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Status of shrimp diseases and their management practices at Satkhira in Bangladesh

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Abstract
Shrimp farming is one of the fastest rising economic activity in coastal parts of the Asia-Pacific regions including Bangladesh. The coastal region, especially the south-western part of Bangladesh including Khulna, Bagherhat and Satkhira is one of the most promising areas for shrimp and prawn farming. Mainly *Penaeus monodon* and *Macrobrachium rosenbergii* are cultured in South-western part of Bangladesh. The study was conducted to know the status of Shrimp diseases and their management practices. The data were collected from sixty farms in three sites *i.e.* Shyamnagar, Buri Goalini, Munshiganj covering mainly shrimp and prawn farming area at Satkhira district. Data were collected through questionnaire interview, key informant interview; personal contact and participatory rural appraisal (PRA) i.e. focus group discussion (FGD) with local people, farm owners, shrimp and prawn farmers. A number of diseases were reported in the study area by the farmers i.e. White Spot Syndrome, Yellow Head Disease, Vibriosis, Black Gill Disease and Soft Shell Disease. WSS was the most widespread problems for shrimp species in the study area. A variety of aqua drugs, chemicals, antibiotics and disinfectants were used during pre-stocking, post-stocking and disease management. During pre-stocking management farmers used lime (100%) followed by fertilizer (90%), hunter (70%) and zeo-prime (30%). During culture period and disease management farmers used lime (92%), fertilizer (83%), salt (80%), formalin (50%), oxy-tetra-vet (42%), aquakleen (27%) and potasium per manganet (15%). In the study area, the average production of shrimp 73 No/dec. (3 kg/dec), prawn 32 No/dec. (3.5kg/dec). Lack of technical knowledge about culture, quality Post Larvae of shrimp and prawn, awareness about the use of chemicals, diagnosis of diseases, and improper stocking density and disease problems were the main problems in shrimp and prawn culture in the study area. Farmers demanded training on different aspects of shrimp culture and management practices for higher production. According to the respondents, low-cost laboratory facilities and knowledge sharing and learning (KSL) center could be developed at community level with the coordination of government extension unit, development organization, local service providers and farmers which could be enriched with different information including descriptions of disease symptoms, means of diagnosis and how to prevent or treat diseases etc. The information of the study will be helpful for successful management of disease occurred in shrimp farms of Bangladesh.

Keywords: *Penaeus monodon*, *Macrobrachium rosenbergii*, aquaculture, disease management, aquadrugs and chemicals

Introduction
Bangladesh is one of the world's leading fish producing countries with a total production of 41.34 lakh MT, where aquaculture contributes 56.44 percent to total production [15]. Aquaculture sector in Bangladesh has expanded rapidly all over the country [29]. According to FAO statistics 2016, Bangladesh is ranked 5th in world aquaculture production [15]. Fisheries sector contributing significantly in food security through proving safe and quality animal protein; almost 60 percent animal protein comes from fish. It contributes 3.61 percent to our national GDP and around one-fourth (24.41 percent) to the agricultural GDP [15]. In our country more than about 15.6 million people are directly and indirectly involved in this sector [25, 1].

Bangladesh earns a significant amount of foreign currencies by exporting fish, shrimps and other fisheries products. In 2016-17, the country earns BDT 42876.40 million by exporting almost 68.31 thousand MT of fish and fisheries products [15]. This success is due to export of quality shrimp introducing HACCP procedure and traceability regulation according to the requirement of European Union (EU) and USA. Bangladesh is enriched with a huge aquatic

resource in the forms of fresh and brackish water among brackish water bodies is suitable for shellfish production. Shrimp farming is one of the fastest growing economic activities in coastal regions of the Asia-Pacific regions including Bangladesh. The coastal area of Bangladesh is considered suitable for shrimp farming and 0.276 million hectares of land are presently under brackish water shrimp farming [27]. Shrimp farming in Bangladesh has expanded rapidly after 1980s due to huge international market demand and high export value. At this time, a big group of large companies in Cox's Bazar region were involved in establishing semi intensive farm. The south-western part including Khulna, Bagherhat and Satkhira is the most promising areas for shrimp and prawn farming for two main reasons. The first reason is the mangrove ecologies with distinctive feature of biodiversity and the second one is the suitable habitat for shrimp, prawn faming [23]. It has been documented as a part of Blue Revolution for the geographic features of southwest coastal area [4, 16, 39, 40]. Coastal aquaculture in the brackish water ghers of the south-west Bangladesh mainly deals with culture of shrimp (*Penaeus monodon*). Another commercially valued species for aquaculture is *Macrobrachium rosenbergii* [34]. The biology of these two species is generally linked with the salinity of the environment. Khulna area is geographically located in the diverse climatic condition between fresh, brackish and marine environment. Shrimp and prawn are both suitable culture in this ground. Shrimp farming plays a significant role in the economy of Bangladesh and this is major export items in Bangladesh. Shrimp and prawn collectively constitute the second largest exportable items, total shrimp and prawn production including capture has been increased from 1.60 lakh MT in 2002-03 to 2.46 lakh MT in 2016-17 [15]. This sector not only earns valuable foreign exchange but also employs significant numbers of rural workers. The farming activities of shrimp directly and indirectly employ more than 0.6 million people in the country [24]. Yet, the progress of this sector is often unregulated, uncontrolled and uncoordinated [14, 33, 43, 5]. Sudden disease outbreak is frequently disrupting our whole shrimp farming industry, fluctuation of water quality parameters (pH, temperature and dissolved oxygen etc.) makes shrimp susceptible to stress, leading to diseases [37]. Viral diseases are the most devastating because they are difficult to detect and impossible to treat in ponds [11]. White Spot Syndrome (WSS) in shrimp aquaculture results huge economic losses every year in coastal regions of Bangladesh [10]. The disease leading cause of production losses especially in Asia and is posing a major threat to the shrimp farming industry [18]. The intake of polluted water from neighboring farms often spreads water-borne pathogens from farm to farm [36], which can be prevented through proper management practices [19]. The prevention of fish disease is adept through good water quality management, nutrition and sanitation, and farmers of Bangladesh use both traditional and commercial aquaculture-drugs and chemicals during pond preparation, water quality management, growth promotion and disease treatment [41]. Usually farmers use variety of drugs including lime, urea and TSP for pond preparation and potassium permanganate, tetracycline, oxytetracycline, formalin, salt and lime for health management and disease treatment [21, 38]. The drugs and chemicals are improves the growth and disease resistance capacity of fish and shrimp [3]. The culture technology of shrimp with the provision of prevention of viral disease is developed by Bangladesh Fisheries Research Institute (BFRI) [42]. Consequently, an initiative has been assumed to find out how the farmers change their farming practices, their production and awareness about diseases. So successful shrimp farming depends on its good management and improved system at various culture practices. The present study was conducted to assess status of the disease problems and management practices for shrimp (*P. monodon*) and prawn (*M. rosenbergii*) farming systems primarily based on a systematic survey of 60 grow-out farms in Satkhira district in Bangladesh.

2. Materials and Methods

2.1 Selection of the Study Area

The study was conducted in three sites Shyamnagar, Buri Goalini, Munshiganj in Satkhira district of Bangladesh (Fig 1) which covering mainly shrimp and prawn farming area. The area was identified as having high density of shrimp and prawn farm (Gher).

2.2 Description of the Study Area

The study was conducted in 60 private shrimp and prawn farms (Gher) of Satkhira district. A stratified random sampling strategy has been followed as the development of shrimp and prawn farming takes place in a geographically distributed area.

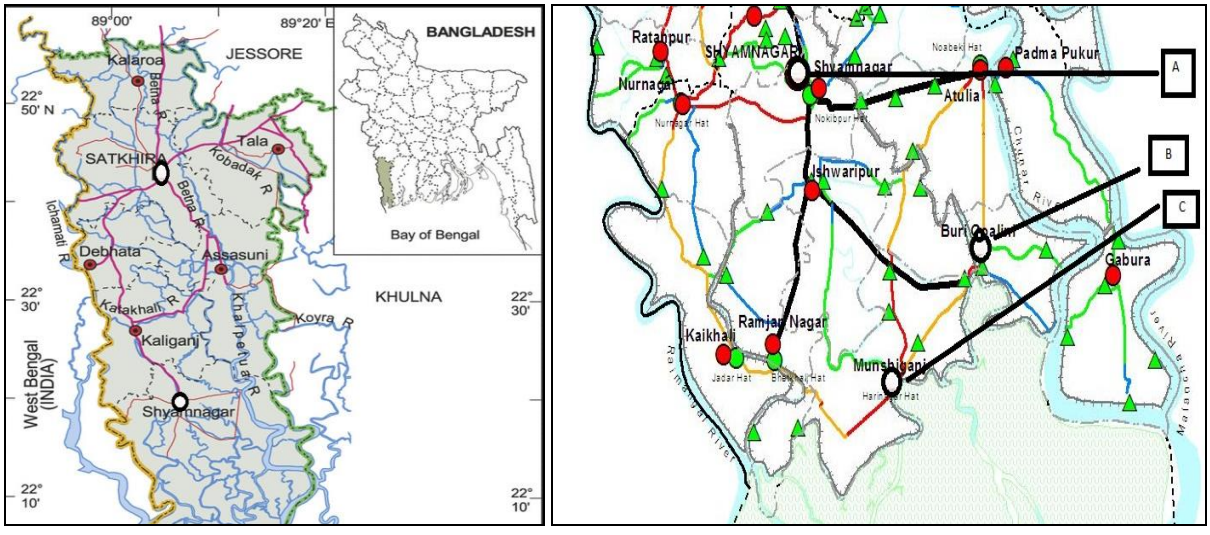

Fig 1: Map showing the study area (Banglapedia)

2.3 Duration of the Study
The study was conducted for a period from July 2018 to December 2018. Data were collected through questionnaire interview (QI) and focus group discussion (FGD) of the fishermen, the key informant interview (KII) are leader farmers and Upazilla Fisheries Officer (UFO).

2.4 Flow Chart of the Methodology:
The present study has been undertaken and completed according to the following order of methodology-

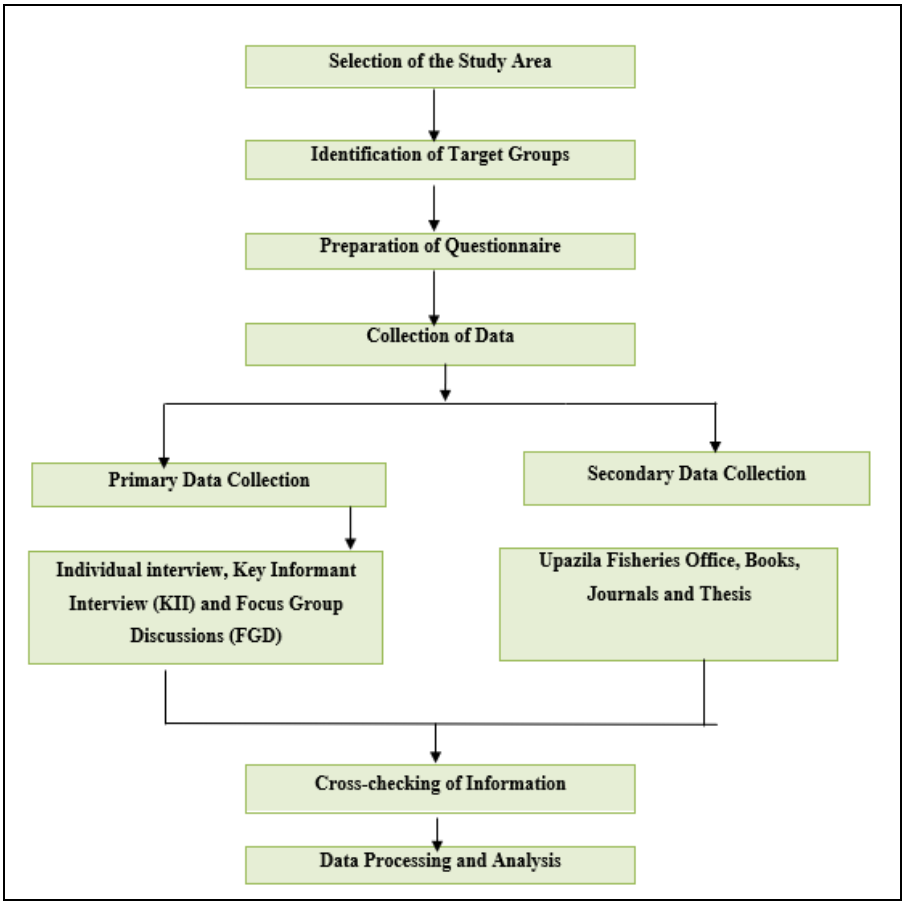

Fig 2: Design of research methodology

2.5 Identification of Target Groups
A large number of people are engaged with shrimp and prawn farming activities in the study area. The data was collected from different target groups to have an overall scenario of disease of shrimp and prawn associated in this area. A total number of 60 farms from three sites of Satkhira district were selected for the study (Table 1).

Table 1: Location of the farms (N=60) and sample size

Sl. No.	Distribution of the Farms	Sample size
01.	Shyamnagar	20
02.	Buri Goalini	20
03.	Munshiganj	20
Total		60

2.6 Questionnaire Preparation
A draft questionnaire was developed before preparing the final questionnaire based on the objectives of the study. The draft questionnaire was used for pre-testing with few sample respondents. The questionnaire was then changed, modified and rearranged according to the experience gathered from the pretest. The final questionnaire was then developed in logical sequence so that the fishermen could answer chronologically. Questions related to present status of shrimps diseases and their management practices were included. The survey also covered detail information on chemical and biological products used in aquatic health management (e.g. active ingredients, dosages, purpose of application) during last production season and whether they were used for disease prevention or treatment. In order to triangulate especially the data on chemical and biological products was reported by farmers, data were crosschecked by comparing with product label indication and data from shops selling chemicals for aquaculture.

2.7 Data collection method
Both primary and secondary data were considered for the present study. During the study period a combination of Participatory Rural Appraisal (PRA) tool such as questionnaire interview (QI), focus group discussion (FGD) and cross-check interviews with key informants were used.

2.7.1 Method of Primary Data Collection
2.7.1.1 Participatory Rural Appraisal (PRA)
Participatory rural appraisal (PRA) is a method to collect information from target group in participatory fashion. The advantages of PRA over other method were that through wide participation of the community, the information collected was likely to more accurate. For the present study, PRA tools such as Focus Group Discussion (FGD) was conducted with fishermen to obtain an overview of the main disease symptoms faced by each of the different farm groups. In FGD sessions, a set of disease picture cards were displayed and

respondents were asked about the major symptoms of the disease that they observed during the production year. Respondents were also asked about the fish health management practices related to the treatment of disease or prevention and the health hazards of farmers due to the use of chemicals. A total 6(six) FGD were conducted in these study where each group size was 10-12 persons and the duration of each session was approximately 1.5 hours. FGD sessions were held in front of the farmer's house and gher, village shops, local schools and community clubs wherever there were spontaneous gatherings and where participants could sit and feel comfortable.

2.7.1.2 Questionnaire Interview (QI)
During the study period, a 60 farms and gher leader farmers were randomly selected for questionnaire interviews from three sites surrounding the study area. The questionnaire interviews were done at gher and farms, in front of village shop, local schools depending on the presence of the shrimp and prawn farmer and farm owners.

2.7.1.3 Cross Checking of Information with Key Informant
Key informants are persons which have special knowledge on a specific topic. After collecting the data through FGD and questionnaire interviews (QI), it is necessary to check the information for justification of the collected data. Cross-check interviews were accompanied with key resource persons such as District Fisheries Officer (DFO), Upazila Fisheries Officers (UFO) and local leaders. The key informant interviews (KII) of the respondents were conducted in their office during office hour.

2.7.1.4 Summarization, Tabulation and Reliability of Data
After collection, the data were recorded in master table sheet. After completion of the pre tabulation task, actual tabulation work was started. A number of tables were prepared on the basis of the objectives of the study. Finally, tabulated data were analyzed and condensed using average and percentages.

2.7.2 Method of Secondary Data Collection
Secondary data was collected from various sources including official documents from BFRI, DoF office and websites. Relevant journals and publications were downloaded from internets which were available in the websites.

2.8 Data Processing and Analysis
After collection of data, the primary and secondary data were reviewed, stored, coded and then input into computer for further analysis. All the collected information were accumulated and analyzed by MS Word, MS-Excel and then presented in textual, tabular and graphical forms. The summary sheets were prepared accordance to the objectives of the study.

2.9 Problems Encountered During Data Collection
Some problem was encountered during data collection farm and gher owner were unavailable and busy in the farming activities; they were unwilling to spend time for interview. Language and communication was also a barrier for the data collection because they used their local names and terminologies. However, the above problems were overcome tactfully and real information for the sake of a successful study was collected as far as possible.

3. Results

3.1 Status of Shrimp/Prawn Respondent Farms
This study conducted into three sites Shyamnagar (A), Buri Goalini (B) and Munshiganj (C) of Satkhira district. A total of 60 farms were randomly surveyed from the selected study area. The surveyed farms were divided into most important three farm groups as shrimp, prawn and Shrimp/prawn + fish defined by the major species produced in the selected area. From the study area there were 45 shrimp, 8 prawns and 7 mixed cultured farms were selected for this research purpose (Table 2).

Table 2: Species cultured in the study area

Culture Species			No. of Respondent farms, n=60				
			Shyamnagar (A)	Buri Goalini (B)	Munshiganj (C)	Total RF	(%) RF
Shrimp		*Penaeus monodon*	15	16	14	45	75
Prawn		*Macrobrachium rosenbergii*	3	2	3	8	13
Shrimp/Prawn +Fish	Rui	*Labeo rohita*	2	2	3	7	12
	Catla	*Labeo catla*					
	Silver Carp	*Hypophthalmichthys molitrix*					
Total			20	20	20	60	100

*RF-Respondents Farms

Shrimp and prawn culture occurred mainly in the gher. The term gher refers to a paddy field which has been modified for the production of shrimp or prawn. Typically, paddy is cultivated in the middle of the field surrounded by canals with high wide dikes where the shrimp and prawn are stocked. Previously most of the fry collect from river but after disease outbreaks it dropped down due to low price of fry from hatchery. The government of Bangladesh recently banned to collect fry from the river and this was another cause of reducing the use of river fry. The Hatchery fry sources are Cox's Bazar, Chittagong and Thailand. However successful shrimp and prawn production depends not only on the technique of cultivation but also on the whole management practices such as pre-stocking, stocking, post-stocking, disease and other risk management.

3.2 Investigation of Diseases Symptoms from the Study Area
As shrimp is very susceptible to disease, the farmer should be careful to disease diagnosis and its treatment. None of the topics in our study group had formal and intensive diagnostic training, suggesting poor capacity of farmers to diagnosis

disease accurately. According to survey report, they have little capacity to identify some disease symptoms based on their previous experience. In the FGD sessions a set of disease picture cards were shown and respondents were asked about the main symptoms of disease that they had observed during the production year. Respondents were also asked about the health management practices related to disease treatment or prevention and the health hazards of farmers due to the use of chemicals.

During the period of study, several causes of shrimp diseases have been recorded. Disease has had a devastating impact on commercial shrimp farming in Bangladesh. A total number of five different types of diseases have been reported from the study area according to their sign and symptoms (Table 3). White spot syndrome disease (WSS) was the major problem for shrimp species and 75% farms had encountered this disease (Table 3). On the other hand Soft shell disease found minimum (only 8%) farms from the study area (Table 3).

3.2.1 White Spot Syndrome (WSS)

According to the study, there were 75% shrimp farm was experienced by white spot syndrome (WSS) and serious economic losses and production of shrimp may occur (Table 3). The studied farm groups reported that WSS mainly appeared from April to August. There were three most important clinical symptoms of WSS were found: (a) white spot mainly on carapace or sometimes a little bit on whole body surface (b) aggregation at the gher edges and (c) sluggish movement (Table 03). Moreover, some symptoms were summarized from (FGD) such as less appetite, reduced preening activities, erratic or spinning swimming near to gher surface and reddish discoloration.

3.2.2 Yellow Head Disease (YHD)

This disease occurred mainly in shrimp but not in prawn farm. From the survey report the disease found 38% of shrimp farm by the symptoms in the study area (Table 03). Farmers reported different symptoms including (a) yellowish discoloration under carapace or hepatopancrease, (b) aggregation at the pond edge and (c) erratic swimming near the surface (Table 3). From FGD session, some another symptoms were documented as abnormal swimming behavior at the edge or surface of gher, sluggish movement, less appetite and reduced growth.

3.2.3 Vibriosis

According to the investigation the disease found in 12% of the studied farms (Table 03). The disease found both in shrimp and prawn farm. Vibriosis often acts as an opportunistic pathogen causing mortality ranging from slight to 100%. Symptoms may found according to survey (a) black spot on different parts of the shell (b) abnormal swimming behavior at the edge or surface of gher (c) lethargic and loss of appetite (Table 3). Some symptoms were summarized from focus group discussion (FGD) such as spongy body, sluggish movement, opaque and whitish muscle (looked like cooked shrimp).

3.2.4 Black Gill Disease

According to the investigation the disease found in 10% of the studied farms (Table 3). The disease found both in shrimp and prawn farm and it mainly appeared at the time of harvest. Poor water condition may lead black gill disease. Symptoms may found according to survey (a) black spot on gill under carapace, (b) sluggish movement and (c) damage gill (Table 3). From the FGD session bacterial erosion on carapace and gill, less appetite and damage gill.

3.2.5 Soft Shell Disease

Soft shell disease may be reported 8% of the farm from the study area (Table 03). Farmers reported different symptoms including (a) the shell become thick and soft (b) shell is rough and wrinkled and (c) slow growth rate (Table 3).

3.3 Chemicals Used for Pre-stocking Management

Before stocking, management practices involving the culture s ystem are known as prestocking management in order to prep are the water body and its surroun-ding environment for life and growth. Pond preparation and the maintenance of water quality are compulsory to improve the production of shrimp. During pond preparation almost all studied farms used lime, fertilizer and variety of aqua drugs like rotenone (Hunter) for removal of predator and zeolite (Zeo-prime) for prepare and refine of water quality. Urea and TSP are mainly used in the gher sometimes farmers used MP and DAP.

From the present study, it was found that 100% farmer used lime followed by fertilizer (90%), hunter (70%) and zeo-prime (30%) respectively (Fig 3 & Table 4). Those chemicals are widely used both in shrimp and prawn gher of the study area. The benefits of using these chemicals are to neutralize water pH, control of water color, disinfection, reduce turbidity of water, increase primary productivity and reduce toxic gas from the aquatic environment.

Table 3: Different diseases with clinical symptoms occurred from the study area

Disease Name	Types	Clinical symptoms	No of Respondent Farms, n=60											
			Shrimp/Prawn							Shrimp/Prawn+ Fish				Total (%)
			A		B		C		Total	A	B	C	Total	
			S	P	S	P	S	P						
White Spot Syndrome	Viral	a) White spot on inside surface of carapace and appendages b) Aggregation at the gher edges c)Sluggish movement d) Less appetite and reddish discoloration.	14	0	15	0	13	0	42	2	1	3	6	48 (75%)
Yellow Head Disease	Viral	a) Yellowish discoloration under carapace or hepatopancrease b) Aggregation at the pond edge c)Erratic swimming near the surface	8	0	7	0	5	0	20	1	1	1	3	23 (38%)
Vibriosis	Bacterial	a) Black spot on different parts of the shell b) abnormal swimming behavior at the edge	2	0	2	0	1	1	6	1	0	0	1	7 (12%)

		or surface of gher c) Lethargic and loss of appetite												
Black Gill Disease	Environmental	a) Black spot on gill under carapace b) Sluggish movement c) Damage gill	0	2	0	1	1	1	5	0	0	1	1	6 (10%)
Soft Shell Disease	Nutritional	a) The shell become thick and soft b) Shell is rough and wrinkled	1	1	0	1	0	1	4	0	0	1	1	5 (8%)

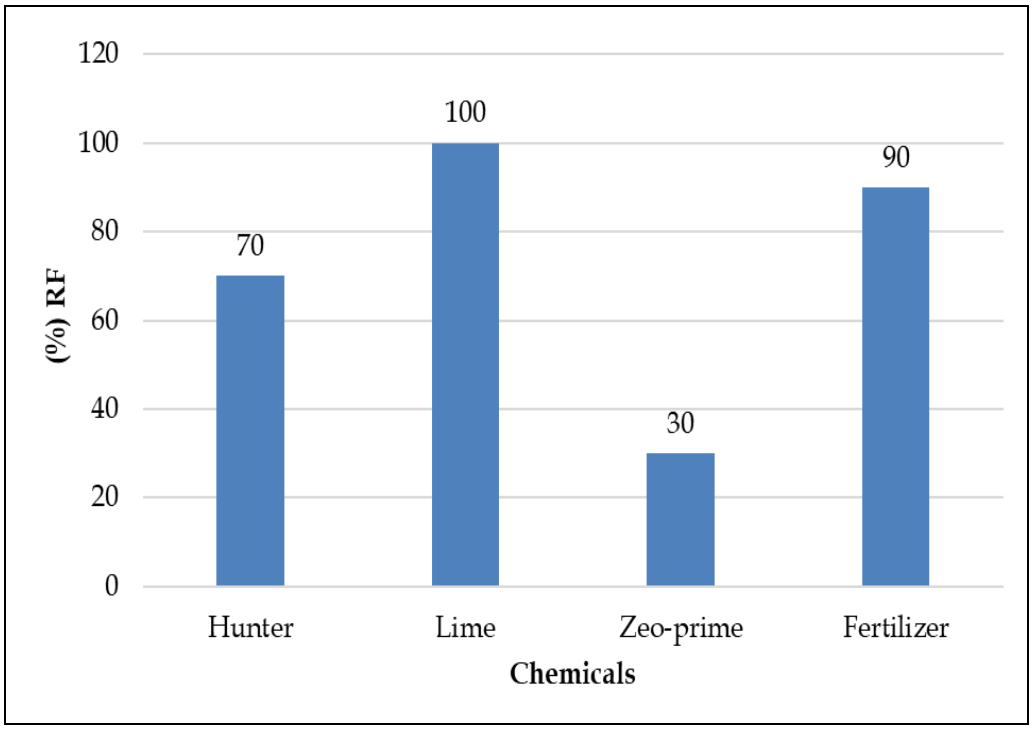

Fig 3: Percentage (%) of respondents using different chemicals

3.4 Chemicals Used for Post-stocking and Disease Management:

Different types of chemicals have been used during culture period as disinfectants, insecticides and ectoparasiticides, oxygen supplier, stress reducer and growth promoter. Farmer use fertilizer mainly during post stocking management for growing plankton in the gher. A wide variety of antibiotics and chemicals have been used to control bacterial, fungal and protozoan disease in both shrimp and prawn gher. For treating protozoan and external bacterial diseases farmers used lime, salt, formalin and KMnO4. Melathion can be used for treating viral diseases but is not active in case of WSSV.

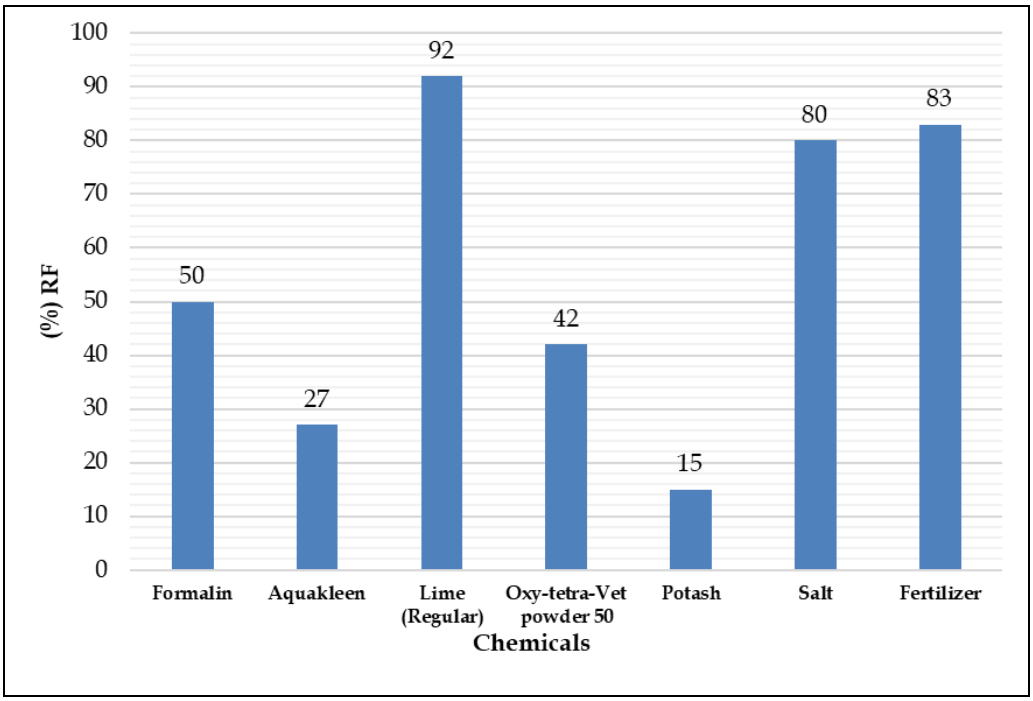

Fig 4: Percentage (%) of respondents using different chemicals

From the record of the study, it was found that 92% farmers used lime followed by fertilizer (83%), salt (80%), formalin (50%), oxy-tetra-vet (42%), aquakleen (27%) and potash (15%) respectively (Figure 04 & Table 05). The benefits of using these chemicals are to reduce hardness, disinfection, improve water quality and prevent bacterial, fungal, protozoan and viral disease.

3.5 Stocking Density and Production Economics

3.5.1 Stocking Density

Optimum stocking density plays a vital role in providing better environmental condition. The stocking density of shrimp PL found in the study area 80-120 No/dec. and for prawn 50-80 No/dec. respectively. For mixed culture rui, catla and silver are also cultured along with shrimp and prawn. Their stocking density can be documented as 1-3, 1-2 and 3-5 No/dec. respectively (Table 06).

3.5.2 Production

In the study area, the average production of shrimp 73 No/dec., 3 kg/dec. and for prawn 32 No/dec., 3.5kg/dec. respectively (Table 06). Average price found from the study area for shrimp 950tk and for prawn 550tk. For Shrimp/Prawn+ Fish the average price of rui, catla and silver as 100, 80 and 60tk.

Table 4: Chemicals used for pre-stocking management

Trade Name	Chemical Composition	Dosage	Purpose	No of Respondent Farms, n=60								Total	% RF
				Shrimp/Prawn				Shrimp/Prawn+Fish					
				A	B	C	Total	A	B	C	Total		
Hunter	Rotenone 9%	20 g/dec.	Predator killer	13	12	12	37	1	1	3	5	42	70
Lime	CaO /$Ca(OH)_2$	1kg/dec.	Fungicides and maintaining water pH	18	18	17	53	2	2	3	7	60	100
Zeo-Prime	Hydrated SiO_2, Al_2O_2	10-15 kg/acre	To remove gas & improve water quality	6	5	5	16	1	0	1	2	18	30
Fertilizer	Urea	100-150 g/dec.	Increased primary productivity	16	17	15	48	2	1	3	6	54	90
	TSP	100-120 g/dec.											
	DAP	70-80 g/dec.											

Table 5: Chemicals used for post-stocking and disease management

Trade Name	Chemical Composition	Dosage	Purpose	No. of Respondent Farms, n=60								Total	% RF
				Shrimp/Prawn				Mixed					
				A	B	C	Total	A	B	C	Total		
Formalin	CH_2O	1-3 ppm	To control protozoan disease & improve water quality	7	9	11	27	1	1	1	3	30	50
Aquakleen	Tetradesail Trimethyl Ammonium bromide	0.01-0.02 lit/dec.	Disinfectants	4	6	4	14	1	1	0	2	16	27
Lime (Regular)	CaO/ $Ca(OH)_2$	15-20 g /15days	Fungicides and maintaining water pH	17	16	16	49	2	1	3	6	55	92
Oxy-tetra-Vet powder 50	Oxytetracline 30%	1 mg /kg feed	Prevent bacterial disease	8	8	6	22	1	2	0	3	25	42
Potash	KMnO4	0.1-0.2 ppm	Disinfectants, prevent bacterial disease	4	2	2	8	0	1	0	1	9	15
Salt	NaCl	500 g /dec.	Disinfectants, fungicides	14	13	15	42	2	2	2	6	48	80
Fertilizer (Regular)	Urea	20-30 g/dec./wk	Increased primary productivity	14	15	13	42	2	1	3	6	50	83

Table 6: Stocking density and production in respondent farms

Culture Species		Stocking Density No./dec.	Production No. /dec.	Production Kg/dec.	Avg. Price per kg (Tk)
Shrimp		80-120	73	3	950
Prawn		50-80	32	3.5	550
Shrimp/Prawn + Fish	Rui	1-3	2	0.5	100
	Catla	1-2	1	0.6	80
	Silver	3-5	3	0.5	60

4. Discussion

Health management of fish and crustacean are recognized internationally as useful parts of sustainable aquaculture management, often in the form of formally laid-out "Better Management Practices" [9]. No such standards were adopted for shrimp or prawn culture in Bangladesh. The Khulna University (KU), Bangladesh Fisheries Research Institute (BFRI) have expertise and laboratory facilities to diagnosis various pathogenic disease. Amongst all the causal agents, viruses showed to be the most severe due to heavy mortality of shrimp [12],viral diseases are the most devastating because they are difficult to detect and difficult to treat in ponds. The intake of polluted water from neighboring farms often spreads water-borne diseases across different farms [36].

According to this study, it was observed that white spot syndrome, yellow head disease, vibriosis, black gill disease and soft shell disease was the most common and severe problem for bagda farming. About 75% of small scale bagda

ghers were affected by white spot syndrome disease followed by yellow head disease 38%, vibriosis 12%, black gill disease 10% and soft-shell disease 8%. Some previous studies also revealed the similar reports about the different disease of shrimp farm in Bangladesh [8, 20, 22, 32, 6, 30]. Health management of shrimp is focused on disease prevention through proper nutrition, maintenance and stress reduction. The common control measures of diseases in both brackish and freshwater shrimp farming were water change and liming in the ghers. These measures were simple and environmentally acceptable. To overcoming the pathogenic problem, application of disinfectants and antibiotics is a common practice in shrimp culture [36]. A number of chemical compounds are available in the market which are being used to pond preparation and improving water quality of shrimp and prawn pond. In the study area different types of chemicals are used for shrimp and prawn pond preparation. From the record of the study, farmes used lime (100%), fertilizer (90%), hunter (70%) and zeo-prime (30%). Farmer also used different chemicals after stocking and also for prevents bacterial, viral, protozoan and fungal disease. From the present study, farmers used lime (92%), fertilizer (83%), salt (80%), formalin (50%), oxy-tetra-vet (42%), aquakleen (27%) and potash (15%). A number of authors also reported similar conditions about the use of different drugs and chemicals in aquaculture activities of Bangladesh [2, 28, 26, 7, 17, 44, 35].

Problems Associated with Shrimp/Prawn Farming Activities

- Lack of availability of quality PL [13, 31] however, mentioned about the problems of shrimp farms which were the non-scientific culture methods, lack of credit and quality PL.
- Lack of government support, lack of extension and motivation on improved culture techniques.
- Disease susceptibility is one of the main obstacles in shrimp and prawn industries and the mortality rate is very high.
- Respondents were strongly agreed that forecasting the symptoms of shrimp diseases is poor. WSSV screening facilities are almost nonexistent.
- Sometimes the farmers should not follow the proper stocking density. For getting more production as well as more benefit they stocked more. Higher stocking density may create different disease.
- The farmer has not enough technical knowledge about shrimp culture.
- Respondents were strongly supporting that there is not adequate government patronization.
- Lack of knowledge about the use of chemical. Lack of awareness about the safety issues in using hazardous chemicals.
- The socio-economic status of the fishermen is so lower that they cannot afford even can't make the bigger investment.

Recommendations to overcome the problem faced in Shrimp/Prawn farms

- Collect high quality and disease resistance PL from hatchery. Before stocking, the PL should be tested to free from WSSV.
- Prevention is better than cure. The mortality rate of shrimp and prawn is very high. Before disease outbreak prevention should be done properly.
- For shrimp and prawn farming it is very important to maintain proper stocking density, proper water quality and related aquatic environment.
- The disease should be identify properly and diseased shrimp may be removed quickly from the water body and burn it.
- Provide different seminar and training program on disease management for increase awareness of the farmer.
- Respondents were strongly agreed that government should provide more training & development program for the purpose of improving technical knowledge of shrimp and prawn farmer.
- Use proper chemicals and drugs for specific disease and maintained safety issue.
- Quality control measurement standard should be more developed. Government should conduct awareness campaign of quality management of shrimp and prawn because there are lacks of knowledge of quality management among the stakeholders.
- Shrimp transportation should be facilitated with modern facilities like insulated & refrigerated carrier van and handling of shrimp with food graded plastic basket.
- Apply quality certification system at all levels of the shrimp and fish based industry to ensure food safety, traceability, environmental sustainability and social responsibility is needed.

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