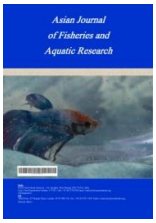

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Outbreak of COVID-19: Impact on Socio-Economic Condition of Shrimp Farmers in South-West Coastal Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. All the authors were an active part of the concept, design, analysis of data, drafting and revising the manuscript, while authors SA and MRW performed the entire work together. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The study investigated the impacts of COVID-19 on livelihood status of coastal Shrimp farmers using farm size, production and income of South-west Bangladesh.
Study Design: This study is empirical in its design. Data on socio-economic factors were collected randomly from selected Shrimp farmers. Both open and closed ended questionnaire and directed to the Shrimp farmers of South-west coastal region of Bangladesh.
Place and Duration of Study: The present study was carried out at Khulna district (seven selected Shrimp farming locations; *viz.,* Paikgacha, Lasker, Goroikhali, Lata, Kapilmuni, Amadi and Koyra) of Bangladesh for a period of five months during pandemic of COVID-19 (April-August, 2020).
Methodology: The key data were collected from face to face interview of 120 respondents. A brief outline about the nature and aim of the study was given to each respondent before the interview was commenced. The information of the respondents were written in the questionnaire

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immediately after completing the interview. Collected data were tabulated and analyzed using Microsoft Excel (version 2016).

Results: Most of the respondents were middle aged (68 %) and living in nuclear families (71 %). Majority of the Shrimp farmers were illiterate (53 %). A greater proportion (66 %) involved in small scale Shrimp farming as a primary occupation followed by moderate (27 %) and large scale (7 %) Shrimp farming. More than half of the respondents earned >20000 BDT (USD$ 1 = 85 BDT) in each month before the pandemic. The production activities were seriously hampered due to unavailability of inputs including aquamedicine, disinfectants, labor crisis, seed and feed, growing the price of production materials and interrupted communication etc. due to the pandemic. However the outbreak of COVID-19 pandemic reduced the production from their Shrimp ghers, drastically curtailed the market price, and consequently greatly compressed their income and livelihoods.

Conclusion: The pandemic known as COVID-19 has had a catastrophic impact on human activities, with the Shrimp farming sector being no exception. This study revealed that the socio-economic and income status of the Shrimp farmers was noticeably vulnerable during the COVID-19 pandemic. Thus, large numbers of farmer families were unable to fulfill their minimum needs (food, income, and medical care).

Keywords: Decreased; income; lockdown; pandemic; SARS-CoV-2.

1. INTRODUCTION

The COVID-19 epidemic in Bangladesh is part of the worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was confirmed to have spread to Bangladesh in March 2020. Institute of Epidemiology, Disease Control and Research (IEDCR) reported the first three known cases on 8 March 2020. Since then, the pandemic has spread globally and the number of infected people has increased gradually. The total number of COVID-19 infected people in Bangladesh has drastically increased from only three (8th March, 2020) to 237,661 (31st July, 2020) [1]. Similarly, the total number of infected cases in the world were increased in more drastic manner like 121,475 (8th March, 2020) to 18,213,503 (31st July, 2020) [1].

Aquaculture is the fastest-growing food-producing sector in the world and has been recognized for its potential to alleviate poverty and economic welfare [2]. The fisheries sector plays an important role in boosting up of Bangladesh economy by contributing to the national income, employment generation and foreign exchange earnings. Fish and fishery products are recognized as the cheapest source of protein and an important source of diet for thousands of people in many parts of the world. Shrimp aquaculture is a fast-growing industry in many areas of the world, including Asia and Latin America [3]. Bangladesh is the twelfth leading producer of cultured Shrimp and the fifth leading producer of giant tiger prawns in the world [4-5]. Shrimp is known as the white gold of Bangladesh because it is the second-highest export earning commodity after the garment sector. About 275,583 ha of land are used for Shrimp farming in the coastal areas of the country [6]. This sector contributes to 5 % of national gross domestic production (GDP) in Bangladesh and nearly 8.5 million people ofthecoastal areas depend on this sector for their livelihood [7]. Bangladesh has a long history of extensive Shrimp farming, predominantly in the tide-fed high saline coastal region. Many fisheries challenged total shutdowns at the commencement of social isolation restrictions (i.e. Namibia [8]). Such indiscriminate lockdowns on fishing activities arguably express a pre-existing propensity to underplay the role of fish in food systems [9]. In India, for example, fisheries were totally closed down at the start (contrary to farming), and only after serious pressure from civil society directing to their vital role in food provisioning was fishing permitted to continue actions within some bounds [10].

The fisheries and aquaculture sector of Bangladesh represents one of the most dynamic food-producing sectors and the 3rd largest aquatic biodiversity in Asia after China and India [11]. Most of the Shrimp production gained from the culture farms of Black Tiger Shrimp (*P. monodon*) and Freshwater prawn (*M. rosenbergii*) of two major divisions Khulna (80.44 %) and Chattogram (17.23 %) in the coastal belt of Bangladesh [12]. Bangladesh exported 32,539.11 MT Shrimp, equivalent to 363.96

million USD. Shrimp export alone holds 60.76 % of total earning from fisheries export [12]. Though Shrimp culture has been increasing gradually but the export quantity decreasing straightly from the last few years [12]. In Bangladesh, fish and Shrimp farming sectors were facing a four-pronged crisis in-term of human, physical, social, and financial capital. Among them the major vulnerabilities could be noticed in the three specific parts *viz.,* COVID-19 Shocks, adverse trends, and unfavorable seasonal ban period [13].Bangladesh's fares make up over 70 % of the crab and Shrimp in the export market. But many countries quit bringing in crab and Shrimp this year in an offer to stem the episode of COVID-19 [14]. Considering the issues, the present study was planned to explore the livelihood status and COVID-19 caused problems to the farmers involved in Shrimp culture. The study would be helpful for the researchers, policymakers, and students to understand the current socio-economic status of coastal Shrimp farmers of South-west Bangladesh as well as the impacts of COVID-19 on the great sector.

2. MATERIALS AND METHODS

2.1 Study Sites and Duration

The present study was carried out at Khulna district of Bangladesh for a period of five months during the pandemic of COVID-19 (April-August, 2020).Seven selected Shrimp farming locations were used for the study; *viz.,* Paikgacha sadar, Lasker, Goroikhali, Lata, Kapilmuni, Amadi and Koyra sadar (Fig. 1). However, sample size was estimated using Cochran formula [15].

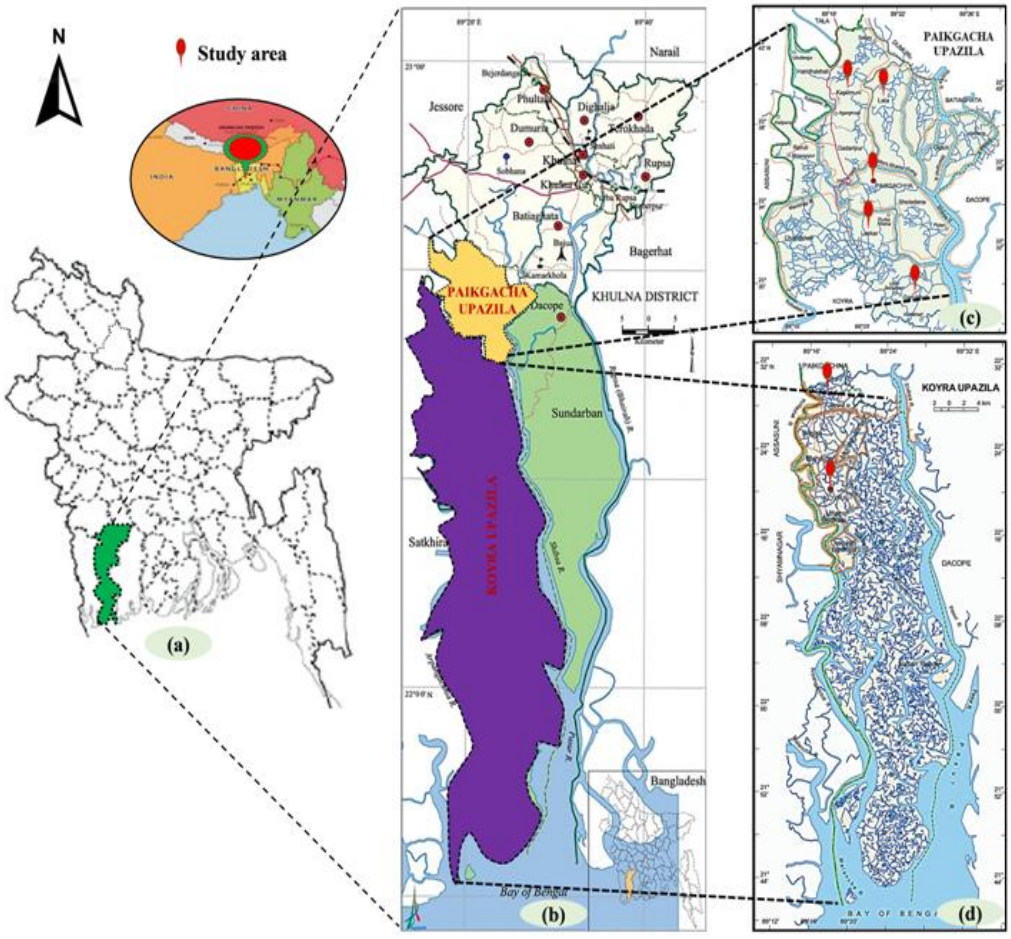

Fig. 1. Geographical presentation of the study area; Bangladesh map (a) Khulna district map (b) Paikgacha Upazila map (c) Koyra Upazila map (d) indicating study site

2.2 Methods of Data Collection

The data were collected through face to face interviewing of 120 respondents. Questionnaire was prepared for the collection of relevant data and information in accordance with the study objective. To draw the accurate scenario, both open and closed forms of questions were included in the questionnaire for collecting data in detail [16]. However, the reliability of the questionnaire was determined using Cronbach's alpha [17]. The questionnaires were prepared in English and then the authors translated it into Bengali to ensure effective communication with respondents during direct face to face interview. Each respondent was given a short oral explanation about the purpose of the study before starting the interview. Henceforth, the questions were asked one by one based on serial number provided to the study participants previously. For each interview, the given time was about 25 minutes for answering.

2.3 Data Analysis

Collected data were fed in Microsoft Excel (version 2016) and analyzed by considering descriptive statistics and presented in histogram and pie charts. Data of age, family size, educational status, and gher size were coded and enlisted. Similarly, the percentage of variables occurrence were also calculated.

3. RESULTS

3.1 Age Structure and Family Size of the Respondents

This study showed that 68 % of the respondents were between the age frame of 26 and 50 years, 17 % of the respondents were old aged (above 50 years old) and the rest 15 % respondents were young aged (below 25 years old) (Fig.2.a) which indicates that the Shrimp farmers were dominated by the middle-aged group. Of the total 120 farmers, 45 % of the respondents had a family size of 4-6, 32 % had 6-8, 16 % had 2-4 and rest 7 % of the respondents had a family size of 8-10 members (Fig.2.b).

3.2 Educational Background and Farmer's Category Based on Gher Size

The majority (53 %)of respondents were illiterate followed by 31 % of respondents were primarily educated (who can only read and write) and the remaining Shrimp farmers 16 % (13 % secondary and 3 % higher secondary) completed some sort of formal education (Fig. 3.a). The educational background of the respondents was not satisfactory as more than half of the respondents were illiterate. Shrimp farmers were categorized based on the gher size; marginal (1-10) bigha (1 ha = 6.17 bigha), moderate (11-50 bigha) and large scale (greater than 50 bigha). The majority of respondents (66 %) were marginal Shrimp farmer followed by moderate (27 %) and only 7 % was large scale Shrimp farmer (Fig. 3.b).

3.3 COVID-19 Caused Problems Faced by Shrimp Farmers

The production of Shrimp, as a major contributor to national GDP, is facing great challenges during the pandemic situation of COVID-19. About 88 % of the respondents reported that almost all export and import-based business is going slowdown globally and nationwide lockdown situation imposed the processors in shutdown mode and that resulted in an oversupply of Shrimps with low demand. Shrimp farmers major problems in the lockdown periods were unavailability of inputs (93 %) including Shrimp PL, feed, aqua-medicine, and disinfectants, etc. low harvesting rate (64 %), low income (89 %), lack of other income-generating activities (86 %), a decrease of consumer demand (58 %) and 74 % mentioned increasing the production cost while 57 % respondents reported that market shutdown and unable to sell the Shrimp forced them to borrow with high interest from the local moneylender (Fig.4).

3.4 The impact of COVID-19 and Shrimp Disease Outbreak on Production

In the present study, it was found that, the total production of Shrimp (April to August) was decreased 61.35 %, 77.55 % and 72.83 % in marginal, moderate and large scale farms respectively in 2020 compared to 2019. In 2019 (April-August), the average annual Shrimp production in marginal, moderate and large scale farms were 587.625 kg/gher, 4,023.75 kg/gher and 18,165.9 kg/gher, respectively (Fig. 5). But during COVID-19 lockdown period, the coastal farmers were not getting sufficient Post Larvae (PL) for stocking, lack of transportation facilities and due to outbreak of Shrimp diseases (white spot disease and acute hepatopancreatic necrosis disease) the total production was decreased to 360.54 kg/gher, 3,120.24 kg/gher and 13,240.85 kg/gher, respectively (Fig. 5).

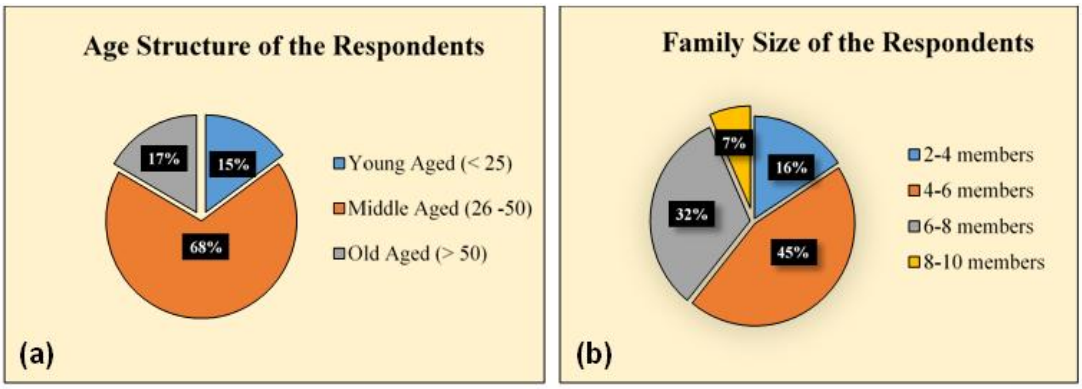

Fig. 2. Age distribution of the respondents (a) Family size of the Shrimp farmers of South-west coastal region of Bangladesh (b)

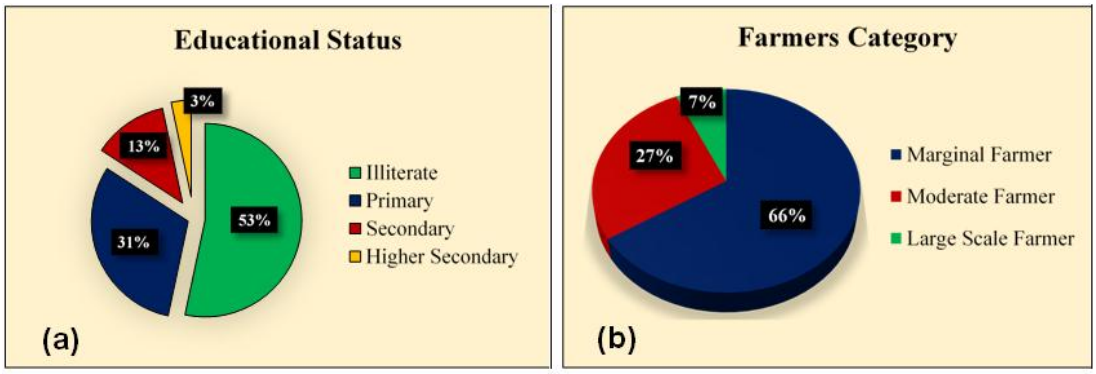

Fig. 3. Educational status of Shrimp farmers (a) Shrimp farmers category according to gher size of South-west coastal region of Bangladesh (b)

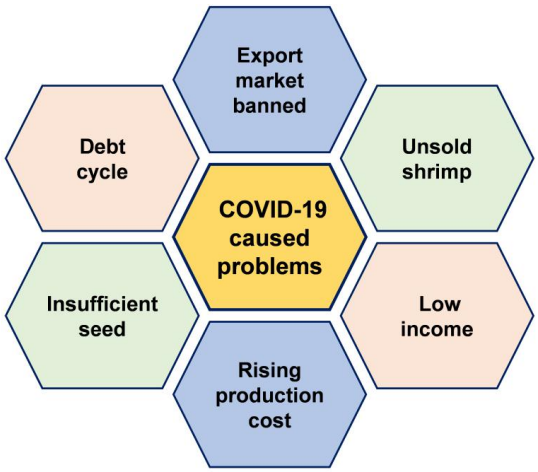

Fig. 4. COVID-19 caused problems faced by Shrimp farmers of South-west coastal region of Bangladesh

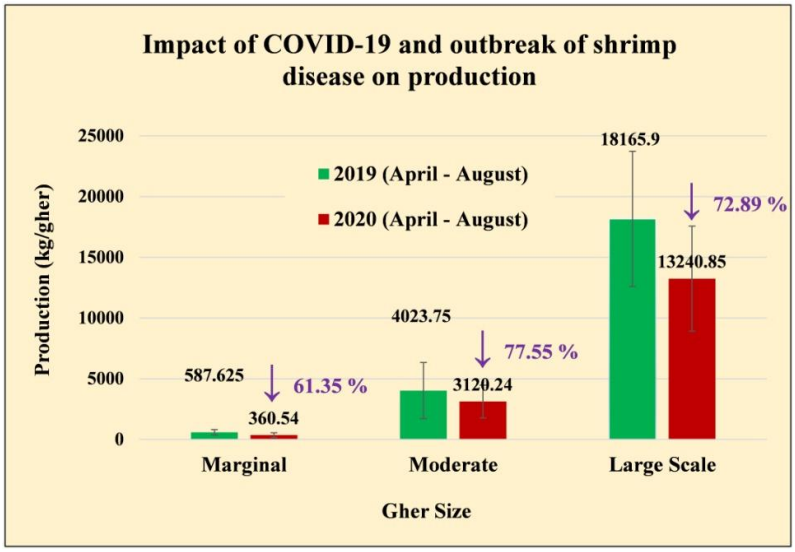

Fig. 5. The impact of COVID-19 and Shrimp diseases on production (April- August)according to gher size of South-west region of Bangladesh

3.5 Impact of COVID-19 on Income

The income status of Shrimp farmers was greatly declined due to COVID-19 pandemic as they were not able to look after their farms during lockdown and unable to harvest expected amount due to low market value. Before the outbreak of COVID-19 the average annual income (April-August, 2019) of marginal, moderate and large scale Shrimp farmers were 28,300 BDT, 125,000 BDT and 316,665 BDT per month, respectively (Fig. 6). Whereas, the annual income (April-August, 2020) decreased to 5,833 BDT, 28,166 BDT and 75,000 BDT per month, respectively due to COVID-19 outbreak and its subsequent impacts (Fig. 6). Therefore, from the analysis we found that Shrimp farmers (marginal, moderate and large scale respectively) income decreased by 20.61 %, 23.33 % and 23.68 % respectively.

4. DISCUSSION

Our study indicates that the Shrimp farmers of South-west Bangladesh were dominated (68 %) by the middle-aged group (prime working-age group). In prime working-age, farmers are more active, energetic, experienced, and efficient in resource utilization with maintaining improved management practices in shrimp farming than young and old aged group [18]. Study founded on fishers of Chandakhola wetland, Dhubri, Assam [19] revealed that age of 52.5 % respondents ranged between 31 and 50 years followed by 18 – 30 years (25 %) and the rest were above 50 years. Most of the fishermen families were nuclear (87 %) followed by joint families (13 %) as reported by [20]. Meanwhile, 53 % and 47 % of the respondents reported as they lived in joint and nuclear families, respectively [19]. The finding of the present study resembles the findings of above studies.

In our study, majority of the respondents (53 %) were illiterate. Majority of fishermen were uneducated (63.3 %) adjacent to Jamuna River, Bangladesh also reported by [21]. Similar illiteracy rate (63 %) of fishers was also reported for fishing community in Assam by [19], whereas [22] reported it as 72.1 %. According to [23] the socio-economic conditions of the fishing community of Meghna River adjacent to Narsingdi district of Bangladesh were illiterate (71 %) as they have low income and minimal facility for education. In Kanyakumari district of India, a similar observation was made for mussel fishermen (68.7 % illiteracy) [24].

The findings of our study represents that majority of Shrimp farmers of South-west coastal region of Bangladesh were marginal farmers followed by moderate and large scale farmers. A very minor numbers (18.70 %) of farms were less than 1 acre and above 5 acres were 13.82 % [25]. The highest number of larger farms (i.e. more than 5 acres) was found in Mongla, Bagerhat and less than 1 acre in Paikgacha Sadar, Thana. Farms were operated by both

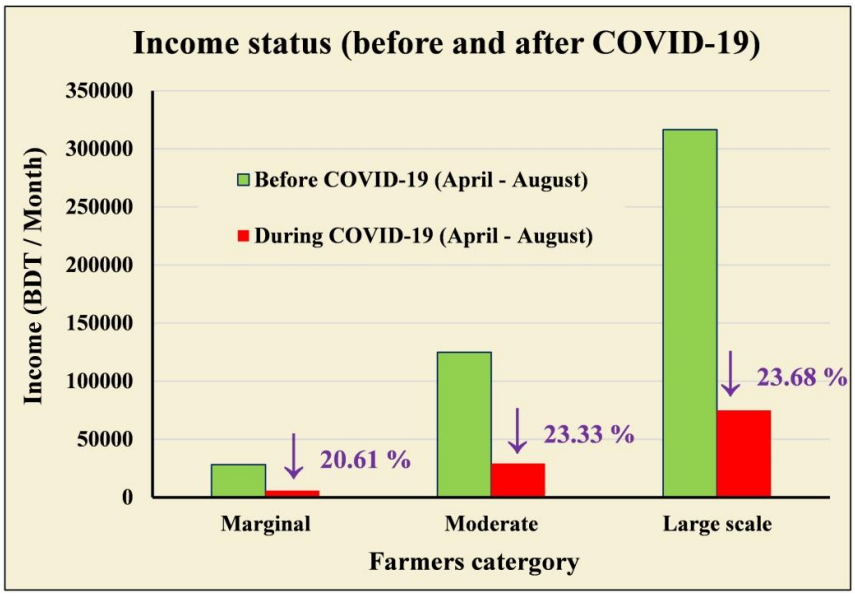

Fig. 6. The impact of COVID-19 on income of Shrimp farmer's in South-west Bangladesh

single 54.47 % and multiple 45.53 % owners. Single ownership was higher (85 %) in Fakirhat Thana and lower (25 %) in Rampal Thana [25]. Similar low levels of educational status among the fishermen community in different parts of different country was also reported earlier [26-29]. About 71.65 % of the fishers were illiterates followed by primary level (20 %), secondary level (2.5 %) and college level (5.9 %) reported by [28]. Size of the most (67.48 %) Shrimp farms was between one to five acres [25]. Chandra et al. (2010) reported that, the typical annual yields of bagda, golda and white fishes were 350.37, 428.08 and 172.52 kg/ha [25]. The maximum bagda production was found in Mongla (673.34 kg), whereas the minimum was seen in Chitalmari Thana (105.04 kg), similarly the upper most production of golda was found in Mollahat Thana (879.91 kg) and lowest (143.35 kg) in Rampal. The total yield of Shrimp was 465 kg and total return was 228,000 BDT per acre that covers the breakeven point of quantity and its monetary value [18].

In the present study, we found that, the production condition of Shrimp was hampered in 2020 rather than 2019 due to COVID-19 pandemic. The production of Shrimp might be reduced due to belated stocking of Shrimp PL in ghers because of unavailability of Shrimp PL in lockdown period for COVID-19. During lockdown period wholesale fish market (kata) was totally closed which impacted on farmer's income. Since export market including Shrimp processing industry was banned due to COVID-19 that resulted lower Shrimp price and ultimately affect the income status of Shrimp farmers. Interrupted communication also hampered the supply of regular inputs for Shrimp farming that improperly prolonged management activity. COVID-19 extremely caused great loss for those who do not have their own land for Shrimp farming. Especially for those who took lease from other for interest and makes them both social harassment and economic crisis.

Moreover, Shrimp is also prone to various disease outbreaks like WSSV, AHPND and various pathogenic organisms as the farmers were not able to maintain their farms properly during this pandemic [30]. Therefore, due to COVID-19 the Shrimp farmers harvested the diseased Shrimp and sold at lower price that ultimately affect their income status. Lockdowns subjected the worth chain to severe national and global transport interruptions for production inputs, processing, and finished products for national consumption and export. Strict implementation of restrictions on the movement of ingredients and other people, including employees, farm inputs, like feed and seed unavailability. Small farmers suffered commercial losses because they might not sell their yields, and/or were forced to sell at low prices. Many farmers cannot keep nursing their stock for too long without income as they need to repay loans

in every month even during COVID-19 situation. In Bangladesh, fish and Shrimp farmers were unable to harvest their yields and therefore, could not start a new production cycle. The result are going to be a decrease in fish supply within the coming months [31]. Hatcheries were unable to provide seed because they might not find specific pathogen free broodstock from their sources overseas for limitation of flights. Farmers will now miss a cycle.

Besides, Shrimp processing units have not been operating at best capacity because of an acute scarcity of labor. Currently, the government has partially released the restrictions to comfort the movement of food supplies and important services [32]. In Bangladesh, India and Thailand [33], Shrimp exports are most suffering from reduced, delayed or cancelled orders from major markets like China, the EU, Japan and therefore the USA. Lately, some importers have restarted ordering, and governments have released lockdown measures. However, in some countries like China, Bangladesh, India and Thailand, processors remain operate at reduced capacity with fewer workers per shift to comply with physical-distancing requirements. This is not a causal claim, there are multiple "general equilibrium effect" and there is the joint effect of both COVID-19 and the mitigation strategies. The negative consequences may be underestimated since stress, anxiety, and mental health may have worsened too and may negatively affect the income in the long run [34]. Asking the farmer about their previous income after the shock may bias the results due to measurement error, as a limitation of the study.

4. CONCLUSION

Due to SARS-CoV-2 and the partial engagement in Shrimp farming activities poor socio-economic conditions of the Shrimp farmers in Khulna district of Bangladesh was revealed in this study. Thus, large numbers of farmer families were unable to fulfill their minimum needs (food, income and medical care). Most of the Shrimp farmers were middle aged, mostly illiterate and lived in families with >5 members. The overall Shrimp production and income was greatly reduced and that of the livelihood was noticeably threatened during the COVID-19 pandemic.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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