Effect of Covid-19 pandemic on shrimp farming at Navsari, Gujarat, India

Abstract

The lockdown on account of the Coronavirus disease 2019 (COVID-19) adversely impacted the food production sector including aquaculture globally. Unfortunately, it coincided with the major shrimp farming season in India which contributes 60% of the national annual shrimp production hence the impact was substantial. Shrimp farmers follow the different management practices in shrimp farming operations like seed, feed, probiotics, medicine, disruptions in the supply chain, transportation, harvesting and marketing. Therefore, the objective of present study was to find out the impact of COVID-19 pandemic on shrimp farming sector in Navsari (Gujarat). These findings are depicted that management practices of the shrimp farming in study area was disturbed and huge economic losses was faced by the shrimp farmers during pandemic situations. It is suggested that technical and financial assistance for safe, sufficient and hygienic supply of seed, feed, probiotics, chemicals, medicines and probiotics by the government agencies should be ensured which help to shrimp enhance the aquaculture production and survive of shrimp farmers. The result of present study is also helpful for the government authorities to develop policies and execution of the plans during such pandemic condition for shrimp farmers that can prevent the production loss and sustain the shrimp farming industry.

Keywords: Aquaculture, COVID-19 pandemic, Shrimp farming, Probiotics, Medicines.

1. Introduction

"The aquaculture refers to the cultivation of aquatic organisms in controlled aquatic environmental condition for commercial and recreation purpose" [1]. "Aquaculture contributed 43 percent of aquatic animal food for human consumption in 2007 and is expected to grow further to meet the future demand. Global aquaculture has grown dramatically over the past 50 year to around 52.5 million tons in 2008 worth US$98.5 Billion and accounting for around 50 percent of the world's fish food supply". [2].

"India is an important country that produces fish through aquaculture in the world. Brackish aquaculture production in the country largely on account of shrimp farming is estimated that out of about 1.23 million ha recognized as potential areas for brackish water fish farming in the country 10% area is being farmed at percent of this area, about 80% is under traditional farming systems and the remaining is under extensive farming and semi extensive shrimp farming. Farmed shrimp accounts for 55 % of the shrimp produced globally" [3]. "Shrimp farming provides direct employment to about 0.3 million people and ancillary units provide employment for 0.6 to 0.7 million people in our country" [4]. "The brackish water sector includes the culture of shrimp varieties primarily, the native giant tiger prawn, *Penaeus monodon* and exotic white-leg shrimp, *Litopenaeus vannamei*. Today, *Litopenaeus vannamei* species is the most extensively farmed crustacean species in the world" [5].

"Gujarat is one of the emerging shrimp producer State of India which has 1600 km long coastline and owns rich brackish water resources, a large suitable shrimp farming area, freezing plants, peeling sheds etc. Gujarat contributed about 2.80 percent of national shrimp production, in spite of having 2nd largest brackish water area only after west Bengal" [3]. "The area under shrimp aquaculture in Gujarat was 2059 hectare from which it produced 6064 MT of shrimp during the year 2011-12" [6].

The first COVID-19 case was reported in December 2019 in Wuhan, China [7] then the virus has spread throughout the world. "It has infected approximately 22.86 million people worldwide and about 0.78 million people lost their lives as on 20th august 2020. In India, around 2.77 million people were diagnosed positive for COVID-19 and 53,000 people lost their lives by the end of august 2020" [8].

"The COVID-19 pandemic affected the agricultural activities including fish and shrimp culture sector. Most of the shrimp producing countries particularly in south-east Asia have been affected due to the lockdown, quarantine rules and regulations ordered by the countries, which was assigned to reduced and control the COVID-19 pandemic spreading in the globes" [8]. "In addition, export restrictions across countries have limited global food and agricultural trade

and market access" [9]. "Therefore, the reduction of cargo capacity for commercial flights of agricultural goods led to disruption of the global supply chain" [10, 11]. "Further, the labor shortage, delay in shrimp harvesting and insufficient supply for the processing of shrimp in the plants are other impacts due to corona virus outbreak" [12].

"The COVID-19 pandemic was severely dampen global shrimp production in 2020 as well demand for fresh and frozen shrimp was declined significantly. In Asia, the early season's farming activities slowed down considerably with lower density of stocks and delayed stocking of ponds in most producing countries. As of early May 2020, pond stocking in India's largest vannamei producing state Andhra, declined by 60 percent compared to the same period of previous year. The aquaculture season in Asia, which generally begins in April is now pushed towards June/July" [13]. "In addition to raw material shortages in the producing countries, social distancing rules and other control measures adopted to combat the COVID-19 pandemic continue to hampered processing and shipments of the existing import orders" [13]. "It is reported that after declaring pandemic lockdown in India during the March 2020, the summer crop of shrimp was in jeopardy and shrimp industry faced about $1.5 billion loss" [13].

"India's annual shrimp feed requirement is about 12-13 lakh tones, most of which is produced by 8-10 major companies located mostly in the state of Andhra Pradesh and Tamil Nadu, and few from Gujarat, Haryana and West Bengal. Barring the minor glitches during the first week of lockdown, feed mills resumed their production to the near normal period except the issues related to labor and transportation which hindered the timely supply. Since feed mills are totally dependent on the demand from farming operations, poor stocking activity, both in term of farming area and stocking densities in the farms led to the scaling down of feed production. Further, lockdown affected the movement of raw materials such as fish meal, soybean meal and other specialized inputs such as fish oil, krill meal etc., compelling the feed mills to curtail their production capacities. Similarly, shrimp healthcare products including nutritional supplements, probiotics and pond management inputs are crucial for successful shrimp farming. Based on the reports on marketing trends, lockdown is reduced the sale of feed and healthcare products and employment" [14]. "Professional support from the input dealers in the areas of feed, health and pond management to farmers was also interrupted due to restrictions in their movement, under lockdown" [14]. "It is important to highlight the fact that informal supply chains are facing greater impacts due to the lack of formal contractual relationship (no established cold chain or insurance, among others). Another consequence of the virus outbreak linked to global trade is the cancellation of key seafood trade events across the world" [15].

2. Materials and Methods

Study area: The present study was conducted in Onjal, Karadi, Samapor, Matwad, Menther-Bhat villages of Navsari district of Gujarat state (Fig. 1).This area was prominent in shrimp farming hence selected for the study.

Survey methodology: The information regarding impact assessment of COVID-19 on shrimp farming was collected from respondents through questionnaire (Survey methodology) which was prepared to follow the [16] and data were collected through personal interview of shrimp farmers. Total 64 respondents were interviewed and analyzed on the basis of convenience sampling technique during November 2020 to February 2021 for current study [16].

Data processing and analysis: The data were collected from study area and were processed and analysed in form of table and graph by Microsoft Excel 2010.

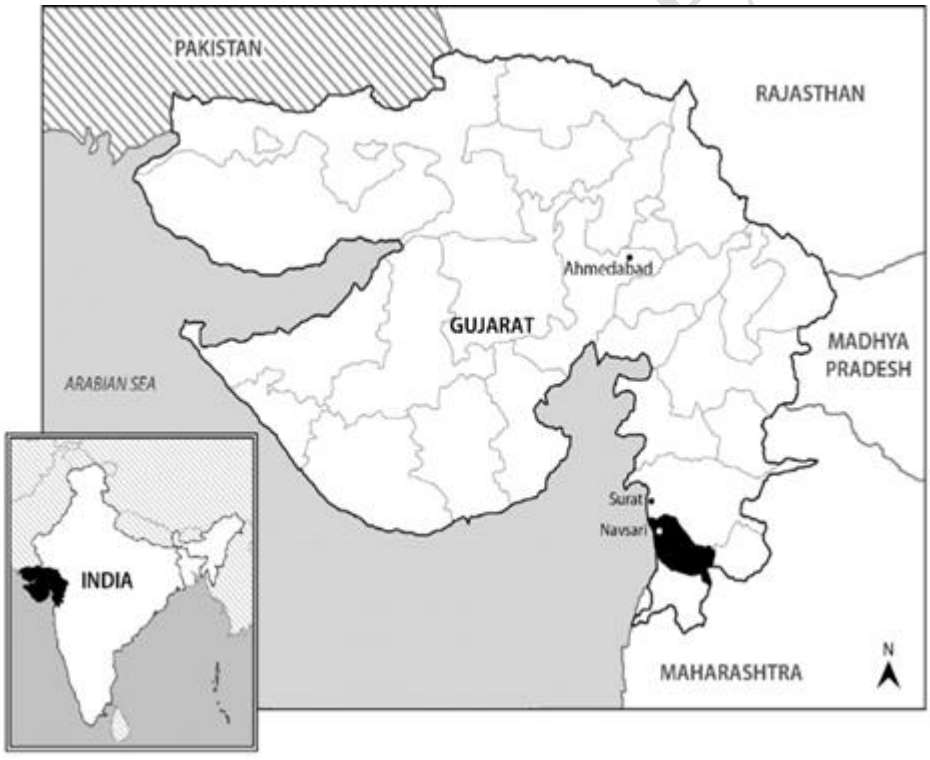

Figure 1. Map of the study area (Navsari, Gujarat)

3. Results and Discussion

The pandemic related disruption adversely affected the shrimp farming in study area. Overall impacts of COVID19 pandemic and pandemic induced lockdown on the shrimp farming were estimated based on the response of the farmers.

3.1 Problems faced by the farmers in shrimp farming

3.1.1 Seed supply

The results shows that COVID-19 lockdown adversely affected the shrimp hatcheries and respondents of the study area was faced problems in unavailability of seed . The seed produced by the shrimp hatcheries before lockdown which should have been ideally sold to the farmers during lockdown but could not be sold due to total disruption in transportation. As result most of the shrimp hatchery discarded the available seed stock. The16 billion larvae were produced in India by March 2020, of which some 1 to 1.5 billion PL were discarded by the hatchery operators during lockdown due to decreasing demand by the farmers [14]. Respondent (67%) faced problem of high cost followed by respondents (61%) faced problem of unavailability of seed while respondents (44%) faced problems in breakdown of seed supply chain during COVID-19 lockdown (Table 1). Most of the hatchery prepare the seed but due to the sudden lockdown seeds are not transported in shrimp farming regions. Non-availability of seed and feed due to cost transportation increased resulted severe constraints of seed in shrimp farming business reported by [17].

3.1.2 Feed supply

The results (Table 1) revealed that the 49% respondents met problems with unavailability of feed. During covid-19 pandemic lockdown transportation was closed and all interstate and intra state transportation were disturbed. Feed is an important criteria for sustainability of shrimp farming. Respondents (24%) have faced the hurdle of the scarcity of feed supply as feed mills were closed during lockdown. Respondents (27%) faced problem in high cost of feed supply due to the demand of feed in shrimp farming during COVID-19 pandemic. Similar results were found by [17, 18].

3.1.3 Probiotics supply

The results (Table 1) explained that 39% respondents admitted problem in unavailability of probiotics while same number of respondents faced problems of breakdown of supply chain. On other side, 21% respondents faced problem in high cost during COVID-19 pandemic. The global lockdown has put much pressure on the supply chain of transportation. Till date no data was found on this. This study is done for the first time particularly in this area.

3.1.4 Medicine and chemical supply

The results (Table 1) revealed that 17% respondents faced problem in unavailability of medicine and chemical supply while 10% respondents faced problems of breakdown of supply chain. Due to the covid-19 pandemic lockdown transportations were closed all over the

country. Till date no data was found on this. This study is done for the first time particularly in this area.

3.2 Problems in harvesting

The results (Table 1) showed that the most of the respondents (86%) confronted problem in harvesting due to the lack of unavailability of workers. During COVID-19 pandemic lockdown all the migrant workers have returned to their home/state due to fear of infection and lack of salary. There are 27% respondents reported that they didn't have any accessories such as gear. Findings of current study revealed that farmers faced problems in shrimp harvesting due to unavailability of labor that evident by [8] which reported that manpower shortage at farm and non-availability of skilled technician at shrimp hatcheries due to pandemic restrictions in the movement or transportation.

3.3 Problems in post-harvesting preservation

The results (Table 1) denoted that the most of the respondents admitted problems in preservation. Respondents (74%) have inadequate storage facilities. Respondents (24%) have inadequate ice facilities due to the lack of transportation. Respondents (2%) faced problems in breakdown of cold chain due to the covid-19 pandemic lockdown. Findings of present study supported by [8].

3.4 Problems in transportation

The results (Table 1) revealed that all respondents accepted problems in transport facilities. Inadequate facilities are seen during lockdown. During lockdown, all the public transportations are closed. Respondents (69%) faced problem in high transportation cost while 28% respondents have inadequate transport facility and 84% respondents have inadequate manpower at study area as Government implemented strict rules for the transportation during pandemic lockdown 2020. Similar findings were noted by [12, 19].

3.5 Problems in marketing

The results (Table 1) specified that during marketing of shrimp, 91% respondents faced problems in price fluctuation, 80% in low prices offered by buyers, 2% in decreased domestic demand, 3% in the close of domestic market, 27% in decreased international demand, 20% in the close of international market and 50% in delay or no advanced payment during COVID-19 pandemic. Respondents experienced fluctuation in price, maybe it happened because all the import and export of farmed shrimp are closed. Respondents faced these problems mainly due to restriction in importing seed production, the supply of farm inputs, processing and marketing of shrimp. According to [20] investigated the most common issue of low market pricing which was the source of concern for shrimp farmers, especially in the wake of the pandemic similarly

shrimp prices in the local and worldwide markets fluctuate dramatically because of inconsistencies in the supply chain [21]. On the other hand, consumers are paying more money for aquatic products but dealers pay less to buy these products from farmers [22]. In pandemic lockdown period for COVID-19 the restrictions on transportation and other human activities are imposed which is resulted that wholesale fish market was totally closed and significantly impacted on shrimp sale and income of shrimp farmers.

3.6 Overall impact on the farming development

The findings showed that overall farming operations and development were affected during COVID-19 pandemic. Respondents (86%) agreed to decrease in the farm income while 70% and 64% respondents agreed to decrease in farm operations and farm income respectively (Table 1). Similar results of current study was reported by [19].

Table 1. Impact assessment of the COVID19 caused lockdown on farming operations

S.N.	Components	Respondents	
		Faced	Not faced
1.	Problems faced in		
a.	Seed supply		
	i) Unavailability	39 (61%)	25 (39%)
	ii) Breakdown of supply	28 (44%)	36 (56%)
	iii) High cost	43 (67%)	21 (33%)
b.	Feed supply		
	i) Unavailability	25 (49%)	26 (51%)
	ii) Breakdown of supply	12 (24%)	39 (76%)
	iii) High cost	14 (27%)	37 (73%)
c.	Probiotic supply		
	i) Unavailability	11 (39%)	17 (61%)
	ii) Breakdown of supply	11 (39%)	17 (61%)
	iii) High cost	6 (21%)	22 (79%)
d.	Medicine and chemicals supply		
	i) Unavailability	11 (17%)	53 (83%)
	ii) Breakdown of supply	7 (10%)	57 (90%)
	iii) High cost	-	-
2.	Problems in harvesting		
	i) Unavailability of accessories	17 (27%)	47 (73%)
	ii) Unavailability of workers	55 (86%)	9 (14%)
3.	Problems in post-harvesting preservation		
	i) Inadequate storage facility	40 (74%)	14 (26%)
	ii) Inadequate ice facility	13 (24%)	41 (76%)
	iii) Breakdown of cold chain	1 (2%)	53 (98%)
4.	Problems in transportation		
	i) Inadequate transport facility	18 (28%)	46 (72%)
	ii) Inadequate transportation cost	44 (69%)	20 (31%)

	iii) Inadequate manpower	54 (84%)	10 (16%)
5.	Problems in marketing		
	i) Fluctuation in Prize	58 (91%)	6 (9%)
	ii) Low price offered by buyer	51 (80%)	13 (20%)
	iii) Decreased domestic demand	1 (2%)	63 (98%)
	iv) Close of domestic market	2 (3%)	62 (97%)
	v) Decreased international demand	17 (27%)	47 (73%)
	vi) Close of international market	13 (20%)	51 (20%)
	vii) Delay in payment or no advanced payment	32 (50%)	32 (50%)
6.	Overall impact on the farming development		
	i) Farm income was decreased	55 (86%)	9 (14%)
	ii) Farm operations were affected	45 (70%)	19 (30%)
	iii) Farm development were affected	41 (64%)	23 (36%)

3.6 Disease infestation in shrimp

Respondents (67%) observed disease in shrimp while 33% respondents did not find disease in shrimp during COVID-19 lockdown (Table 2). COVID-19 pandemic lockdown affected the transportations and the supply chain of probiotics, medicine and chemicals. Till date no data was found on this. This study is done first time particularly in this study area.

3.7 Availability of sufficient farm workers

Respondents (63%) did not have sufficient farm workers during/after lockdown while 37% respondents have sufficient farm workers (Table 2). Shrimp farming has two major seasons in India such as summer crop (March-April to June-July) and the winter crop (July-August to November-December). Unfortunately, the lockdown coincided with the main cropping season. Most of the farmers were not able to do stocking in March-April due to uncertainty of good quality seed and lacking of farm workers. Similar results were published by [23].

3.8 Government assistance for farming

All respondents (100%) did not have any government assistance for farming during this study (Table 2). Findings of present study are supported by [18].

3.9 Organization or institutions provide guideline to sustain in shrimp farming

Respondents (53%) did not find any guideline for farming while 47% respondents found guideline for sustainable farming after year of Covid-19 pandemic (Table 2). According to [24], there were no significant changes found in technical guidance regarding shrimp farming.

3.10 Alternative for livelihood

Study showed that victimised farmers (45%) thinking to adopt alternative livelihood to sustain the life while 55% farmers were not thinking the same (Table 2). Similar findings were recorded by [18].

3.11 Insurance policy covered the COVID-19 pandemic

All respondents (100%) neither have any crop insurance nor covered COVID-19 pandemic losses. Most of the farmers did not have crop insurance policy because they were thinking that it is difficult and time-consuming process (Table 2). With support of this study [25] reported that 91.7% respondents were not having risk coverage insurance. Insurance policy is one of the major factor. Most of the farmers faced huge economic losses in pandemic situations and not recovered from it due to ignorance of an insurance policy.

Table 2. Impact of COVID19 pandemic on shrimp farming development factor

S. N.	Component	Responses of the respondents	
		Yes (%)	No (%)
1.	Disease infestation in shrimp	67%	33%
2.	Availability of sufficient farm workers	37%	63%
3.	Government assistance for farming during COVID19 pandemic	-	100%
4.	Organization or institutions provide guideline to sustain in shrimp farming after COVID19 pandemic	47%	53%
5.	Alternative for livelihood	45%	55%
6.	Insurance policy covered the COVID-19 pandemic	-	100%

4. Conclusion

On the basis of results it is clearly concluded that COVID-19 pandemic which badly impacted the aquaculture sector. Shrimp farming operation were negatively affected due to delay in the farming inputs like seed, feed, medicine, chemicals and probiotics. The nationwide quarantine rules and regulations during pandemic affected transport and harvesting facilities, migration of labour cause the unavailability of workers and stop the national or international market and marketing facilities resulted negative effect on shrimp farming. The overall shrimp production and income was greatly reduced and that of the livelihood was noticeably threatened during the COVID-19 pandemic.

5. Recommendations

The study recommended that procurement of shrimps for domestic consumption is needed at government fixed price. The small farmers should be provided viable insurance cover

and awareness regarding it to mitigate risk in shrimp farming. The state government should take initiatives to support the farmers and ensure uninterrupted operation in aquaculture sector.

Competing interests

Authors have declared that no competing interests exist.

Authors' Contributions

The first author a (NPS) helped in sample analysis and manuscript writing while author b (NCU) was involved as research guide and helped in manuscript reviewing and editing whereas third author c (URP) is involved in fish samples collection. All authors read and approved the final manuscript.

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