the primary level of education. This study identified both opportunities and challenges for the dry fish market. The major constraints faced by dry fish traders were a lack of credit facilities followed by high transportation costs and inadequate storage facilities.

Keywords: Dry fish, fish price, marketing channel, economic condition

INTRODUCTION

Fish is a significant provider of animal protein and necessary micronutrients for human health. Asian people typically consume fish as their main source of animal protein (Jahan et al., 2021; Phillips et al., 2015). Although fresh fish is preferred by most Bangladeshis, chilled and dry fish are also very popular in urban and suburban areas. The export of dry fish has increased in the country to 3,301 crore BDT (302.84 million USD) in 2021-22 statistical year from 233 crore BDT (21.38 million USD) in 1997-98 (1 USD equal to 109 BDT during the study period). The revenue has increased from 3.11 million to 844.40 million BDT (Bangladeshi currency) during that period (BBS, 2023). Fresh fish makes up around 70% of the fish sold commercially, dry fish makes up 25%, and the other traditional fish processing methods include fermented and frozen products (Faruque et al., 2012). The dried fish industry offers employment to a large number of individuals, with a significant portion being women (Belton et al., 2022).

Fish drying is a vital traditional preservation technique that involves removing water from the food to prevent microbial growth (Lithi et al., 2020). Drying has some advantages over other processing techniques like freezing, chilling, and smoking, such as lower production cost and smaller storage space (Bharda et al., 2017). In all of Bangladesh's coastal regions, marine fish is frequently dried, and there is a significant market demand for these dry fish on both the domestic and global markets. In Bangladesh, fish drying typically begins in October and lasts until March. The study of Nowsad (2005) found that in certain coastal areas, the season starts in early September and might extend until May. It is available for sale in international markets like Singapore, Hong Kong, Malaysia, United Kingdom, United States of America, United Arab Emirates, and other countries (Al Mehedi et al., 2020).

Saidpur is an upazilla in Nilphamari district of Bangladesh, where a well-known dry-fish marketplace was founded in 1983. The dry fish businesses are operational from February to September. The majority of fish are caught in the Bay of Bengal, except the Banded Snakehead (*Channa striata*) found in Chalan Beel in Pabna, Natore, and Bogura districts. Dry fish meets the protein demand of the people who live in Bangladesh's North Bengal areas. It provides 65-70% protein,

15-20% fat, omega-3 and omega-6 fatty acids, and other nutrients (Majumdar et al., 2023). Additionally, marine dry fish are rich in various minerals and vitamins. However, to destroy the microorganisms, in the conventional system of fish drying, the producers of dry fish use a variety of chemicals or pesticides, including Dichlorodiphenyltrichloroethane (DDT), Sobicron, Selcron, Setara, Nogos, Rocket, and Sumithion, which are harmful to human health (Islam and Kabir, 2019).

Fish are regarded as "white meat", which is advantageous for human health. Fish drying is an age-old preservation procedure that lowers the moisture content of fish, requiring lower storage temperatures than fresh fish. Bangladeshis, particularly in coastal, central, and northeastern districts, favor dried fish (Nowsad, 2007; Mamun-ur-Rashid et al., 2023). Most dry fish available in the dry fish markets in Saidpur City are marine species, with only a small number being freshwater fish (Islam and Kabir, 2019). The freshwater fish supply has declined due to urbanization and pollution. The fisheries industry is attempting to cope with this loss through the induced breeding of fish. However, a market study in Saidpur city revealed that the demand for dried and processed fish species is high in the domestic and international markets, but no significant research has been made to look into the state of the dry fish market in this area. This study was aimed to assess the current status of the dry fish market, availability of dry fish, sources, prices, storage, marketing channels, and restrictions in the retail dried, as well as to evaluate the hygienic condition and quality of dry fish in the dry fish market of Saidpur, Bangladesh.

MATERIALS AND METHODS

A survey was conducted to collect data from various stakeholders of a dry-fish market, such as traders, processors, intermediaries, and consumers. The period of the study was from January to June 2023. Before the survey, participants' permission was considered, and all respondents were informed about the principal goal and possible benefits of the research. All participants' willingness for this study and anonymity have been assured as well as confidentiality of each interview was strictly maintained. The formal ethical agreement for this study was received from the ethical committee of the Department of Aquatic Environment and Resource Management; Faculty of Fisheries, Aquaculture and Marine Science; Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. Figure 1 shows an overview of the methodology.

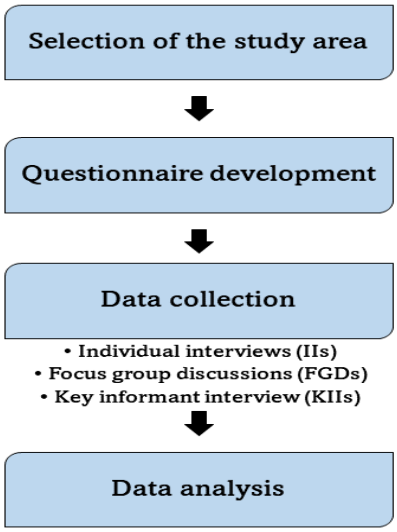

Figure 1. Flow diagram showing the methodology used for data collection

Selection of the study area

The study area was the Saidpur city dry fish market of Nilphamari District, Rangpur Division, Bangladesh. It is the commercial hub for the surrounding districts having a population of 312,988 (BBS, 2022). The study location was between 25°46' N and 88°53' E (Figure 2). It's a dry fish wholesale market situated near the Saidpur bus terminal. The dry fish shops are located on both sides of the road. This market is the second largest dry fish market in Bangladesh after Chattogram. It is also famous and popular in the northern part of Bangladesh; prices in the market are also reasonable with the quality of fish. Various types of dry fish from the local rivers and the sea are available here.

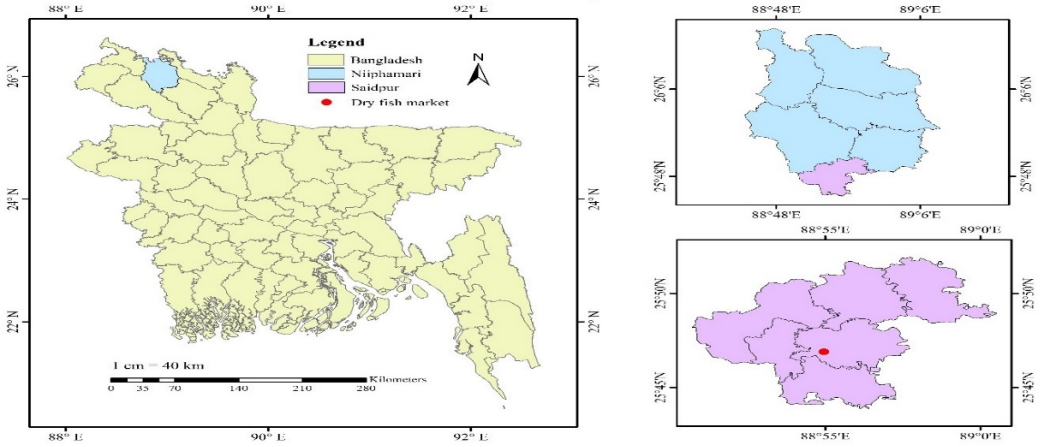

Figure 2. Map indicating the location of the study area (25°46' N and 88°53' E)

Questionnaire development

A semi-structured questionnaire was prepared to collect data. It was used to collect data for a part of the study area in order to test feasibility and effectiveness. The questionnaire was pretested on the ground and subsequently moderated based on the outcomes.

Data collection

Data were collected using participatory rural appraisal (PRA) tools i.e., individual interviews, focus group discussions, and key informant interviews (Table 1). The application of PRA tools aided a participatory and inclusive approach, engaging local stakeholders to opine on their social demographics and livelihood status.

Table 1. A summary of the empirical data collection procedure

Tools	Participants	Total participants	Research objectives
Individual interviews (IIs)	Dry fish traders, processors, market intermediaries, fishers involved in fish drying practices, consumers	40 (Male-30, Female-10)	Socio-demographic factors, fish availability, education, occupation, housing condition, income, savings, credit access, etc.
Focus group discussions (FGDs)	Young and elderly fish traders, community leaders, consumers	20	Semi-structured data gathering method that allows respondents to discuss critical issues
Key informant interview (KIIs)	Experienced traders, learned persons, researchers, government officials, NGO workers	12	Cross-checked and validated the collected data

In this study, a total of 72 individuals participated in different PRA tools. Individual interviews were conducted with 40 respondents one-on-one to collect qualitative and quantitative information. Before the interviews, the respondents were informed about the purpose and nature of this study, and their consent was obtained. Each interview was conducted for 30–40 minutes. In addition, two (02) focus group discussions, each with ten (10) participants, were conducted with various stakeholder groups to foster interaction and generate new knowledge. Each group consisted of 10 people and had a checklist, with each session lasting for 70–80 minutes. Furthermore, 12 key informants were interviewed face to face. The specific goal of such discussions was to gather data on fish drying and marketing processes, pricing, and value addition for dry fish at various levels, the supply chain, transportation, and lastly the credit system in the dry fish industry. It is worth mentioning that consistency and data reliability were ensured through FGDs and KIIs as these facilitated cross-checking of the gathered information.

Data analysis

Following data collection, data were modified for analysis. Data were collected in local units and converted into standard units for accurate analysis. The acquired data were properly summarized and tabulated in a sheet which was then transferred to the computer. The accuracy of the data was verified by comparing the original data sheets to computer spreadsheets. R and RStudio were used to process, analyze, and visualize data.

RESULTS

Dry fish sellers and consumers

In Saidpur city dry fish market, there were about 70 permanent dry fish shops with 50 owners. Some owners possess several shops and some makeshift dry fish sellers sell their products on vans and using var (a bamboo stick carrying two baskets).

It was found that 66.67% of consumers were low-income people (income $1,025 or less/year) while only 8.33% high-income people (income $12,476 or more/year) consumed dry (Figure 3).

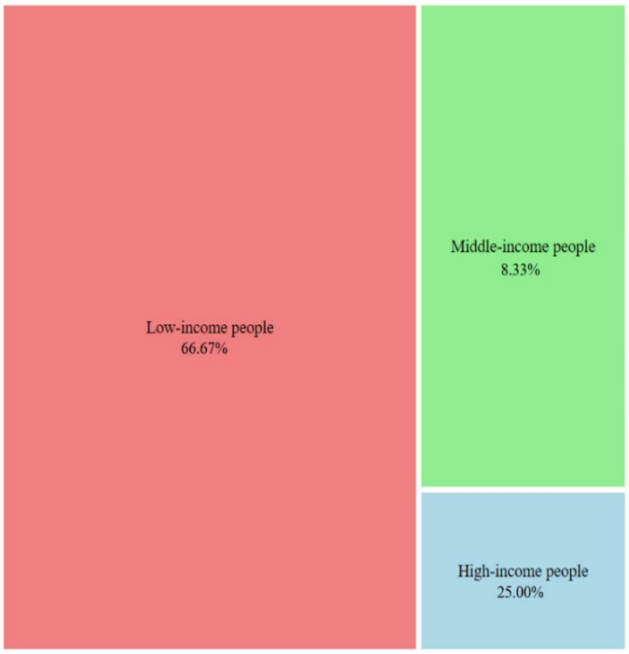

Figure 3. Distribution (%) of dry fish among different level of consumers

Availability of dry fish

In this study, we observed 18 species of dry fish and 5 types of semi-fermented and salted fish products in the Saidpur city dry fish market. Among the fish species found, 14 were freshwater, and only 4 were marine; however, in terms of price, Surma and Churi, two marine species, were the

highest. The price range varied from 1.83 to 9.71 USD/Kg. The most common dry fish species were Loitta, Churi, Holufa, Bata, Icha, Chewa, and Kachki. However, the survey recorded that the most popular and highest-selling items in the market were Loitta, Chewa, Holufa, Bata, and Churi.

Figure 4 displays the available dry fish species and their prices, while Table 2 provides data on the pricing of various semi-fermented and salted fish products. In the case of semi-fermented and salted fish products Kata Ilish and Nona Ilish were sold at the highest price (Table 2).

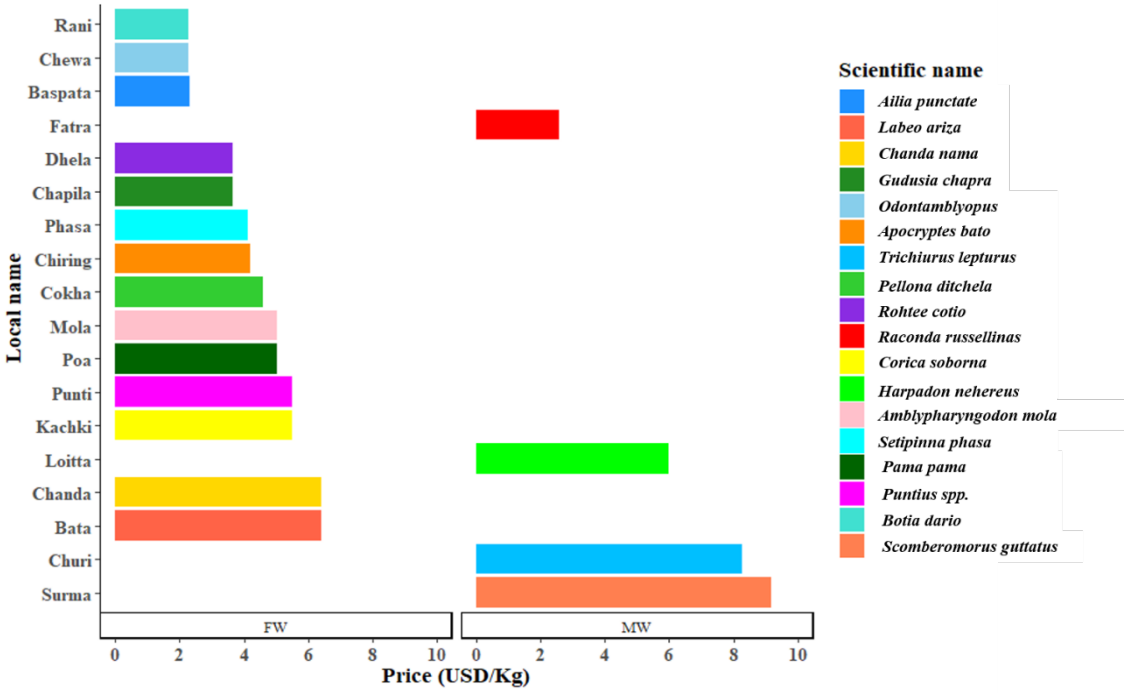

Figure 4. Available fish species price (USD/kg) in the study area

Table 2. Prices for semi-fermented and salted fish products

Local Name	Habitat	Scientific Name	Price (USD/kg)
Chingri	Marine water	*Penaeus monodon*	1.83-6.42
Punti shidal		*Puntius sp.*	2.75-5.96
Kata hilsha	Freshwater	*Hilsha ilisha*	4.58-8.25
Nona hilsha		*Tenualosa ilisha*	4.58-7.33
Phasa shidal		*Setipinna phasa*	1.83-4.58

Sources and supply of dry fish to Saidpur city market

The dry fish merchants from Khulna, Sylhet, Chittagong, Mymensingh, and Chalan Beel region (the north-west of Bangladesh) brought their fish to the Saidpur city dry fish wholesale market of Nilphamari district. The Saidpur city wholesale market was adjacent to two dry fish retail markets with 30 stores each. In the study region, there were a lot of mobile vendors who sold dry fish by physically carrying it on their bikes, vans, or rickshaws (Figure 5).

Dry fish sourced primarily from the Saidpur city wholesale market were supplied to the districts of Nilphamari, Thakurgaon, Dinajpur, and Panchagar. Thakurgaon district was the highest (35%) receiver of dry fish from the Saidpur city wholesale market. On the contrary, Dinajpur district received the lowest supply of dry fish (15%).

Marketing season

In this survey, the peak season for dry fish sales was the rainy season (June to October), followed by winter (October to March) and summer (March to June) (Figure 6).

Marketing channel of dry fish

According to our study, there was no particular marketing chain in Bangladesh for these fishery products, and the length of the channel varied depending on the location and time of year. Wholesalers and retailers acquired dry fish through a variety of intermediaries and the number of intermediaries was in between 2 to 6 during the survey. Figure 7 depicts the dry fish marketing channel in the Saidpur City dry fish market. It was noted that the retailers occasionally obtained the dry fish directly from the processors to increase their profit. It was found that longer marketing channels incurred higher costs. Likewise, the longest marketing channel was found for marine fish Surma and Churi.

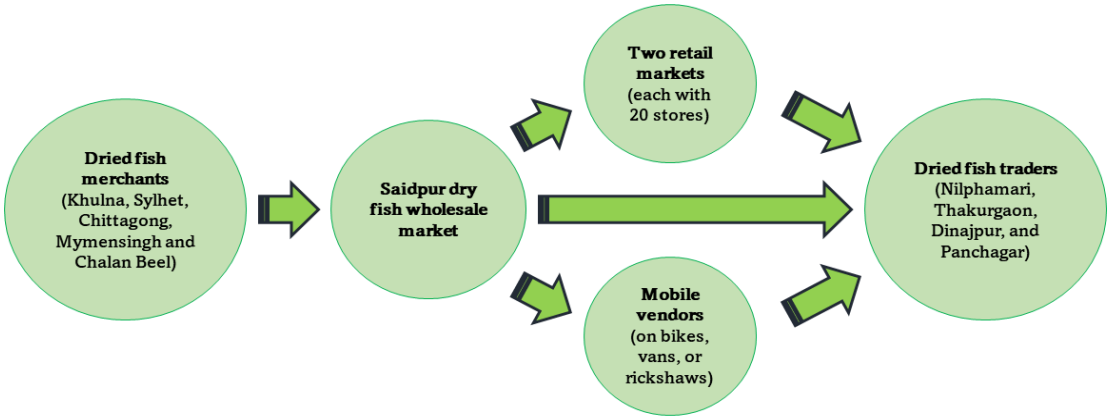

Figure 5. Sources and supply procedure of dry fish to/from Saidpur City dry fish market

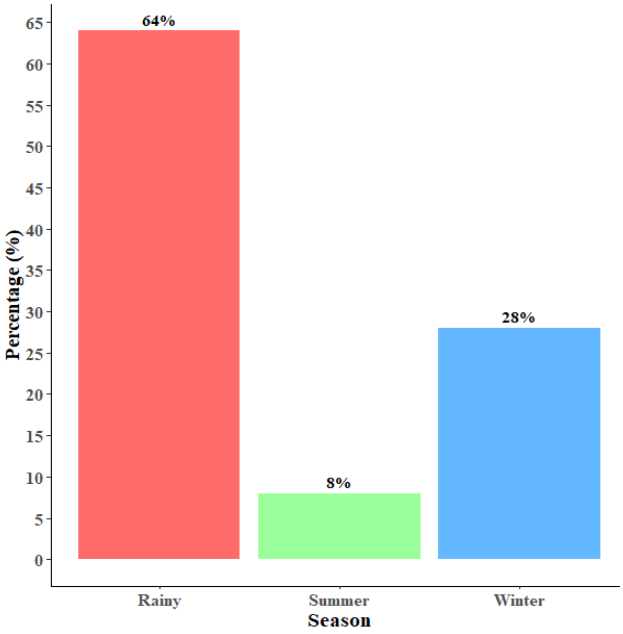

Figure 6. Peak seasons for the marketing of dry fish

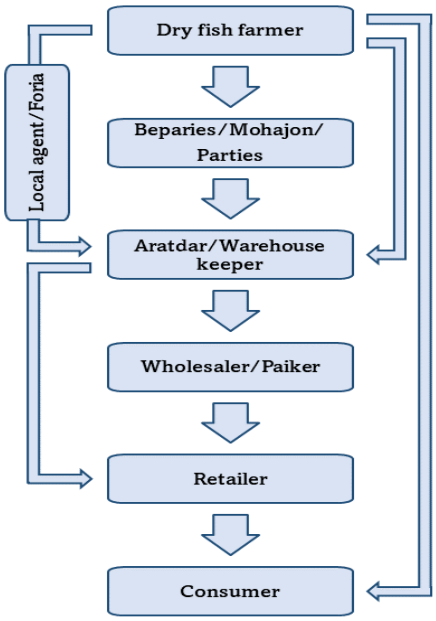

Figure 7. Dry fish marketing channel in Saidpur city dry fish market

Transport and storage

The research revealed that dry fish was transported via trucks, pickup trucks, or buses. The mode of transportation depends on the location of the market. Transportation of dry fish could take from 2 to 10 hours depending on the place of purchase. The storage period of dry fish might vary from a week to two months according to the sales. Plastic bags, jute bags, and wooden baskets were just a few of the many types of bags and baskets used for storage. Products made with Hilsha were stored in plastic buckets and bowls. Shidal of Punti and Faisa were preserved in an earthen vat. The dry fish was kept without refrigeration. It was notable that only 18 shops had storehouses during the survey of 70 permanent shops. No incidents of insecticide application for dry fish during storage were reported in the survey. The producers only used mustard oil to preserve products made from Hilsha, such as Nona Hilsha and Kata Hilsha. However, some respondents stated that fly infestation on dry fish resulted in financial loss. It was evident that the infested dry fish was sold at a discount price to the manufacturer of the fish meal. Moreover, 37.50% of respondents stated that they used preservatives to stop insect infestation, sepsis, and to make the color brighter.

Socio-economic condition of dry fish traders

Table 3 provides a socio-economic overview of dry fish retailers. The dry fish traders are from various age groups. However, 50% of them belong to the age group of 21-35. 33.33% of individuals had 21 to 30 years of experience, and 29.17% had 5-10 years of experience (Table 3).

Three-quarters of the participants had primary or high school education. The current study found that 58.33% of interviewees had no alternative source of income while rest had alternative means of revenue such as grocery shop (8.33%), crop farming (16.67%), and livestock rearing (4.17%) (Figure 8).

Table 3: Socio-economic condition of dry fish retailer

Parameters	Categories	Number of respondents	Percentage (%)
Age group (year)	<20	3	4.17
	21-35	36	50.00
	35-50	27	37.50
	>50	6	8.33
Education level	Illiterate	9	12.50
	Sign only	9	12.50
	Primary	30	41.67
	Secondary	24	33.33
Experience of business (year)	<5	6	8.33
	5-10	21	29.17
	11-20	18	25.00
	21-30	24	33.33
	>30	3	4.17
Sources of alternative income	Yes	30	41.67
	No	42	58.33
Daily average sell (kg)	1-5	33	45.83
	5-10	21	29.17
	10-20	12	16.67
	>20	6	8.33
Daily average income (USD)	1.83-4.58	36	50.00
	4.58-9.17	30	41.67
	>9.17	6	8.33
Housing structure	Katcha (strponents)	2	2.78
	Tin-shed	48	66.67
	Half cemented building	20	27.77
	Cemented building	2	2.78

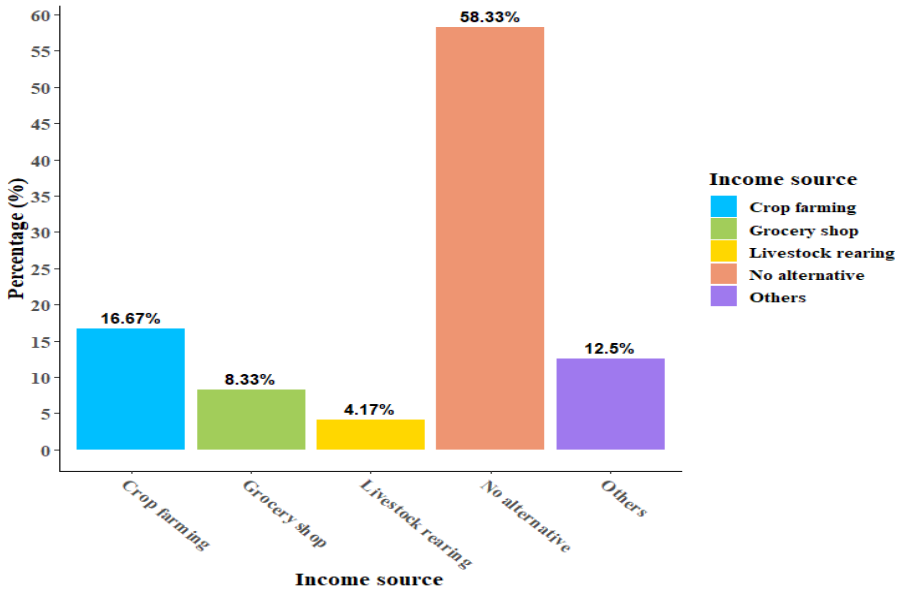

Figure 8. Different income source of fish traders

According to the survey, 45.83% of retailers sold 1-5 kg of dry fish per day, while 29.17% sold 5-10 kg per day. Half of the traders earned 1.83 to 4.58 USD/day while 41.67% of farmers earned up to 9.17 USD. Only 8.33% of farmers earned more than 9.17 USD (Table 3).

Figure 9 depicted that 37.50% of the dry fish traders consulted the village doctor locally known as Kobiraj for health issues, while just 12.50% have access to doctors having a Bachelor of Medicine and Bachelor of Surgery (MBBS). According to the current survey, the majority of respondents (83.33%) used their own tube well for drinking water, while 16.67% of retailers utilized a neighbor's or a public tube well.

In our study, it was observed that the majority of respondents (62.22%) financed their business with their own capital, whereas the remaining retailers took loans from banks and local NGOs (Table 4).

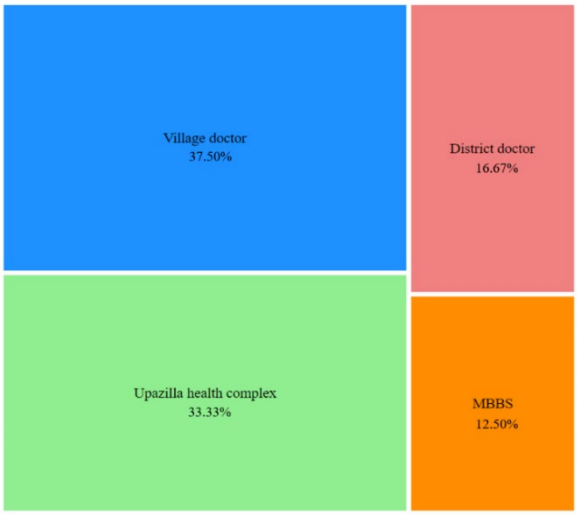

Figure 9. Various types of health facilities for retailers in the study area

Table 4. Credit facilities of the retailers in the study area

Credit facilities	Percent of retailers (%)
Not taking loan	62.22
Bank	5.00
NGOs	32.78

Major constraints of the dry fish market

The dry fish market in Saidpur city had a number of challenges including capital shortage, high transportation costs, insufficient storage space, and unhygienic market conditions. Besides, some interviewees mentioned other constraints like interference of local influential persons and availability of alternate protein sources like meat or fresh fish (Figure 10). In the present study, 33.33% of respondents think they could not smoothly run the business due to the shortage of capital. In addition, one-quarter of respondents expressed that higher transportation costs have taken a toll on their business. Furthermore, 16.67% of respondents found inadequate storage facilities a hurdle for their business.

In addition, quality control and hygiene standards are a significant challenge. Ensuring that dry fish products meet safety and quality standards is essential, but it can be difficult to maintain these standards throughout the production and distribution chain. 12.50% of the respondents perceived that dry fish is unhygienic. Finally, competition from alternative protein sources and imported products can influence the dry fish market. Affordable and readily available substitutes can challenge the market's growth and profitability. Addressing these constraints is crucial for the sustainable development of the dry fish industry.

DISCUSSION

In the study area, there were a total of 70 permanent shops and several temporary shops. Kleih et al. (2003) found that there were 200 wholesalers in the Asadganj dry fish market, Chattogram which is the largest in Bangladesh, and people in that region historically like dry fish. It is believed that low-income people consume more dry fish than rich people in society. The probable reason is that it requires a small amount for a meal and there are no issues with storage. On the other hand, comparatively high-income people are not inclined to take dry fish due to the popular belief that during the storage of dry fish, different chemicals or pesticides are used. A Similar trend was observed in research conducted by Islam et al. (2020). The study revealed that 36% of customers worked in business and 27% worked in low-wage jobs without a bachelor's degree, whereas 11% of consumers were middle to upper-class job holders with a bachelor's degree.

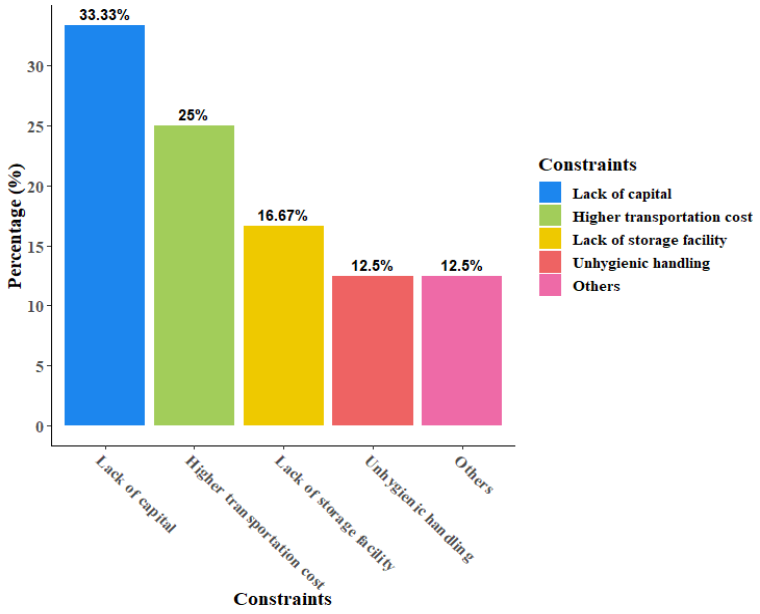

Figure 10. Some major constraints facing in the dry fish market

A total of 23 dry fish products, 18 different species and 5 types of semifermented products, were found in the study area. Of which only four types of dry fish were from marine sources because of the location of the market which is situated far from the sea. Haque et al. (2015) and Hasan et al. (2016) observed 35 (29 freshwater species) and 22 (all freshwater species) dry fish species in dry fish markets in Sylhet, Bangladesh, respectively. Flowra et al. (2010) reported 25 dry fish species in the different markets of Rajshahi and Thakurgoan. Species of a market can vary due to the source of fish and consumers' preferences. In this study, the price ranges varied from 1.83 to 9.71 USD/Kg. Hasan et al. (2016) found the price variation from 2.75-7.34 USD/kg in Sylhet, Bangladesh, and Monir et al. (2013) observed the ranges of price from 0.78 to 5.50 USD/kg. Although a bit of variation was noticed due to the time difference of conducting research, both studies support our findings. In Bangladesh, dry fish is produced commercially in significant amounts in Nazirartek, Choufaldandi, Khurushkul, Maheshkhali, and Teknaf of Cox's Bazar district (Alam, 2005; Hossain et al., 2015). It is also found in other districts namely Rajshahi, Thakurgaon, Patuakhali, Sundarbans, Nilphamari, Mymenshingh, and Sylhet (Al Mehedi et al., 2020). Sources of dry fish in a market depend on the distance of the market from that source and the communication system and associated cost. Dry fish from the Chalan beel region reached this market owing to the shortest distance and minimal cost.

The availability of dry fish and fresh fish in a particular region may impact the supply chain in that region. Thakurgaon district received more dry fish than other districts. This is because of lower dry fish production (0.1 metric ton) in Thakurgaon compared to other districts. On the other hand, Dinajpur acquired less as it had an available supply of fresh fish from its sources (DoF, 2022). As of today, no fish has been exported abroad from the region commercially which was observed in other fish markets in the country like Asadganj Dry Fish Market, Chittagong (Faruque et al., 2012). In the study, the peak season of dry fish trading was found from June to October and the lean season was observed from March to June which was slightly different from the findings of Ghorai et al. (2014) and Faruque et al. (2012), respectively. Ghorai et al. (2014) found peak season during October-January in Egra dry fish market, East India and Faruque et al. (2012) found November in a dry fish market in Chittagong, Bangladesh. However, Hossain et al. (2013) stated that dried marine fish is consumed all year long, whereas dry freshwater fish is more sporadic and more readily available in the winter. This study along with other research findings revealed that the market channel of dry is not fixed. In the study of Flowra et al. (2010) most of the retailers were found to buy dry fish from the aratdars of Feni and Chattogram and some from wholesalers of Chowmuhani, Noakhali in terms of necessity. Similar results are observed by other researchers (Aziz et al., 2019; Purkait et al., 2018). It is assumed that the length of the channel varied depending on the location and time of year. In this survey, it was found that different vehicles are used for transportation. Faruque et al. (2012) stated that traders transported products by boat/mechanical boat, vehicles, head loads/shoulder loads to the Asadganj fish market, Chattogram. According to Hall (1997), there might be high risks of rancidity during prolonged storage conditions due to the fatty nature of fresh fish. However, in the case of this study area, such a problem was not heard of as mostly lean fish were chosen for drying.

The socio-economic condition of dry fish retailers in Bangladesh might vary based on factors such as location, market dynamics, and government policies. From this current survey, it was assumed that dry fish retailers often come from lower-income backgrounds and rely on this business for their livelihood. In the current study, it was recorded that 87.50% of traders fall in the age range from 21-50 years old. An earlier study on the socioeconomic situation of dry fish retailers reported that the retailers' ages ranged greatly from 20 to over 55 years old (Nath et al., 2013). Age and years of experience impact the income of stakeholders as fish drying is an assiduous activity (Kaiya et al., 1987). Though only 41.67% of traders had alternative income sources they are engaged in various works. Ahmed et al. (2007) revealed diverse livelihoods in Kutubdia Island and Cox's Bazar which is similar to this study. Findings showed that approximately 51% rely on off-farm activities, notably fishing, 18% on non-farm work, 4% on livestock, 13% on small-scale aquaculture and farming, and 14% on off-farm wage labor. In the current study, it was observed that daily sales and income varied from 1 to >20 kg and 1.83 to > 9.17 USD. A study conducted in a dry fish market found that product sales varied from market to market and ranged between 4 and 10 kg per day (Hasan et al., 2016). A study found similar results where 48% of retailers earn 200-500 BDT (1.8-4.5 USD), 44% earn 500-1000 BDT (4.5-9.1 USD) and 8% earn more than 1000 BDT (9.1 USD) daily in a dry fish retail market in Noakhali (Saha et al., 2022). Moreover, the average income of retailers in seven dry fish markets was estimated as BDT 591.89/day/retailer (5.39 USD/day/retailer), whereas the average profit of retailers in seven markets was BDT 450.69/day/retailer (5.39 USD/day/retailer) (Aktar et al., 2013). These results also support our research findings.

The two-third (66.67%) traders lived in the tin shed house and almost one-third (27.77%) in half cemented buildings in the study area. Similar results are found in Barishal, Kuakata and Noakhali. Studies recorded a majority of dry fish producers used tin shed houses; 53.33% in Barisal (Kubra et al., 2020), 41.67% in Kuakata (Kubra et al., 2020) and 70% in Noakhali (Khatun et al., 2013; Leela et al., 2018). In terms of health facilities in the present study, 37.5% of people depend on village doctors locally known as kobiraj. Similarly, according to Ali and Haque (2011), 40% of fish farmers in the Mymensingh district rely on village doctors or kobiraj for health care. The drinking water scenario of the current study is fairly prevalent in Bangladesh (Ali and Haque, 2011). Most traders rely on their capital as dry fish trading does not require

a huge amount of money. However, one-third of the traders take loans from NGOs with high-interest rates. The findings were supported by Nayeem et al. (2010) and Ali and Haque (2011) for the fish farmers in the Mymensingh district.

The fish market of Bangladesh faces several constraints that impact its growth and sustainability, which may differ depending on the region and market characteristics (Nadia et al., 2022). The limitations identified in the study region were comparable to those found in other studies on both wholesale and retail markets for dried fish. These constraints included rapid spoilage of dried fish, low consumer demand, high transaction costs, poor management skills, limited access to credit facilities, and a lack of marketing infrastructure, transportation, and storage facilities (Monir et al., 2013; Shuchi et al., 2022). There is no denying the fact that the profitability of fish marketing has remained a persistent challenge for the industry (Adegeye and Dittoh, 1982). Rural farmers believe that a premium will be paid for fish in urban or pre-urban markets, but they are hampered by transportation issues (Akinneye et al., 2007) owing to limited market access and distribution barriers that pose hurdles. This is because dry fish is often produced in remote or coastal areas, which restricts its access to broader markets. Concerning hygiene, Reza et al. (2005) investigated traditional drying practices for marine fish in Bangladesh's coastal region. They found that processors commonly soak raw fish in insecticides like DDT and Nogos (Dichloroves) before drying, with concentrations ranging from 20-80 ppm. Traders should prioritize the production of safe dry fish to address consumer concerns about potential long-term risks to their families and others (Belton et al., 2022; Siddique, 2012). It has been stated that retailers confront different internal challenges when selling products in retail markets, such as interference by musclemen and local leaders (Amin et al., 2012), which is consistent with our findings.

CONCLUSION

For the people of Bangladesh, dry fish is a significant source of protein and minerals. Low-income people rely heavily on it because fresh fish is prohibitively expensive for them. The dry fish market also creates employment opportunities. Thus, the Saidpur region might have a great potential to be a key supplier of dry fish. However, the variety and the price of dry fish has fluctuated over the years due to various factors such as the time of year, supply and demand dynamics, and consumer preferences. Socio-economic factors, including the income levels and purchasing power of consumers, also play a crucial role in shaping the demand for dry fish. Most of the traders of the dry fish are significantly influenced by the changes in market conditions and consumer behavior. To thrive in this market, dry fish retailers need to adjust their strategies according to the socio-economic status and consumer preferences. Improving fish product hygiene and reducing marketing intermediaries can lower the price of product at the consumer level. Considering the challenges and opportunities, this region needs to be studied for further development of the dry fish industry. Additionally, it is recommended to study the interplay between market trends and socio-economic conditions, which would facilitate policymakers to make informed decisions to sustain the dry fish business and improve the livelihood status of the fish traders.

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AUTHORSHIP CONTRIBUTIONS

Md. Foysul Hossain: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, review & editing. Md. Mosiur Rahman: Data curation, Methodology, Formal analysis, Writing –original draft. Truong Dan Nguyen-Pham, Koushik Chakroborty and Bhaskar Chandra Majumdar: Methodology, Investigation, Writing – review & editing.

DECLARATION OF INTEREST:

Authors declare no conflicts of interest in the reported work.

ETHICS APPROVAL STATEMENT

Ethical approval for this study was obtained from The Ethical Committee, Department of Aquatic Environment and Resource Management, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh.

DATA AVAILABILITY

Data will be made available on request.

REFERENCES

Adegeye, A.J., & Dittoh, J.S. (1982). *Essentials of Agricultural Economics*. Centre for Agricultural and Rural Development, University of Ibadan.

Ahmed, M., Islam, M.N., & Shamsuddoha, M. (2007). Value chain analysis in the dry fish production and marketing of postharvest fishery products (PHFP) in the coastal belt of Bangladesh. *Bangladesh Fisheries Research Forum (BFRF)*, Mymensingh, Bangladesh.

Akinneye, J.O., Amoo, I.A., & Arannilewa, S.T. (2007). Effect of drying methods on the nutritional composition of three species of fish (*Bonga* sp., *Sardinella* sp. and *Heterotis niloticus*). *Journal of Fisheries International*, *2*(1), 99–103.

Aktar, N., Islam, M.R., Hossain, M.B., & Rahman, M. (2013). Fish species availability and marketing system of fish in different markets of Noakhali district in Bangladesh. *World Applied Science Journal*, *22*(5), 616–624. https://doi.org/10.5829/idosi.wasj.2013.22.05.66117

Al Mehedi, M.J., Shahriar, A., Fahim, S.M.H., & Uddin, M.G. (2020). Status of drying fish, marketing channel and associated problems in the Kuakata

coast of Patuakhali district, Bangladesh. *Asian-Australasian Journal of Bioscience and Biotechnology*, *5*(2), 48-59. https://doi.org/10.3329/aajbb.v5i2.53863

Alam, A.K.M.N. (2005). Low-cost processing of fish in coastal Bangladesh. Bgd/97/207. Food and Agriculture Organization of the United Nations. *Bangladesh Representation Office*, Dhaka, Bangladesh, 73.

Ali, H., & Haque, M. (2011). Impacts of *Pangasius* aquaculture on land use patterns in Mymensingh district of Bangladesh. *Journal of the Bangladesh Agricultural University*, *9*(1), 169-178. https://doi.org/10.22004/ag.econ.208635

Amin, M.A., Islam, M.R., & Hossain, M.B. (2012). Marketing channel of dried marine fish in the southeastern coastal belt of Bangladesh. *Middle-East Journal of Scientific Research*, *12*(3), 301–306. https://doi.org/10.5829/idosi.mejsr.2012.12.3.6464

Aziz, A., Sahu, S., Das, B.K., Dora, K.C., Chowdhury, S., Hazra, S., & Sahu, S. (2019). The efficiency comparison of marketing channels at Jagiroad dry fish market, Assam during 2017-2018. *Journal of Entomology and Zoology Studies*, *7*(5), 1273–1275.

BBS (Bangladesh Bureau of Statistics). (2022). *Population & Housing Census 2022 Preliminary Report*.

BBS (Bangladesh Bureau of Statistics). (2023). *Statistical Yearbook Bangladesh 2022* (42nd ed.). https://bbs.gov.bd/ S

Belton, B., Johnson, D.S., Thrift, E., Olsen, J., Hossain, M.A.R., & Thilsted, S. H. (2022). Dried fish at the intersection of food science, economy, and culture: A global survey. *Fish and Fisheries*, *23*(4), 941–962. https://doi.org/10.1111/faf.12664

Bharda, S., Desai, A.Y., Kumar, T.R., & Kumar, T.J. (2017). Production of different type of dry fish and its yield measurement at Veraval, Gujarat, India. *Research Journal of Recent Sciences*, *6*(7), 28–32.

DoF (Department of Fisheries) (2022). *Yearbook of Fisheries Statistics of Bangladesh, 2021-22* (Vol. 39). Fisheries Resources Survey System (FRSS), Department of Fisheries, Ministry of Fisheries and Livestock.

Faruque, M.O., Nazrul, K.M.S., Tonny, U.S., Islam, K.R., Dey, S.C., Mona, S. J., & Saha, D. (2012). Status of an ideal dry fish market of Bangladesh: A study on Asadganj dry fish market, Chittagong. *International Journal of Life Sciences Biotechnology and Pharma Research*, *1*(3), 214–225.

Flowra, F.A., Sen, S.C., Galib, S.M., Kamal, M.M., & Islam, S.N. (2010). Dry fish marketing in Rajshahi and Thakurgaon, Bangladesh. *International Journal of BioResearch*, *1*(5), 13–16.

Ghorai, S.K., Bera, S.K., Jana, D., & Mishra, S. (2014). Status of the largest dry fish market of East India: A study on Egra Regulated Dry Fish Market, Egra, Purba Medinipur, West Bengal. *International Journal of Current Research and Academic Review*, *2*(5), 54–65.

Hall, G.M. (1997). *Fish Processing Technology*. Springer Science & Business Media. https://doi.org/10.1007/978-1-4613-1113-3

Haque, S.F., Iqbal, M.M., Hossain, M.A.R., Hossain, M.A., & Rahman, M.A. (2015). Value chain analysis of dry fish marketing at Massimpur in Sylhet of Bangladesh. *Journal of the Sylhet Agricultural University*, *2*, 107–116.

Hasan, M.M., Rasul, M.G., Ferdausi, H.J., Hossain, M.M., Shah, A., & Bapary, M.A.J. (2016). Present status of dried fish markets in Sylhet of Bangladesh. *Progressive Agriculture*, *27*(2), 235-241. https://doi.org/10.3329/pa.v27i2.29336

Hossain, M.A.R., Belton, B., & Thilsted, S.H. (2013). Preliminary rapid appraisal of dried fish value chains in Bangladesh. In *World Fish Bangladesh,* Dhaka, Bangladesh.

Hossain, M.A.R., Belton, B., & Thilsted, S.H. (2015). Dried fish value chain in Bangladesh. In *World Fish, Bangladesh and south Asia Office*: Dhaka, Bangladesh.

Islam, M.N., & Kabir, M.A. (2019). Application of organic preservatives for sustainable storage of dried fishes. *International Journal of Fisheries and Aquatic Studies*, *7*, 40–43.

Islam, M.T., Chowdhury, P., Jahan, S.N., Flowra, F.A., & Islam, M.T. (2020). *Consumers' preference for dried fish with emphasis on packaging in Dhaka city*.

Jahan, S., Habib, A.H.M.S., Islam, S., Hasan, M.D.K., Begum, M., & Bardhan, S. (2021). Comparative study on proximate and mineral composition of native and hybrid Pangas (*Pangasius pangasius*, *P. hypophthalmus*) at raw and fried stages. *Journal of the Asiatic Society of Bangladesh, Science*, *47*(1), 13-22. https://doi.org/10.3329/jasbs.v47i1.54183

Kaiya, M.K.U., Mollah, M.F.A., & Islam, M.S. (1987). Survey of pond fishery resources in Mirzapur upazila under Tangail district in Bangladesh. *Bangladesh Journal of Fisheries*, *10*(1), 37-43.

Khatun, S., Adhikary, R., Rahman, M., Sikder, M., & Hossain, M.B. (2013). Socio-economic status of pond fish farmers of Charbata, Noakhali, Bangladesh. *International Journal of Life Science, Biotechnology and Pharma Research*, *2*, 356–365.

Kleih, U., Alam, K., Dastidar, R., Dutta, U., Oudwater, N., & Ward, A. (2003). Livelihoods in coastal fishing communities, and the marine fish marketing system of Bangladesh. Synthesis of participatory rural appraisals in six villages, and assessment of the marketing system (NRI Report No. 2712).

Kubra, K., Hoque, M.S., Hossen, S., Husna, A.U., Azam, M., Sharker, M.R., & Ali, M.M. (2020). Fish drying and socio-economic condition of dried fish producers in the coastal region of Bangladesh. *Middle-East Journal of Scientific Research*, *28*(3), 182-192. https://doi.org/10.5829/idosi.mejsr.2020.182.192

Leela, M., Zaman, M.F.U., Asif, A.A., & Hossain, M.A. (2018). Availability of fish species in fish markets and fish marketing in Noakhali district. Bangladesh. *Journal of Entomology and Zoology Studies*, *6*(4), 1332-1344.

Lithi, U. J., Surovi, S., Faridullah, M., & Roy, K.C. (2020). Effects of drying technique on the quality of Mola (*Amblypharyngodon mola*) dried by solar tent dryer and open sun rack dryer. *Research in Agriculture, Livestock and Fisheries*, *7*(1), 121-128. https://doi.org/10.3329/ralf.v7i1.46840

Majumdar, B.C., Ahammad, B., Kabir, I.E., Mollik, J.R., Baidya, A., Hossain, M.F., Asadujjaman, M., Roy, T.K., Paul, S.I. (2023). Sensorial, physicochemical and microbial quality evaluations of sun-dried marine fishes available in the Bay of Bengal of Bangladesh. *Applied Food Research*, *3*(2), 100369. https://doi.org/10.1016/j.afres.2023.100369

Mamun-ur-Rashid, M., Sadat, N., Mahmood, M.T., & Musaddique, M.H.M. (2023). Women in dry fish processing activities: an in-depth study of a selected coastal region of Bangladesh. *Development in Practice*, *33*(8), 910–925. https://doi.org/10.1080/09614524.2023.2247592

Monir, M.S., Haque, M.R., & Rahman, S. (2013). Dry fish marketing in Nilphamari district of Bangladesh. *Journal of Science and Technology*, *11*, 32–36.

Nadia, Z.M., Roy, P., Hossain, J., Hossain, M.F., Rahman, M., Salam, M.A., & Jahan, R. (2022). Fish availability and market channel in Rajbari, Bangladesh. *Heliyon*, *8*(9), e10526. https://doi.org/10.1016/j.heliyon.2022.e10526

Nath, K.D., Majumdar, R.K., Borah, S., Saikia, D., & Kalita, P. (2013). Marketing system of dried fish products and socioeconomic condition of the retailers in local markets of Agartala, Tripura. *Environment & Ecology*, *31*(2C), 1092–1094.

Nayeem, M.A., Pervin, K., Reza, M.S., Khan, M.N.A., Islam, M.N., & Kamal, M. (2010). Marketing system of traditional dried and semi-fermented fish product (cheap shutki) and socio-economic condition of the retailers in local market of Mymensingh region, Bangladesh. *Bangladesh Research Publication Journal*, *4*(1), 69–75.

Nowsad, A. (2005). Low-cost Fish Processing in Coastal Bangladesh. *FAO: Rome, Italy*, *5*, 88.

Nowsad, A.K.M. (2007). Participatory Training of Trainers: A new approach applied in fish processing. BFRF.

Phillips, S.M., Fulgoni III, V.L., Heaney, R.P., Nicklas, T.A., Slavin, J.L., & Weaver, C.M. (2015). Commonly consumed protein foods contribute to nutrient intake, diet quality, and nutrient adequacy. *The American Journal of Clinical Nutrition*, *101*(6), 1346S–1352S. https://doi.org/10.3945/ajcn.114.084079

Purkait, S., Sahu, S., Arefin, B., Pradhan, S.K., Sharma, A., Boda, S., Karmakar, S., & Sahu, S. (2018). Marketing profile of dry fish in Digha coast of West Bengal. *International Journal of Current Microbiology and Applied Sciences*, *7*(10), 3457-3470. https://doi.org/10.20546/ijcmas.2018.710.401

Reza, M.S., Bapary, M.A.J., Azimuddin, K.M., Nurullah, M., & Kamal, M. (2005). Studies on the traditional drying activities of commercially important marine fishes of Bangladesh. *Pakistan Journal of Biological Sciences*, *8*(9), 1303-1310. https://doi.org/10.3923/pjbs.2005.1303.1310

Saha, R. C., Rima, N.N., Haq, M.E., & Sultana, T. (2022). Dry Fish Market Condition and Socio-economic Status of Dry Fish Retailer: A Survey Study in Noakhali, Bangladesh. *Asian Journal of Fisheries and Aquatic Research*, *16*(6), 22-29. https://doi.org/10.9734/AJFAR/2022/v16i630389

Shuchi, R.T., Sultana, T., Ghosh, S.K., Tamzi, N.N., Dey, S.K., & Faisal, M. (2022). Present status of traditional dry fish processing and marketing, and assessment of socio-economic status of dry fish processors in Nazirartek, Cox's Bazar, Bangladesh. *Bangladesh Journal of Veterinary and Animal Sciences*, *10*(2) 12-21.

Siddique, M.A.M. (2012). Explaining the role of perceived risk, knowledge, price, and cost in dry fish consumption within the theory of planned behavior. *Journal of Global Marketing*, *25*(4), 181–201. https://doi.org/10.1080/08911762.2012.743203