



## RESEARCH PAPER

## OPEN ACCESS

## Study on the effect of COVID-19 on the finfish hatchery industry in the Jashore region of Bangladesh

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### Abstract

The COVID-19 outbreak has startled every entrepreneurial sector in Bangladesh, including the fin fish hatchery sector. Personal interviews, focus group discussions, and cross-check interviews with 150 hatchery workers and 50 hatchery owners were conducted in Jashore, Bangladesh, to reveal the COVID-19 impacts on finfish hatchery operations and to learn about the demographic and socio-economic status of hatchery workers. Hatchery workers' and owners' perspectives were collected in order to demonstrate how the changes felt and how they affected hatchery operations and the demographic features of workers, and the results were catastrophic. Reduced income, negative impact on livelihood, decreased household consumption, increased mental stress, negative impact on recreational activities, rising unemployment problem, rising family conflicts, barriers to education/drop out, the occurrence of COVID-19 infection, increased birth rate, increased child marriage rate, interruptions in festival celebration, homestead economic development, increased time spent with family, and rising use of social media were identified. The pandemic caused capital crisis, labor shortage, inability to pay workers, low fry demand, high commodity prices, high price of fish feed, low market price of fry, increased disease susceptibility, low attendance service providers, unsold fish fry, transportation obstruction, increased transportation cost, weak value chain, and long-term negative effects on fisheries production. The government should give financial assistance and develop the local market value chain so that disadvantaged workers and owners can pursue alternate sources of income. As a means of tackling the current issues of the COVID-19 epidemic, some resiliencies are advised for the entire fish hatchery business.

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## Introduction

The first cases of infection of a new coronavirus (2019-nCoV) were reported in Wuhan, Hubei Province, China, on December 31, 2019 (WHO, 2020a), which generates the disease known as COVID-19 (Wang, 2020). It differs from SARS-CoV and MERS-CoV in that it is highly contagious and has quickly spread to over 210 countries and territories (Siche, 2020). COVID-19 is a public health emergency, but it also poses a threat to food security if necessary precautions are not taken. Pandemics in the past have proven that quarantines and fear damage not only human activities and economic growth (Arndt and Lewis, 2001; Bermejo, 2004; Hanashima and Tomobe, 2012) but also aquatic food systems and all types of agricultural activities, causing a rise in hunger and malnutrition (Burgui, 2020; Sar *et al.*, 2010).

The COVID-19 epidemic has wreaked havoc on global food systems, putting economic and food security at risk. Bangladesh is a lower-middle-income Southeast Asian riverine country with one of the world's densest populations (Sunny *et al.*, 2020a; Sunny *et al.*, 2020b). Agriculture is the country's main source of revenue, which is organized into three sub-sectors: crop, fishery, and livestock. Aquatic food value chains account for a significant portion of Bangladesh's food system. Bangladesh is now combating the negative effects of COVID-19 on the economy, as the virus has disrupted industry, poultry, dairy, agricultural, and marine food systems, affecting the livelihoods of dependent communities directly and indirectly. Due to existing and emerging challenges with both economic and physical accessibility, the COVID-19 pandemic may produce a food crisis in underdeveloped countries. People who are already hungry, weak, and disease-prone are more vulnerable, according to UNFAO, and a 'crisis inside a crisis' might occur if the existing health crisis is compounded by a hunger crisis (FAO, 2021).

Because of the presence of inland open water (catch fishery), inland closed water (culture fishery), and coastal fisheries, fish plays an important role in the

nutrition of the people of Bangladesh (Sunny *et al.*, 2019a; Sunny *et al.*, 2020a; Sunny *et al.*, 2020b). The consistent growth performance in the fisheries sector has contributed to total fish production of 45.03 lakh MT in 2019-20, which is close to the objective of 45.52 lakh MT in 2020-21. The aquatic food system makes a significant contribution to food and nutrition security by continually promoting safer and higher-quality animal protein (Islam *et al.*, 2018a; Sunny *et al.*, 2019b). Bangladesh provides 62.58 g of fish per person per day in dietary consumption, which complements 60% of the daily animal protein requirement (Islam *et al.*, 2016; Sunny *et al.*, 2017). The Department of Fisheries Bangladesh has played an important role in Bangladesh's socio-economic growth. This sector accounts for 3.50 percent of the national GDP and 25.72 percent of the overall agricultural GDP in the country (BER, 2019).

Fish is an important and crucial animal source of food in Bangladesh, and it is critical to ensuring food security. In developing nations, the nutritious contribution of fish intake, increased income from fish sales, and enhanced economic solvency of women through aquaculture participation are markers of fish's contribution to household food security (Bene and Kawarazuka, 2010). A high proportion of low-income urban people work in the fish supply chain, and their existence is heavily reliant on it. Furthermore, per capita daily consumption of fish in urban homes is higher than in rural households (BBS, 2012). Fish and fishery products provide high-quality protein, vital minerals, vitamins, and long-chain n-3 polyunsaturated fatty acids (Bell *et al.*, 2006; USDA, 2012.). Fish is an iron-rich food that aids in the prevention of iron deficiency anemia. This disease currently affects one-third of the world's population (HLPE, 2014). During the COVID-19 epidemic, higher fish costs and scarcity raise the risk of malnutrition in low-income households.

The Covid-19 epidemic has the potential to harm food and nutritional security at all levels, particularly those of lower to middle-income households and marginalized people in urban areas. Job loss during

the epidemic puts tremendous hardship on a household, depending on each individual's income. The restrictions enforced on transportation during the lockdown affected the food supply chain, and the purchasing power of low-income households in metropolitan regions dropped.

In the past, our country's fish production was entirely natural. However, providing fish nourishment to the entire country was not feasible. As a result, humans are gradually discovering new technologies and starting to cultivate fish in hatcheries instead of relying on natural resources. Currently, the majority of the country's fish seed is produced in hatcheries to meet the demands of the country and is also sold to several foreign countries. In the previous year, total hatchling production in this region was 90912.5kg. In this region, Jashore is the main district for hatchling production. In the last year Jashore region produce 71514kg, which is the highest in this region.

Fishers, small-scale fish growers, and fish farm laborers, notably women and youth, have been the country's deadliest victims of the COVID-19 pandemic (Hussain, 2021). A total of 14.7 million fish farmers, including all finfish seed producers, 0.83 million shrimp farmers, including shrimp seed producers, and 1.36 million fishermen are directly involved in the value chain (DoF, 2019). As a result, disruptions in the chain have a severe impact on millions of people's livelihoods and millions more's access to nutrient-dense seafood for sustenance.

COVID-19 infections may have an indirect and direct influence on fish hatchery sectors in the surrounding area due to trade disruptions, affected people being unable to work, and necessary government interventions. Because of a lack of data, governments are unable to function. Although a few studies on various elements of hatcheries have been undertaken (Islam *et al.*, 2018; Rahman *et al.*, 2021), no information on the consequences of this pandemic on the hatchery business is known. The current study sought to ascertain the effects of the COVID-19 pandemic on the livelihoods and food security of

finfish hatchery workers, as well as the resilience of fish hatchery industries.

## Materials and methods

### Study area

In the Khulna division, there are currently 113 fish hatcheries, most of which are located in the broader Jashore region (DoF, 2020). The survey was carried out on 50 fish hatcheries located in Jashoresadarupazilla, Jashore District, Bangladesh (Fig. 1). The covid-19 epidemic significantly hampered fish hatchery operations. As a result, the survey was conducted in this area.

### Data collection

#### Primary data collection

Primary data collection was difficult to collect data since hatchery workers and owners did not keep any written records and the data they provided were mostly from their memory. The methodological techniques used to gather primary data included questionnaire interviews, telephonic interviews, key informant interviews with hatchery workers and owners, focus group discussions, and cross-check interviews. The utilization of a telephone interview makes it much easier to complete the study in such a short amount of time and collect data quickly and inexpensively. During data collection, the steps below are followed (Fig. 2).

Questionnaire interview: Workers (150) and owners (50) were interviewed through a questionnaire at the hatchery locations. A brief introduction to the study's aims was given to each worker and owner at the start of the interview, assuring them that all information would be kept confidential. Each question was clearly explained and asked in a systematic manner to ensure that they understood everything.

At the time, questions about demographics, COVID-19-related issues such as employment, income, transportation and marketing, demand and production of fish fry, and technical issues were asked, and responses were recorded. Each interview took from 25-30 minutes to an hour.



Fig. 1. Map of Jashore Sadar Upazila, showing the study area Chanchra.

**Focus group discussion:** Focus group discussion (FGD) is a very successful strategy for gathering large amounts of relevant information in a short amount of time. The focus group was held to identify their issues and gather feedback from hatchery workers and owners on the problem-solving process.

**Cross-check interviews:** Cross-check interviews with Upazila Fisheries Senior Fisheries Officer and Field Assistant were held at their offices after data was collected via questionnaire and focus group discussion. They provided important data on COVID-19's impact on fish hatchery production and broodstock management.

#### *Secondary data collection*

Secondary data was collected from the Institute of Epidemiology, Disease Control, and Research for COVID-19 (IEDCR, 2021). The data provided a basic

overview of the COVID-19 impact rate, the state of the lockdown, and the number of confirmed, recovered, and fatal cases in the Jashore region of Bangladesh. Additional information was gleaned through scientific journals, technical reports, and press releases.

The Department of Fisheries (DoF), which is part of the Ministry of Fisheries and Livestock in Bangladesh (DoF, 2020), supplied information on fry production, fish harvest, demand, and supply, as well as related aquaculture.

#### *Problem encountered during data collection*

During the period of data collection, the researcher encountered the following methodological problems: Most of the respondents in the study area had no idea about the research work and it was, therefore, difficult to explain the purpose of the study to convince them;

Most of them initially hesitated to provide information to questions;

The respondents did not maintain any written records. Therefore, the investigator had to depend on data supplied by respondents from their memory only;

The respondents used local units of measures in response to questions, which were difficult to be converted to standard units.

*Data analysis*

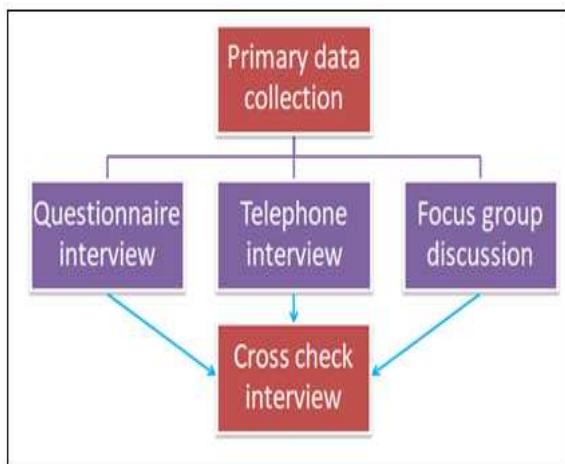
The results obtained in the experiment were subjected to statistical analysis. Qualitative and quantitative analyses of all kinds of data were carried out. MS Excel was used to store all the data. MS Excel and Graphpad Prism were also used for the presentation of the tables and graphs obtained from different types of data. ANOVA was done for the test of significance.

**Results**

*Demographic and socio-economic status of hatchery workers*

*Age group*

There were five major age groups in the survey: adolescent (10-24 years), young (25-44 years), middle (45-59 years), elderly (60-75 years), and senile (76-90 years) (Dyussenbayev, 2017). The majority of the fish hatchery workers were found to be in the adolescent and young age groups. Young people (56%) and senile people (0%), respectively, had the highest and lowest percentages (Fig. 3).



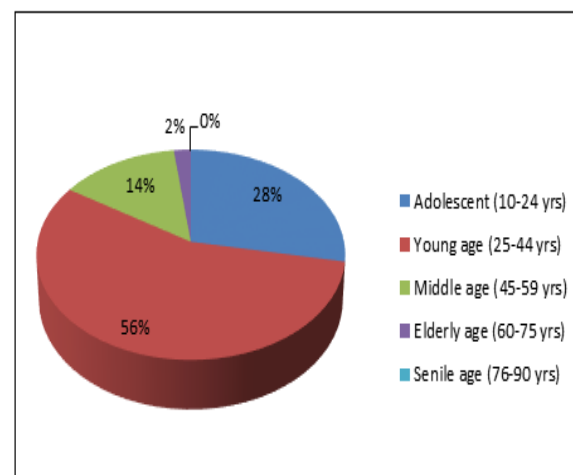
**Fig. 2.** Steps of primary data collection methods.

*Educational status*

Out of 150 workers polled in Jashore's hatcheries, % had no education, 6% had completed SSC-HSC, 14% had completed 6-10 classes, and 26% had completed 1-5 classes, with 36% being literate (able to read and write) (Fig. 4).

*Religion*

Muslim families predominated in certain areas, and the bulk of them worked in the same profession as their forebears. Only 24 of the 150 respondents were found to be Hindus during the research. As a result, Muslim and Hindu hatchery workers accounted for 84% and 16% of the total workforce, respectively (Fig. 5).



**Fig. 3.** Age group of hatchery workers in the study area.

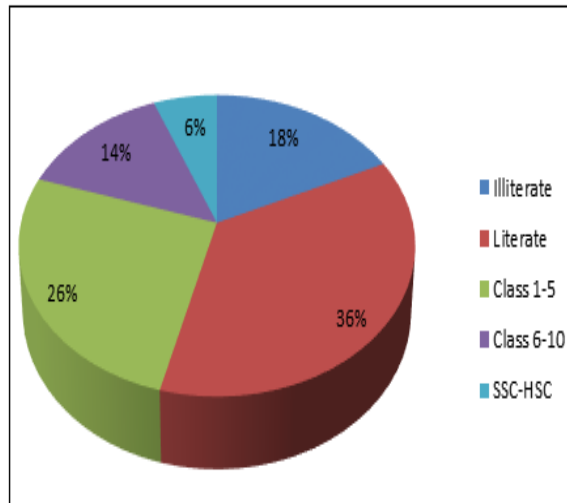
*Annual income*

Hatchery employees are normally paid on a monthly basis. Different employees are paid in different amounts. The respondents' annual salaries ranged from fifty thousand to one hundred and forty-four thousand taka in the poll. The biggest percentage of respondents (52%) was paid a salary of 76000-100000 taka per year (Fig. 6).

*Types of hatchery worker*

In most hatcheries, there are two sorts of workers. They are permanent (full-time employees) and seasonal (part-time employees). Permanent and seasonal hatchery workers were 73 percent and 27 percent, respectively, in the survey. Along with working at the hatchery, seasonal laborers work as

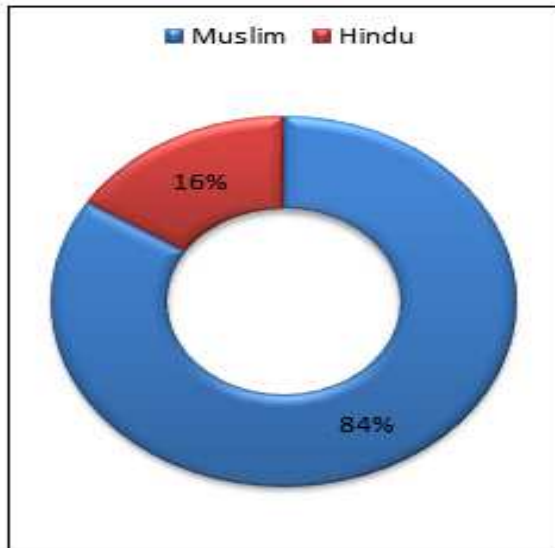
simple bike drivers, fish farmers, day laborers, agriculture, and shopkeeper (Fig. 7).



**Fig. 4.** Educational status of hatchery workers in the study area.

*Family size*

The 5-6 member family had the biggest family size (44%) and the 7-8 member family had the smallest (6%), while 38 percent of people lived in a 3-4 member home (Fig. 8).



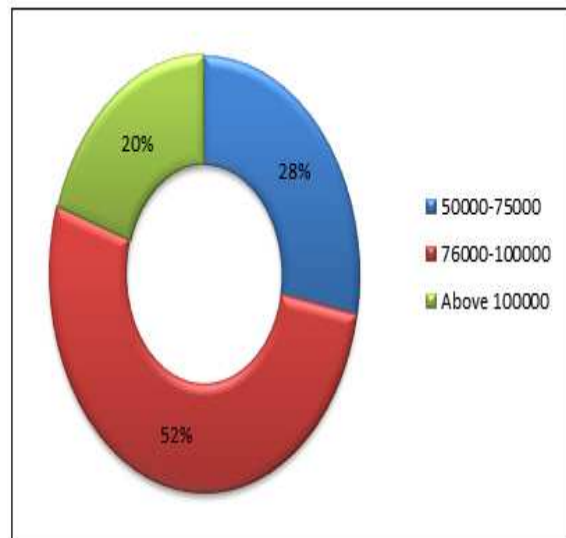
**Fig. 5.** Religious status of hatchery workers in the study area.

*Health facilities*

According to the survey, 44 percent of workers sought quack treatment for ailments, with 28 percent going to Sadar Hospital, 16 percent to Kabiraj, 6 percent to a community clinic, 4 percent to MBBS doctor, and 2 percent to upazila health complex (Fig. 9).

*COVID-19 status in Jashore region*

On March 7, the country reported the first COVID-19 case on its territory; however, several specialists thought that nCoV-2 may have infiltrated the country earlier but went undetected due to insufficient surveillance. The inhabitants of Bangladesh have been affected by many coronavirus strains, including Alpha, Beta, Gamma, and Delta. The first case was confirmed in April 2020, followed by the highest cases in June 2021 (Fig. 10).



**Fig. 6.** Annual income of hatchery workers in the study area.

*Impacts of COVID-19 on hatchery worker*

*Impact on income*

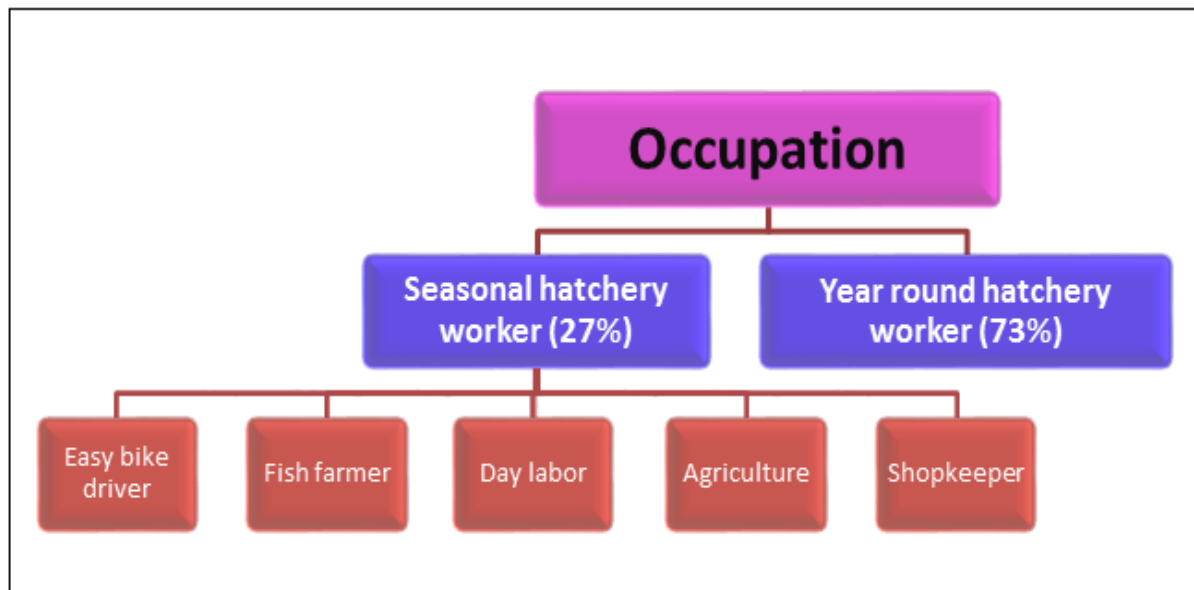
Many urban households reduced their food intake in response to the loss of income, while a similar amount sought help from friends. Many fish hatchery employees have lost their employment, had their working hours reduced, or had their profession changed. In the survey, 76 percent strongly agreed that income had declined, while 20 percent strongly disagreed. Only 4% claimed they were neither agreeing nor disagreeing since they worked in a second career during the outbreak (Fig. 11).

*Impacts on livelihoods*

The Novel Corona Virus (COVID-19) has had a significant negative influence on Bangladesh's underprivileged population. The hatchery workers' livelihood and food security were impacted by the worldwide health crisis. Their living conditions were

terrible due to the pandemic's reduced revenue. They had to adjust their eating habits and were unable to adequately celebrate the holidays. The majority of

respondents agreed or strongly agreed that COVID-19 had a negative impact on livelihood status (Fig. 11). They had to pass a crucial time during the calamities.



**Fig. 7.** Types of hatchery workers in the study area.

#### *Lowering household consumption*

Hatchery activities and businesses were closely shut down as a result of the country's long-term lockdown. Workers could not keep their regular diets at the time. Therefore, they had to adjust their daily food. They had to eat more eggs, vegetables, and lentils while reducing their meat and fish consumption. According to the survey, 78 percent of respondents lowered home consumption, while only 6% of workers did not change their normal consumption (Fig. 11).

#### *Increase mental stress*

Pandemics and other stressful situations can have a significant negative influence on a worker's mental health and physiological functioning. COVID-19 uncertainty is linked to large changes in workers' daily routines, a decrease in their pay, a change in their eating habits, and a rise in their mental stress. During the epidemic, the majority of workers experienced emotional stress, according to the survey (Fig. 11).

#### *Negatively influenced recreational activities*

Many elements of daily life, including leisure activities, have been affected by the COVID-19

epidemic. During the epidemic, restrictions such as not leaving the house, avoiding non-essential travel, and ceasing social gatherings were imposed. People were unable to engage in any recreational activities as a result of these factors. According to the results of this survey, it had no effect on 54 percent of people. However, 12 percent strongly agreed and 16 percent agreed with this statement (Fig. 11).

#### *Increasing unemployment problem*

The COVID-19 pandemic is wreaking havoc on Bangladesh's economy, hurting millions of people and disrupting their livelihoods. The onset of COVID-19 has put extra strain on the job market, which is contributing to the unemployment situation. According to the results of this survey, 84 percent of workers strongly think that COVID-19 is the cause of their unemployment (Fig. 11).

#### *Rising family conflicts*

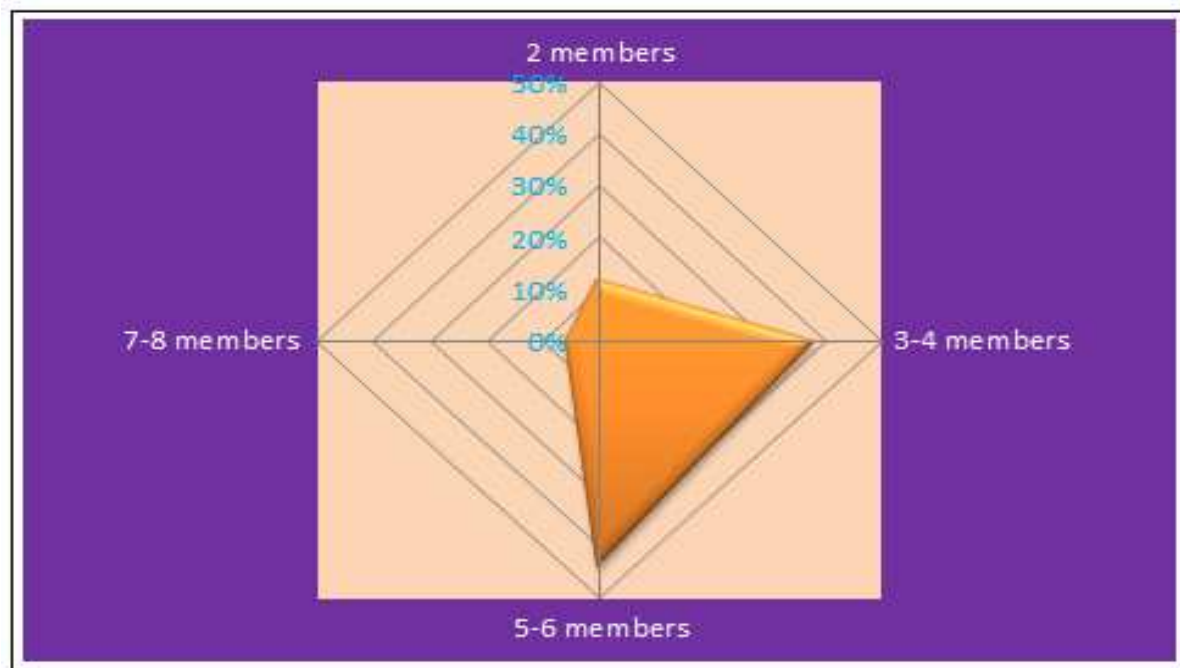
Tensions were running high during the epidemic, disagreements were often flaring, and the amount of friction between family members rose as they remained in the house constantly. However, I had no effect on 40% of the workers' families. 16 percent of

workers strongly agreed with this issue, while 26% agreed with it (Fig. 11).

#### *Barriers to education/dropout*

The Bangladesh government halted primary, secondary, and higher education facilities for 18 months during the peak of the pandemic to prevent

COVID-19 infection. Due to financial hardships and early marriage, many students in school, college, and madrasa were compelled to drop out during the outbreak. COVID-19 is the leading cause of educational barriers, according to this survey, with 58 percent strongly agreeing and 28 percent agreeing (Fig. 11).



**Fig. 8.** Family size of hatchery workers in the study area.

#### *Occurrence of COVID-19 infection*

COVID-19 had a nationwide impact. COVID-19 symptoms were unknown to the hatchery employees. They're also not keen on testing. Fever, back pain, and headaches were thought to be fairly common in everyone. According to the study, 40% of employees believed that positive cases should be investigated, but 46% did not (Fig. 11).

#### *Increased birth rate*

During the lockdown, the employees stayed at home and spent quality time with their families. In the survey, 42 percent of workers agreed with the situation, while 38 percent were undecided (Fig. 11).

#### *Increased child marriage rate*

An unacknowledged and harmful impact of the epidemic is an increase in child marriages as the economy collapse and stay-at-home orders become

the new normal. The COVID-19 pandemic thwarted all previous measures to end child marriage, and as a result, a large number of child marriages occurred during the lockdown. According to the results of this study, 30% of workers agree with this, while the remaining 48% have no view on the subject (Fig. 11).

#### *Disruption in festival celebration*

Festivals are intended to be a unique gathering of people, a captivating celebration of what it means to be human, and a concentrated sequence of remarkable in-person experiences. To combat the spread of the corona virus disease, social distancing regulations have been developed all over the world. Temporary limitations on mass gatherings and the shutdown of public facilities have been implemented, limiting festival celebrations. As a result, the majority of workers were unable to participate in any celebration (Fig. 11).

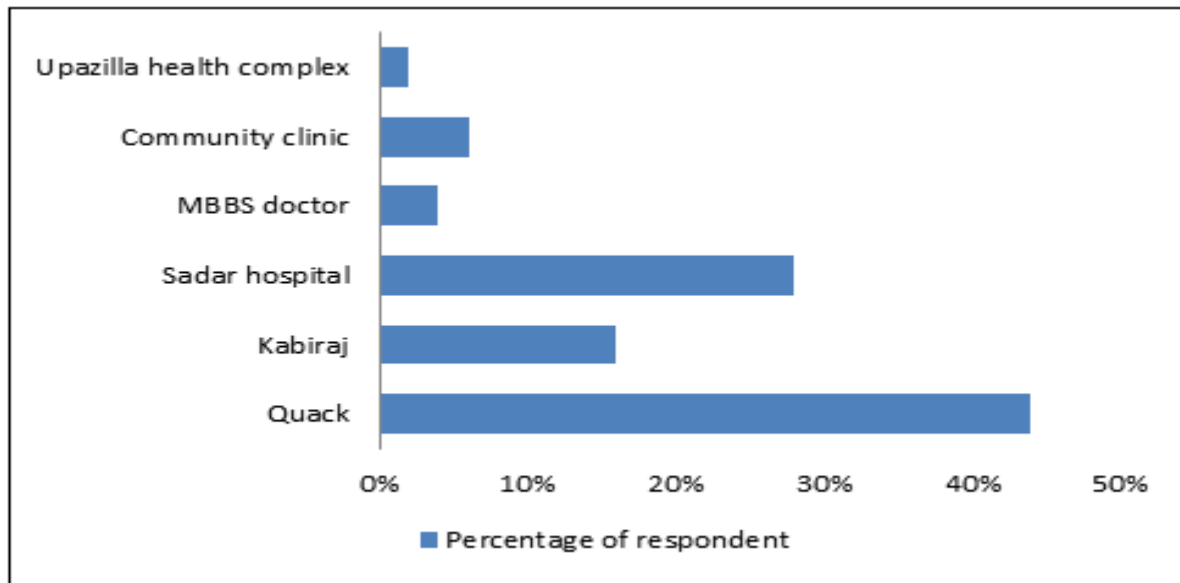


*Homestead income generation*

During a pandemic, everyone is confined to their homes. Workers were looking for many forms of revenue sources at the time. Many of them began cultivating vegetables and fruits in their backyards. In the survey, 44 percent of respondents said they had no opinion on homestead income production, while 26 percent said they disagreed (Fig. 11).

*Increased time spent with family*

No one was allowed to leave the building during the lockdown. Everyone is constantly present in the house, and they have a great time with their family members. In that situation, the level of concern and affection for family members rose. According to the survey, 42 percent of workers strongly agreed and 30 percent agreed (Fig. 11).



**Fig. 9.** Health facilities of hatchery workers in the study area.

*Rising use of social media*

People are now more involved with social media than ever before. Fish hatchery workers also raised their activity on social sites. In the survey, 34% agreed the use of social media was increased at that time. But 24% didn't give any opinion about this (Fig. 11).

*Impact of COVID-19 on hatchery operation**Lack of capital*

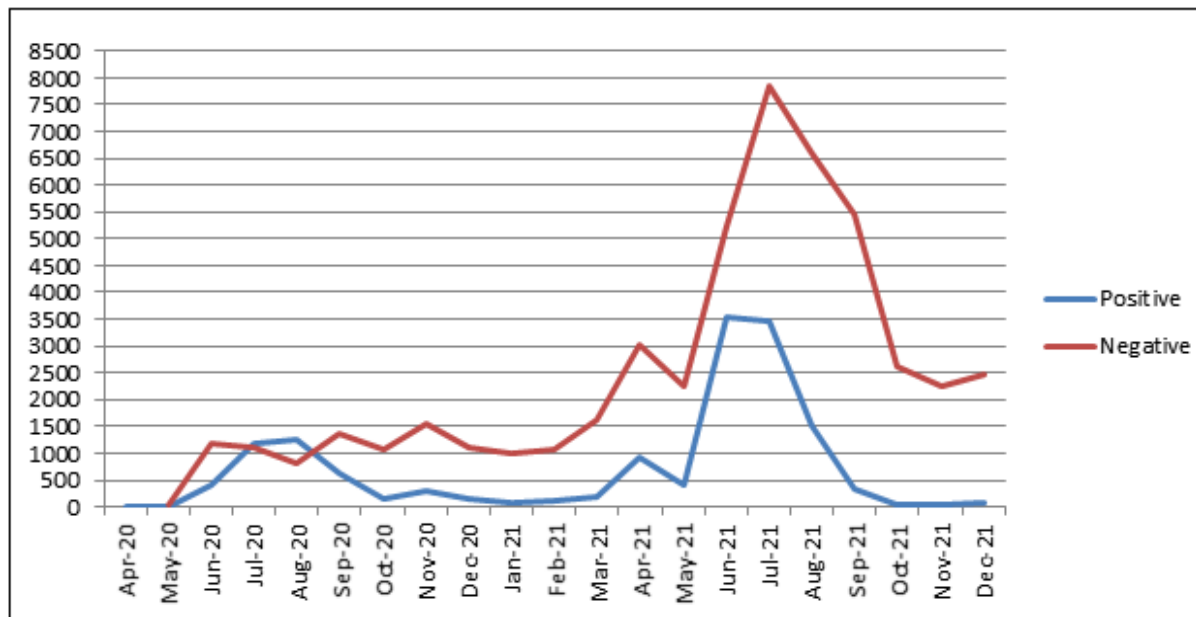
The hatchery owner suffered losses during the lockdown situation. Many of them became deeply in debt. They took money from non-governmental organizations and other sources. However, due to the hatchery's closure at the time, they were hesitant to take out a loan. As a result, they ran out of money to run their hatchery. According to the poll, 96 percent of hatchery owners are experiencing financial difficulties (Fig. 12).

*Labor shortage*

Depending on the size of the hatchery, different numbers of labor were required to run the hatchery properly, and varying salaries were paid. Some workers were unable to work due to illness, others had to change their trade, and others had to return to their village homes because they could no longer afford their monthly costs. According to the poll, 94 percent of business owners noticed a labor shortage during the crisis (Fig. 12).

*Inability to pay workers*

During a pandemic, the majority of hatchery owners suffer losses in their businesses. They also ran out of money to properly compensate the employee. They were unable to obtain a loan due to the hatchery's closure. As a result, they were unable to pay the employee at the time. According to the poll, 98 percent of hatchery owners acknowledged that they were unable to pay their workers due to a lack of funds (Fig. 12).



**Fig. 10.** COVID-19 status in the Jashore region.

#### *Low demand for fry*

The government implemented a rigorous lockdown across the country in March, April and May. As a result, most fry and fingerling vendors were unable to continue operating during the correct season. As a result, demand for fry and fingerlings was extremely low throughout the season. According to the report, 92 percent of owners experienced decreased demand for fries during the crisis (Fig. 12).

#### *Raising commodity price*

During the lockdown, all modes of transportation encountered significant difficulties. During the pandemic, certain items were unavailable. Because of the border closure, export and import facilities were harmed. As a result, the required items were unavailable. As a result, some dishonest merchants increased commodity prices. From this survey, it is observed that the entire respondent agreed about the raising of commodity prices (Fig. 12).

#### *High price of fish feed*

One of the most crucial components of hatchery management is feed. However, during the lockdown, the price range has increased because of transportation issues and feed availability. According to the results of the study, 48 percent and 42 percent of respondents strongly agreed and agreed,

respectively (Fig. 12).

#### *Low market price of fry*

During the lockdown period, the demand for fries was very low. The buyers were not interested in buying fries. In this situation, the prices of the fries are getting low day by day. In the survey, about one-third present of the respondent agreed to this matter (Fig. 12).

#### *Increased disease susceptibility*

Fish were infected with diseases due to a lack of medicine, required ingredients, technical support, and sufficient water quality management. According to the results of this survey, 60% of owners feel that disease susceptibility is increasing (Fig. 12).

#### *Low attendance of service provider*

The authorities imposed a lockdown to lower the affected rate, preventing people from leaving their homes. As a result, service providers in some areas were unable to visit the hatcheries. According to the study, approximately half of the respondents agreed with this (Fig. 12).

#### *Unsold fish fry*

During the shutdown, most hatchery owners lost money since their large quantities of fry and

fingerlings were unsold. Because of the lockdown, customers are unable to purchase fries. However, certain hatcheries were able to sell out a certain amount of fries at the moment.

According to the results of the study, 42 percent of hatchery fish remain unsold, and 46 percent are neither agreeing nor disagreeing (Fig. 12).

*Transportation obstruction*

The fish fry sector almost depends on the transportation system. Throughout the lockdown period, the transportation sector experienced significant challenges. During the lockdown, all

modes of transportation were shut down, including pick-up trucks, buses, and trains. That is why transportation issues were a major issue at the time. According to the results of this study, 92 percent of respondents were in this circumstance (Fig. 12).

*Increase transportation cost*

There was a transportation shortage during the pandemic. The vehicle owner did not want their vehicle rented. Another cause is a lack of vehicles available at the appropriate time and location. Because of these factors, transportation costs were rising at the time. This was agreed upon by 88 percent of respondents in this survey (Fig. 12).

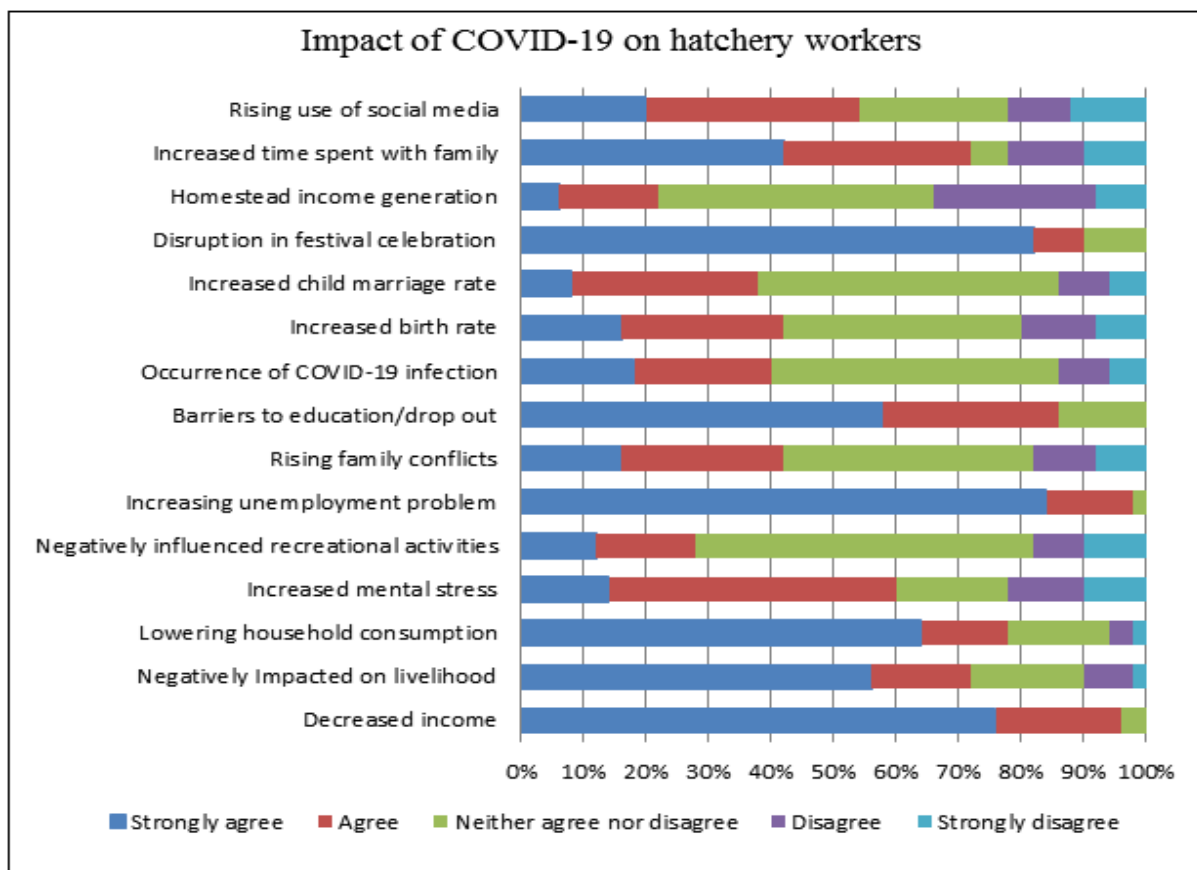


Fig. 11. Impact of COVID-19 on hatchery workers.

*Weak value chain*

Buyers are unable to come out to buy, and sellers are unable to sell those fries in their area. Another source of a broken value chain is transportation issues. The value chain was nearly destroyed at the time. About two-thirds of the respondents in this survey agreed on this (Fig. 12).

*Long-term negative effects on fisheries production*

The essential factor in increasing aquaculture production rates is the availability of fry. The rate of fry supply was severely impeded because of the shutdown. Many additional factors at the time contributed to the unfavorable impact on fisheries production. In the survey, 60% of respondents agreed

with this, while 36% said they were neither agreeing nor disagreeing (Fig. 12).

*Resilience against covid-19/probable environmental extremes*

To meet the current issues of the COVID-19 pandemic, the following resiliencies are advised to better develop the overall fish hatchery sector in general (Fig. 13).The fish hatchery industry has been hit by an economic downturn, a social crisis, and health concerns. Policymakers should take immediate action to keep this industry viable. For a successful operation of this sector, the government and other financial authorities should provide interest-free

loans and tax-free facilities. Workers and their families require training in a variety of income-generating activities as well as the use of various digital tools such as e-marketing apps, tracer apps, technical service apps, and so on. The government should keep a tight eye on this sector to ensure that market prices for goods, fries, and transportation costs are all under control. Workers and owners have experienced so much emotional stress as a result of COVID-19 that they require psychological counseling to recover. Above all, if a formal institution can be established for them, they will be able to solve their situation by consulting with the appropriate authorities.

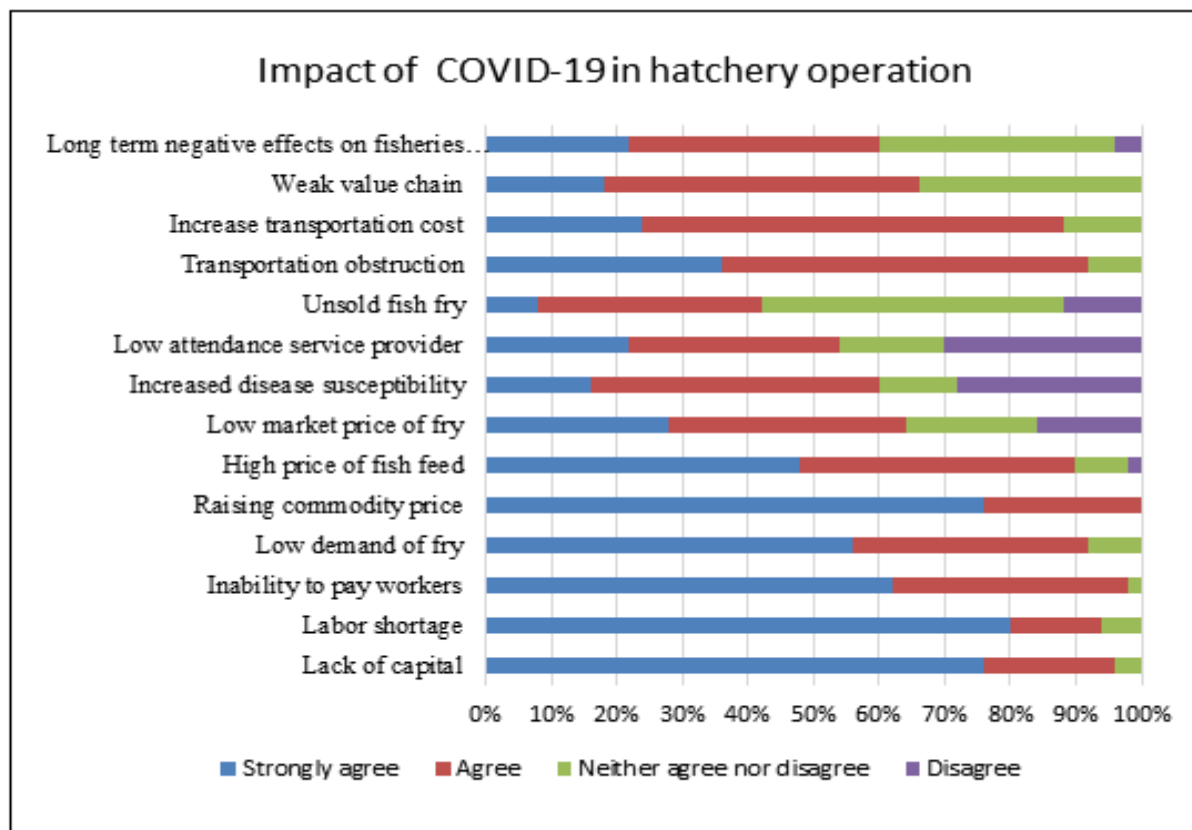


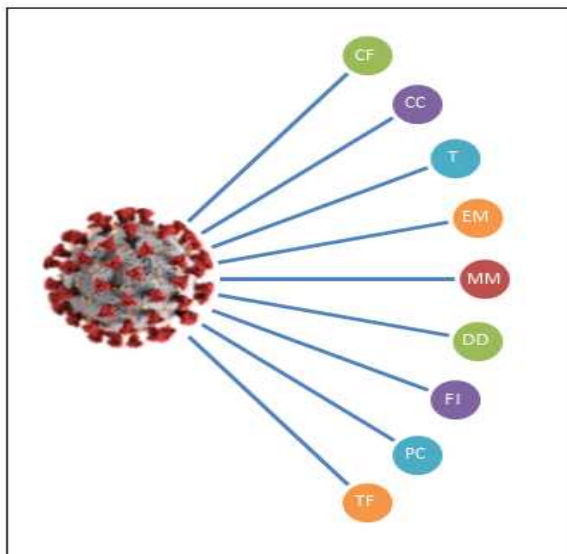
Fig. 12. Impact of COVID-19 on hatchery operation.

**Discussion**

The goal of this study is to learn more about the livelihoods of hatchery workers and the impact of the COVID-19 pandemic on their lifestyles. According to the findings, the majority of hatchery laborers (56 percent) were between the ages of 25 and 44, and the majority of them were from Muslim households. According to Ahmed (1996) in Tangail and Ahmed

(1999), in the coastal region, 66 percent and 70 percent of the population were under the age of 40, respectively. In Mymensingh, Ali *et al.* (2009) discovered that 85 percent of fish farmers were Muslims and 15 percent were Hindus. It resembles the current study in many ways. The average number of laborers in the survey area (53 percent) had an annual income of 76000-100000 BDT. According to

Pravakar *et al.* (2013), fish farmers' annual income ranged from 24,000 to 1,00,000 BDT. Literate people, according to BBS (2011), are individuals who can compose a letter in any language. In the research area, 6 percent of fishermen had passed the H.S.C. and S.S.C., and 14 percent had passed class V, 36 percent could only sign and 18 percent were illiterate. In the current study, the average family size was 5-6 individuals per household, which was higher than the national average of 4-5 people per house (BBS, 2011) for single families. According to the findings, 44.00 percent of workers obtained health care from a village doctor, also known as a quack, while the rest received care from Upazila Health Complex, MBBS doctors, and Sadar hospitals. According to Asif and Habib (2017), 46% of farmers received health care from village doctors, 18% from upazila health complexes, 14% from district hospitals, and 20% from MBBS doctors.



**Fig. 13.** Multilevel resilience features as revealed by the study on the hatchery industry in Bangladesh (CF-Credit Facility, CC-Community Cohesion, T-Training, EM-e-Marketing, MM-Market Monitoring, DT-Digital Tools, FI-Formal Institution, PC-Psychological Counseling and TF-Tax Free).

The COVID-19 pandemic in Bangladesh is part of the global coronavirus disease pandemic of 2019 (COVID-19), which is caused by the coronavirus 2 that causes severe acute respiratory syndrome (SARS-CoV-2). In March 2020, the virus was discovered to have spread to Bangladesh. To protect the population,

the government ordered "lockdown" across the country from March 23 to May 30 and prepared some required procedures to raise awareness about the illness. COVID-19-related transportation, marketing, and labor disruptions, combined with volatile supply and demand trends, impacted perishable food supply chains such as fish, beef, and aquatic food (CGIAR, 2020). According to the findings, 54 percent to 96 percent of respondents believed that hatchery workers' monthly wages, household consumption, and festival celebrations had decreased significantly, while barriers to education, unemployment, poor livelihood status, mental stress, time spent with family, and use of social media had increased. People working in the fisheries sector are at risk of losing their jobs and livelihoods (Nazrul, 2020), with fish farming income declining by 48.32 percent in the country (Hasnin, 2020). The more they stayed at home to avoid being infected, the more concerned they were about feeding their family (Ercilla *et al.*, 2021). Food deficiency stems from a lack of mobility (Workie *et al.*, 2020). Food supplies plummeted as a result of the pandemic's damaged food supply chain, and prices for everyday items increased (FAO, 2021). Furthermore, the closure of educational facilities (from elementary to college level) was not particularly beneficial to fishermen's families, as it had the unexpected consequence of some families being unable to deal with the abrupt change in the educational system (Chaturvedi *et al.*, 2021).

The majority of respondents had no opinion on homestead income generation, increased birth rate, increased child marriage rate, the occurrence of COVID-19 infection, recreational activities, or growing family disputes. This could be owing to their lack of health awareness and expertise. With the COVID-19 epidemic, the situation has gotten much worse, with more parents marrying their minor daughters due to greater financial difficulties as a result of lost income.

According to the survey, most fish hatchery owners faced a variety of challenges in their operations, including a lack of capital, labor shortages, inability to

pay workers, low demand for fry, rising commodity prices, the high price of fish feed, the low market price of fry, increased disease susceptibility, low attendance service provider, unsold fish fry, transportation obstructions, increased transportation costs, a weak value chain, and long-term negative effects on fish. The ideal months to release fry in the agricultural pond are April and May. The fish farmer prepares the pond for the new season between March and April by selling the marketable fish from the previous year. However, transporting fry is a major difficulty for fish hatcheries, nurseries, and farmers during this time of year (Rashid, 2020). As a result of the transportation problem, this underprivileged population suffered higher commodity prices, according to one important informant.

The involvement of a middleman further complicated the situation (Mohammed *et al.*, 2020). Most of the fishermen were unable to sell their catch, forcing them to borrow money from a local money lender at a high-interest rate. They were also unable to obtain a loan from the concerned bank because they lacked sufficient funds for the mortgage (Sunny *et al.*, 2019).

### Conclusion

One of the main drivers of Bangladesh's fisheries revolution is hatchery-produced fish fry. However, due to the COVID-19 epidemic, this hatchery sector has had a particularly difficult time for the past two years. COVID-19 has both direct and indirect effects; workers were directly affected by decreased income and job loss, and their families were embarrassed by low household consumption, bad livelihood conditions, children dropping out of school, festival disturbance, and increased mental stress. Due to a lack of funding, transportation impediments, and unaccounted expenditure for commodities and transportation, the hatchery operation was halted during a total shutdown from March to May 2020, and it ran slowly for the rest of the month. Policymakers involved in this division should take necessary steps as soon as feasible; otherwise, the fishing industry will suffer catastrophic losses in the next few days.

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