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Culture and management practice in Mymensingh District: Perspective of fish production, disease occurrence and preventive measures

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Abstract
The study was conducted to evaluate the existing fish culture strategy and management practices in selected upazilas (*viz.*, Mymensingh Sadar, Trishal, and Muktagacha) under Mymensingh district. The results showed that, the average pond area was ranged between 150 and 2000 decimal in Mymensingh Sadar, whereas it ranged from 100 to 1500 decimal in Trisal. However average pond area was comparatively higher in Muktagacha within 200-4000 decimal. The farmers of the study area adopted monoculture (50%). Whereas, one third (33.33%) of them preferred polyculture and a few (16.67%) followed both the culture systems. Preventive measures such as regular health checking (66.67%), drying of pond (66.67%) and applying lime in the pond (100%) were practiced in the studied farms. About 66.67% farmers used probiotics in their farms for beneficial purposes like water quality management, growth enhancement and disease resistance. 87.5% farmers acclimatized fry before stocking into the ponds at each selected upazila of Mymensingh district. Data showed that fish production was varied with culture types, areas, and culture period. The highest average production was in Trisal (158.5 Kg/decimal). Whereas, the average production in Mymensingh Sadar was (157.5 kg/decimal) and in Muktagacha was (143.5 kg/decimal). It was found that, the year-round production of Pangus was highest in Trisal 245 kg/decimal and lowest (150 kg/decimal) in Muktagachha. Tilapia production data showed the best production (77.5 kg/decimal) in Mymensingh sadar, whereas the lowest (65 kg/decimal) in Trisal. Data regarding the disease and health analysis of cultured ponds showed that there were four different types of diseases found in the study area including bacterial, viral, fungal and protozoan diseases. Most of the farmers took some preventive measures such as regular fish health checking, pond drying, application of lime, weeding the pond, removing water turbidity, addition of water etc. Almost all the farmers (100%) in the selected area, always apply lime in their pond and controlling of aquatic weed was found to be practiced by 41.67% farmers.

Keywords: Culture strategy, stocking pattern, diseases, preventive measures

Introduction
With the increased intensification and commercialization of aquaculture practice, fish health has turned into a most important issue to aqua culturists. Aquaculture is one of the world's promising and fastest developing food-producing sectors with the largest potential to accomplish growing demand of aquatic food. World aquaculture has immensely grown during the last few years as well as becoming an economically significant zone. With the rising commercialization and intensification of aquaculture production, diseases and deterioration of environmental conditions are major problems in fish farming and face massive economic losses. In aquaculture, application of antibiotics was generally used as the most familiar technique for dealing with the incidence of bacterial diseases. The indiscriminate use of these antibiotics for maintaining bacterial infection has been accountable for the development of antibiotic resistant bacteria, that has significant effect on the reduction of the efficiency of a treatment option and may be liable for long term unpleasant impacts in the aquaculture environment such as accumulation of those antibiotics in fish body tissues, reduction of beneficial microbiota and immune suppression of fish. Among all of the mentioned unpleasant impacts, the development of antibiotic resistant bacteria has paid more attention globally.

Due to the threat related with the application of antibiotics, the improvement of a non-antibiotic eco-friendly agent is being considered as the most significant factors for proper health maintenance in aquaculture. Disease prevention, disease monitoring, cleaning and disinfection between production cycles, and general security procedures would all be part of a good biosecurity program for a fish or shellfish aquaculture operation (Smith, 2012) [13].

Aquaculture industry is promoting overall fish production in Bangladesh but facing problems of water pollution and disease outbreaks. The parasites and other factors such as environmental stress, nutritional deficiency etc. are mainly responsible for the disease outbreaks of fish and have caused significant economic losses. Potential economic losses from disease outbreaks are significant, and can affect the survival of the industry. In order to prevent disastrous epidemics of infectious organisms in aqua farms, an adoptive approach to disease management needs to be followed. The total area of Mymensingh district is 4363.48 km2. Some upazilas under this district including Mymensingh Sadar, Trishal, Muktagachha, Tarakanda, Fulbaria, Ishwargnaj, Gouripur etc. are rich in huge amount of hatcheries and farms. Many people are involved in commercial fishing and contribute a major role in the food sector.

Sultana (2001) [14] reported that 92% of the pond owners wanted to culture fish and all of them were in favor of carp culture. Most farmers (64.15%) are interested on polyculture than monoculture because of high production. This has been possible due to enormous natural water bodies in the form of pond, dighi, canal, river, beels etc. and also the support of government and non-government organizations (Rahman, 2005) [11].

Biosecurity requires the adoption of a set of attitudes and behaviors by people to reduce risk in all activities involving domestic, captive exotic and wild birds and their products. Disease causing organisms are often spread by people or equipment. Biosecurity measures reduce the risk of exposing farmed animals to disease causing organisms by preventing the spread of disease organisms onto and off a farm and preventing the spread of disease organisms within a farm.

Probiotics have been proven to be positive promoters of aquatic animal growth, survival and health. In aquaculture, intestines, gills, the skin mucus of aquatic animals, and habitats or even culture collections and commercial products, can be sources for acquiring appropriate probiotics, which have been identified as bacteria (Gram-positive and Gram-negative) and nonbacteria (bacteriophages, microalgae and yeasts). The research of probiotics for aquatic animals is increasing with the demand for environment-friendly aquaculture. Some commercial products are referred to as probiotics, though they were designed to treat the rearing medium, not to supplement the diet.

Considering the situation, a detailed survey is planned to conduct in some selected areas of Mymensingh district to determine and compare the situation of existing culture and management strategies in Aquafarms to understand the appropriate ways for saving the farmed fish stock. The present study will enable to find out the problems related to fish farm and subsequent mitigation measures to enhance fish production of commercial fish farms in Mymensingh district.

Materials and Methods

Study area

Field data on the status of fish farming, production, occurrence of disease, farm biosecurity, using concept about probiotics and overall fish health management strategy were collected for a period of time through questionnaire survey from twenty-four (24) aquafarms of three Upazilas of Mymensingh district *i.e*., Mymensingh Sadar, Muktagacha, and Trisal. Necessary data were collected from fish farmers by frequent field visits and interviews.

Selection of fish farms

Four farmers from each of three upazilas were selected after successful discussions with the upazila fisheries officer, some commercial feed and animal health medicine company Officers. Total 24 farms were selected from Mymensingh Sadar, Muktagacha and Trisal under Mymensingh District.

Data collection method

A set of questions was organized in a sequential and required logical format to collect the data. Participatory rural appraisal (PRA) tool including focus group discussion (FGD) was conducted with fish farmers. Crosscheck interviews were conducted with key informant such as District Fisheries Officer, Upazila Fisheries Officer, different commercial feed company officer and animal health company officer working here in Mymensingh district.

Prior to field survey, background information on the number, location and distribution of fish farms and aquaculture activities were collected. Data collection method was divided into four steps *i.e*., questionnaire interviews, focus group discussion, cross check interviews with key informants and observations of locations.

Questionnaire interviews

The questionnaire had been divided into several sections. The first section focused on general farming and farmer‟s personal information, the second section on stocking and pond management information, the third section covered the information on biosecurity issues and the final section focused on fish health and disease problems, their management interventions used to control disease.

Focus group discussion

Information from fish farmers were collected through focus group discussion. FGD was conducted to get an overview of fish farming activities in the study area.

Cross check interviews with key informants

Cross check, interviews were conducted with key informants such as Senior Upazila Fisheries Officer, Upazila Fisheries Officer and different commercial feed and medicine company officer working in Mymensingh district, where information was contradictory or requested for further assessment.

Observation of the locations

Besides interview, some required information was collected by direct observation including nature of the culture ponds, culture species, biosecurity issues, farming activities and harvesting and marketing system of fish etc. The photographs cover the physical features of the study areas.

Statistical analysis

All collected data were analyzed using “Microsoft Excel 2016”. The summary tables were prepared to fulfill the objectives of this study. The results were shown in descriptive tabular and graphical presentation.

Results

Biosecurity status of some aquafarms of selected Upazila under Mymensingh district, (*viz.*, Mymensingh Sadar, Muktagacha, and Trisal) are described in this chapter.

Pond area and depth

The average pond area was ranged between 150 and 2000 decimal in Mymensingh Sadar, whereas it ranged from 100 to 1500 decimal in Trisal. However average pond area was comparatively higher in Muktagacha within 200-4000 decimal. In contrast, the highest average pond depth was 173.75 cm in Trisal followed by 152.5 cm in Mymensingh Sadar and the lowest was 147.5 cm in Muktagacha Upazila (Table 1).

Table 1: Pond area selected upazila of Mymensingh district.

Description	Pond area of selected upazila of Mymensingh district		
	Mymensingh Sadar	Muktagacha	Trisal
Area (dm)	150-2000	200-4000	100-1500
Avg. area (dm)	1075	2100	800
Depth (cm)	122-183	77-218	127.5-220

Types of culture

Both polyculture and monoculture systems were practiced in all of the selected Upazila. From the data, it was observed that most of the farmers of the study area adopted monoculture (50%). Whereas, one third (33.33%) of them preferred polyculture and a few (16.67%) followed both the culture systems. (Fig.1).

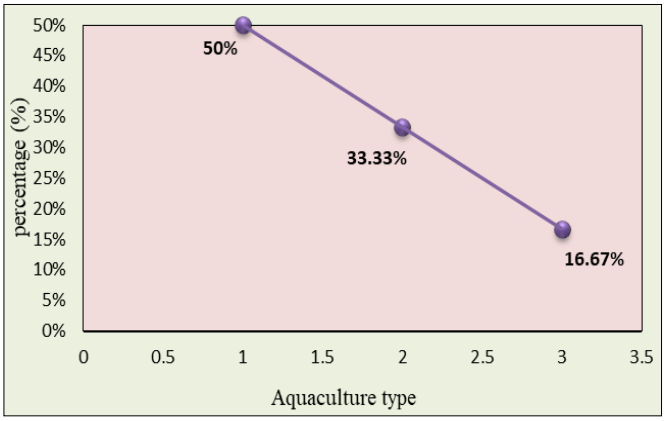

Fig 1: Culture types in Mymensingh district.

Stocking and pond management

Pre-stocking management

Farmers prepared their ponds thorough pond drying (66.67%), pond mud removal (75%), undesirable species removal (100%), repairing pond embankment repair (83.33%), aquatic weeds removal (83.33%), liming (100%) and fertilization (16.67%) (Table 2). The percentages of different measures of pond management were more or less same in all the selected areas. In case of pond mud removal and same on embankment repairing, there was a noticeable difference seen between Muktagachha and other upazila because of comparatively bigger pond area and very often removal of pond mud due to high expenditure. In some areas farmers did not use fertilizer since they used medicine for creating suitable environment especially for enhancing phytoplankton and zooplankton growth.

Table 2: Pre-stocking management in selected Upazila of Mymensingh district.

Measures usually taken before stocking of fish fry	Respondent		Total farmers	Positive (%)	Negative (%)
	Yes	No			
Pond preparation	24	0	24	100	0
Pond drying	16	8		66.67	33.33
Pond mud removal	18	6		75	25
Undesirable species removal	24	0		100	0
Pond embankment repair	20	4		83.33	16.67
Aquatic weeds removal	20	4		83.33	16.67
Liming	24	0		100	0
Fertilization	4	20		16.67	83.33

Fish production

In the selected area, Pangus, Tilapia, Koi, Shing, Pabda and Carps were cultured in studied farms either by monoculture system or by polyculture system. Polyculture with tilapia/pangas/koi were mostly productive than monoculture system. Data showed that fish production was varied with culture types, areas, and culture period. The highest average production was in Trisal (158.5 Kg/decimal). Whereas, the average production in Mymensingh Sadar was (157.5 kg/decimal) and in Muktagacha was (143.5 kg/decimal). It was found that, the year-round production of Pangus was highest in Trisal 245 kg/decimal and lowest (150 kg/decimal) in Muktagachha. In Muktagachha koi production was higher (160 kg/decimal) than Trisal (127.5 kg/decimal). Tilapia production data showerd the best production (77.5 kg/decimal) in Mymensingh sadar, whereas the lowest (65 kg/decimal) in Trisal. Shing production was highest (225 kg/decimal) in Mymensingh sadar where less (115 kg/decimal) was in Trisal (Table 3).

Table 3: Average production (kg/decimal) in selected upazilas of Mymensingh District.

Culture species	Mymensingh Sadar		Muktagacha		Trisal	
	Range	Avg.	Range	Avg.	Range	Avg.
Pangus	180-220	200	140-160	150	200-290	245
Tilapia	75-80	77.5	65-70	67.5	60-70	65
Koi	130-160	140	150-170	160	125-130	127.5
Carp	140-150	145	130-140	135	230-250	240
Shing	220-230	225	200-210	205	110-120	115
Avg. production		157.5		143.5		158.5

Stocking and management of fry

It was observed that 87.5% farmer's stocked diseased free fry in the Survey areas. They tried to collect the fry from renowned hatcheries and most of them were collected from Babura to avoid diseased fry and any other problems. 87.5% farmers acclimatized fry before stocking into the ponds at each selected upazila of Mymensingh district. It was observed that there were no quarantine facilities in any farms.

Feed Preference for Fish

Farmers were asked either they preferred farm-made feed or commercial feed for cultured fishes. Around 16.67% farmers preferred farm-made feed for fish. On the other hand, almost all the farmers (83.33%) preferred commercial feed (Table 4).

Table 4: Preference of feed for fish.

Feed Type	Mymensingh Sadar		Muktagacha		Trisal	
	No. of farmers	(%)	No. of farmers	(%)	No. of farmers	(%)
Farm made	2	25	0	0	2	25
Commercial	6	75	8	100	6	75
Total	8	100	8	100	8	100

Facility of sanitary latrine

The studied farms did not have proper sanitary latrine facilities. Only 33.33% farmers follow the sanitary latrine facility which is important for security of biomass (Fig.2).

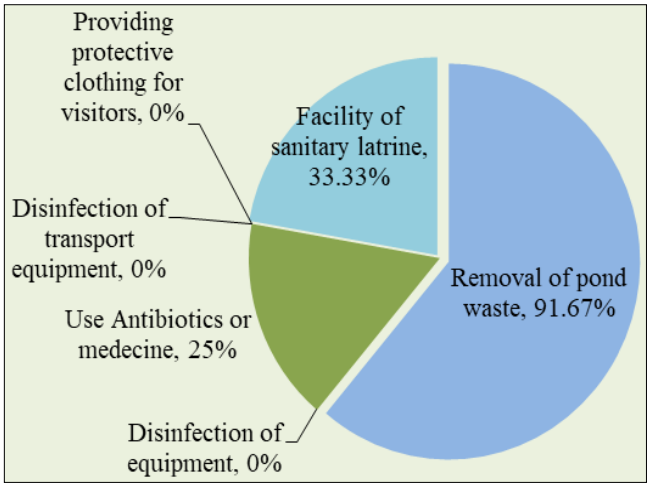

Fig 2: Disinfection strategies practiced in the selected farms area

Disease and Fish Health Management Issues

Health status checking of fish

There were some differences found among the selected upazila on the basis of monitoring fish health. It was found that all (100%) the farmers monitored the health condition of fishes in their ponds. In Mymensingh Sadar, 25% farmers monitored the farms on daily basis, while 37.5% farmers and 37.5% farmers monitored the disease condition weekly and bi-weekly, respectively. 12.5% farmers monitored the health condition of fishes on daily basis and 50% farmers monitored on bi-weekly basis in Muktagacha. On the other hand, 25% and 62.5% farmers monitored the health condition on weekly and bi-weekly basis, respectively in Trisal (Table 5).

Table 5: Monitoring fish health by farmers of study areas.

Criteria	Mymensingh Sadar	Muktagacha	Trishal
	n=24	n=24	n=24
Daily	25%	12.5%	12.5%
Weekly	37.5%	37.5%	25%
Bi-weekly	37.5%	50%	62.5%

Disease and health analysis of cultured ponds

Data regarding the disease and health analysis of cultured ponds showed that there were four different types of diseases found in the study area including bacterial, viral, fungal and protozoan diseases. These diseases further categorized as low, medium, highly and not concerned of the farmers. The whole data is represented in Figure 3.

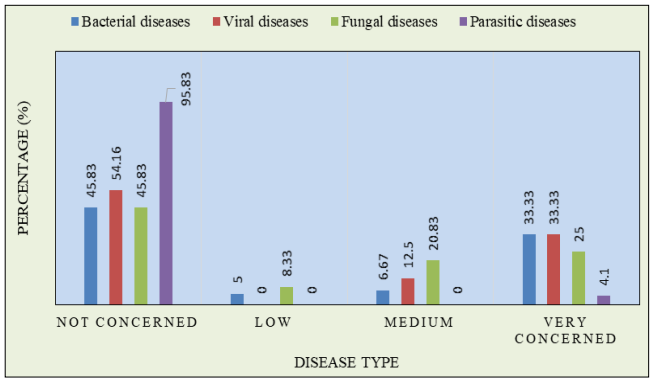

Fig 3: Status of type of diseases in Mymensingh district.

Preventive measures

Most of the farmers took some preventive measures such as regular fish health checking, pond drying, application of lime, weeding the pond, removing water turbidity, addition of water etc. Almost all the farmers (100%) in the selected area, always apply lime in their pond. About 0% farmers in the study area took measures to remove water turbidity where 58.34% farmers always added water into the pond. Controlling aquatic weed was practiced always by 41.67% farmers (Table 6).

Table 6: Preventive measures took by the farmers of three Upazila (n=24)

Measures practiced	Average farmers response		
	Never	Usually	Always
Regular fish health checking	0%	33.33%	66.67%
Pond drying	8.33%	25%	66.67%
Application of lime	0%	0%	100%
Weeding the pond	16.66%	41.67%	41.67%
Removing water turbidity	100%	0%	0%
Addition of water	33.33%	8.33%	58.34%
Other	100%	0%	0%

Discussion

The goal of this study was to learn more about the existing pattern of commercial fish farms of the Mymensingh District. The commercial farmers lacked a thorough understanding of biosecurity procedures. Only a few commercial fish farms were found to be enclosed by fences, whereas the majority of the farms were not. As a result, the most common occurrence in the research region was wild animal entrances, which could be sources of pathogens for disease outbreaks in the farms.

No farm was discovered to have foot bath facilities prior to entering their premises or to provide protective clothes for their own employees or visitors. In the instance of fish hatchery biosecurity, Faruk *et al.* (2012) [5] obtained comparable results. Except for a few well-established large-scale fish farms in the research area, most of the farms were found to lack sanitary toilet facilities. It was discovered that the majority of farmers do not have a bin to store empty packets or pots. Many farmers throw away the empty packets or pots after utilizing medications or other materials in the ponds, thereby deteriorating the farm environment.

According to Yanong and Erlacher (2012) [16], it is critical to prevent predators or pests from entering farms since they can spread disease to other farms. In aquaculture farms, birds are

key predators or pests. It's been proven that birds can spread bacteria and viruses through their droppings.

Due to their smaller size than pangas farms, tilapia and koi farms were shown to have less potential to introduce pollutants into ponds, since the farmers adequately prepared pond dikes. Most pangas farms have the potential to introduce pollutants via surface run-off from industrial, domestic, and agricultural sources, particularly those that were converted from beels. Biosecurity is easier to establish in small, intensive, and regulated farming systems than in outdoor and large-scale operations, according to Horowitz & Horowitz (2003) [6].

For the biosecurity program of an aqua farm, it is necessary to collect and stock disease-free fry. The majority of farmers stocked disease-free fry in their farm ponds, according to the findings of this study. Santahar, Adamdighi, and Bogra were the most common places from where farmers collected pangas fry/fingerling. They used to get tilapia and koi fingerlings from government and private hatcheries in Mymensingh, as well as some local nurseries. Farmers have attempted to generate pangas spawn in their own hatcheries, but the results have been disappointing. The farmers suspected that the soil quality and other criteria in the Mymensingh region were not ideal for generating pangas spawn, but the causes of failure were unknown.

Almost all of the farmers used commercial pelleted feed purchased from various fish feed farms, and the majority of the commercial farms had good feed storage facilities and attempted to maintain correct storage conditions. The fish producers in this study found that keeping records was not a frequent practice. Most farmers kept a basic record of fry prices, transportation costs, labor costs, feeding costs, medicine use, netting and harvesting costs, selling prices, and income, among other things. Faruk *et al*. (2012) [5] found similar results when looking at the biosecurity of fish hatcheries.

The majority of pangas producers likewise eliminated their pond trash every three years. Some pangas farms were so large that removing bottom waste was difficult, if not impossible. Because of the large volume of bottom decomposed mud, the water quality often worsened, weakening the fish and making them prone to disease. Smith (2012) [13] stated that an important area of disease prevention and control that is often overlooked in the aquaculture industry is disinfection. Routine disinfection is used to reduce the pathogen load in a facility, thereby reducing the risk of spreading an infectious organism between groups of fish or shellfish in a single facility.

The majority of farmers were found not to disinfect their transport equipment, such as plastic baskets and aluminum pots, as well as their transport vehicles, such as manual vans, pickup vans, and trucks. According to Winton (2002) [15], before using equipment anywhere on or off the farm, it must be cleaned, disinfected, and dried for the best outcomes in destroying microorganisms.

A few farmers were found to be using various sorts of antibiotics and pesticides to control infections, according to the report. Antibiotics such as Ciprofloxacin, Tetracycline, Oxytetracycline, and chemicals like Zeolite, Bleaching Powder, Phostoxin, Rotenone, and others were used. Farmers are unaware of the long- term effects of these synthetic medications, according to Faruk *et al*. (2008) [3]. Chemical costs were found to be the most expensive, accounting for 25.77% percent of overall costs in the Noakhali district, according to Shohel (1998) [12]. Lack of understanding about chemical use, suitable dose, application method, and indiscriminate chemical use were all recognized as concerns in the study. Therefore, farmers could be suggested to take some preventive measures at the beginning of the winter season which includes application of lime and salt, disinfecting of equipment, addition of water etc. (Faruk *et al*., 2004) [4].

Most studies concerned with the effects of probiotics on cultured aquatic animals and emphasized a reduction in mortality or conversely, increased survival (Chang and Liu, 2002) [2], improved resistance against diseases (Lee and Bullis, 2003; Brown and Brooks, 2002) [8, 1] enhanced ability of beneficial microbes to adhere and colonize in the gut to antagonize harmful organisms (Islam, 2018) [7] and to produce polyamines and digestive enzymes (Lightner, 2003 and Pietrak *et al*., 2010) [9, 10]. Farmers did not receive adequate disease control and health management methods from non-governmental organizations (NGOs) and government extension workers, according to the current study (GEOs).

In summary, from this study it was found that a few (16.67%) followed both the culture systems. Preventive measures such as regular health checking (66.67%), drying of pond (66.67%) and applying lime in the pond (100%) were practiced in the studied farms. About 66.67% farmers used probiotics in their farms for beneficial purposes like water quality management, growth enhancement and disease resistance. 87.5% farmers acclimatized fry before stocking into the ponds at each selected upazila of Mymensingh district. Almost all the farmers (100%) in the selected area, always apply lime in their pond and controlling of aquatic weed was found to be practiced by 41.67% farmers.

Conclusions

The purpose of this study was to explore the subsistent state of fish culture and subsequent health management techniques on several farms in the Mymensingh district. The majority of them had little knowledge of biosecurity issues. In Mymensingh Sadar, 25% farmers monitored the farms on daily basis, while 37.5% farmers and 37.5% farmers monitored the disease condition weekly and bi-weekly, respectively. 12.5% farmers monitored the health condition of fishes on daily basis and 50% farmers monitored on bi-weekly basis in Muktagacha. On the other hand, 25% and 62.5% farmers monitored the health condition on weekly and bi-weekly basis, respectively in Trisal. In an aqua farm, good biosecurity policies are critical for maintaining healthy fish and limiting the danger of disease transmission. Commercial farmers should be made more aware of biosecurity principles, and they should be encouraged to properly implement biosecurity programs on their fields. It is advised that present fish farming methods be upgraded through institutional and organizational measures in order to improve the overall biosecurity status of fish farms.

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