Research article

Pervasiveness and management status of assorted fish diseases alongside comparison of their health

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ABSTRACT

Fish are the most plentiful and beneficial aquatic animals that enrich human meals with protein, which is critical in maintaining their health and managing illnesses. This entails anything from constructing ponds to determining the incidence of diseases, diagnosing and treating them, providing medication, and other essential operations. The objectives of this study are to assess the health, illness control, and survival rate of aquatic animals in a mixed culture system. To study these facts, data on preventive and hygienic measures, disease and abnormalities, medication, mortality and survival rates in mix culture system were gathered and analyzed for ten different fish species. Compounds such as disinfectants and fertilizers were mostly employed in the preventative protocol, while antibiotics, disinfectants, and oxygen enhancers were the primary drugs utilized for healing diseases. The investigation found the highest frequency of epizootic ulcerative syndrome (EUS) at 29.17%, followed by dropsy, chilodonella infestation, argulosis, gill rot, and hypoxemia. Tilapia, rohu, mrigal, kalbasu, common carp, silver carp, sarpunti, and bata showed higher healthiness that was significant (P<0.05)compared to catla and sutchi catfish. It was concluded that aquatic animal health and disease management is not solely comprised of pond preparation, preventative measures, disease detection, treatment, and good management, but it is additionally impacted by the variety or species of fish cultivated simultaneously.

1. INTRODUCTION

Health of aquatic animal is an apprehensive matter now-a-days since they are utilized as major source of protein and is directly associated with human health. As a consequence of growing concern of human health issues, demand of healthy and safe food supply getting gradual priority. Aquatic animals are being used for many purposes over the years especially as a major choice for consumer menu. Various types of fishes have been used as vital source of food and high quality protein (Tidwell and Allan,

2001). Aquatic foods are important in dietary patterns of Bangladesh, its livelihoods and culture. The fisheries industry is crucial to socioeconomic growth, employment opportunities, preservation of aquatic diversity, and consumption of animal protein in Bangladesh. This sector adds 21.83% to the GDP from agriculture and 2.08% to the GDP overall of Bangladesh by producing 4.759 million metric tons of fish. Fish is by far the most popular animal-source food in the country, where the average daily consumption is 62.58g/person (DoF, 2022). It is a major dietary staple,

containing a high concentration of micronutrients and accounting for 60% of animal protein intake (DoF, 2022). It is therefore necessary to put due emphasis in maintaining proper health and managing various diseases of aquatic animals to ensure safe food and fulfill the protein demand, as it has relation to public health.

Like other animals, aquatic animals also be affected by many disease and deformities which occurs due to be infected by different pathogens like virus, bacteria, fungus, parasites etc. (Ahmed et al., 2022) that keeps negative influence to their health and production (Hossain et al., 2013). Numerous studies have been operated previously to sort out the strategies related to fish disease control, diagnosis and treatment as well as to check the status of disease prevalence and health condition of fishes. To maintain good health, to overcome diseases and to increase survival rate; selection of fish species, regular maintenance of health and pond (Hossain et al., 2013) as well as taking preventive measures (Assefa and Abunna, 2018), proper diagnosis and treatment (Terech-Majewska, 2016) are pre-requisites during aqua culture. Since, environment of water and land (Ikeogu et al., 2010) keeps crucial effects on fish health, preparation of pond with certain amount of different chemicals is a must in fish culture (Shah et al., 2022). Lime, salt, potash, urea and TSP are being widely used for preparing pond and also to maintain hygiene thus preventing diseases. Potash by acting as disinfectant (Zhou et al., 2017), lime by balancing ph (Boyd, 2017) and salt by preventing parasitic infestation maintains healthy environment for fish in pond. Urea and TSP contains nitrogen and phosphorus those helps to grow planktons in the pond and increase productivity of pond, thus helps to keep good health of fishes (Burtle, 2015). Diseases of fishes can be categorized into viral, bacterial, fungal infections, parasitic infestation etc. (Untergasser and Axelrod, 1989). Argulosis, epizootic ulcerative syndrome, edwardsiellosis, columnaris, white spot disease, fin and tail rot, gill rot, chilodonella infestation, dropsy, hypoxia etc. are the most common diseases found in fish (Kawsar et al., 2022a; Sharma et al., 2012). However, most of the diseases are diagnosed by close observation of fishes and identification of signs. Besides, movement of fishes, appearance of water, its color help sometimes in diagnosis procedure. Proper and early treatment helps to reduce mortality, increase survivability and decrease production loss. To treat fish diseases various types of medicines such as disinfectant (e.g. potassium permanganate, lime, salt, tymsen), antibiotics (e.g. oxytetracycline, tetracycline, erythro-mycin), vitamins, oxygen enhancer (e.g. oxy-ren) etc. are used (Kawsar et al., 2022b). These medicines kill microorganisms, destroy pathogens, increase oxygen level, thus eliminate diseases and help fish to regain normal health. Unlike other living populations, good health of aquatic animal or fish is indicated by high survivability and low or zero mortality of that population. Some types of fishes survive more and be less susceptible to disease over other types of fishes in mix culture system. Selvamani and Mahadevan (2008) stated that, combination of catla, rohu, mrigal, common carp and silver carp survives more in pond mix culture system than other species of fishes. Hasan et al. (2014), Sikder et al. (2021), Aftabuddin et al. (2016), Islam (2001) and many other author's prior researchhas been conducted in several regions of Bangladesh regarding health conditions, disease prevalence, control, treatment, and survivability of fishes.

Since it has been indicated that, all these factors described above are directly connected to the health of aquatic animal, study related to the maintenance and combination of these factors hence mandatory to keep the optimum health of aquatic animal. Although some of the previous studies have investigated the key aspects of health and disease of fishes, there is still limited data availability regarding those aspects in Bangladesh. Therefore, the present study was conducted to inquire about the status of management of all these factors which are specifically associated with aquatic animal health in aquaculture in root level. The findings of current study can be advantageous for fish farmers in the instance of better fish rearing, leading towards safe aquatic food supply chain for consumers.

2. MATERIALS AND METHOD

Study area and duration

A retrospective cohort study was conducted at ChotoDarogar Hat, Bariadyala, which is located at Sitakund sub-district in Chattogram, Bangladesh (Figure 1). Sitakund is situated at the northwestern part of Chattogram district, between 22'34'N and 22'43'N latitude and 91'38'E and 91'41'E longitude.

Figure 1. Geographicaldistribution of study area located in Chattogram

Study population

To execute this study, data of six ponds occupying five acres of area of a fresh water fish farm were collected. Total 10 species of fishes based on availability which were being cultivated at those six ponds were considered for

data collection. Here, probability sampling technique was used. The species of fishes with their initial stocking amount of hatchling is shown in Figure2.

Study design

In the present investigation, properly organized questionnaires were implemented to collect data. The questionnaire focused mostly on the status of the fish farming system, pond preparation, disease prevalence, and therapeutic agents employed to cure by farmers. The studied fishes were cultivated in confined pond area in mix culture system for about 6-12 months of duration. The pond and its soil were prepared and managed properly by applying lime, salt, potash, urea and TSP (triple super phosphate) which helps to maintain proper environment of pond and soil, keep good health, control disease and increase plankton within the pond. Each pond were occupying average 0.33 hectare of area with 1.5 meter depth. After stocking the hatchlings or fry in pond, they were transferred in another pond after 20 days. Fishes were cultivated up to being juvenile and then adult. Fishes those exhibited a high degree of activity, alertness, and sociability, as well as free and swimming, regular eating and swimming to the surface quickly during feeding times, and regular gill expansion to take in oxygen and water, were deemed healthy.
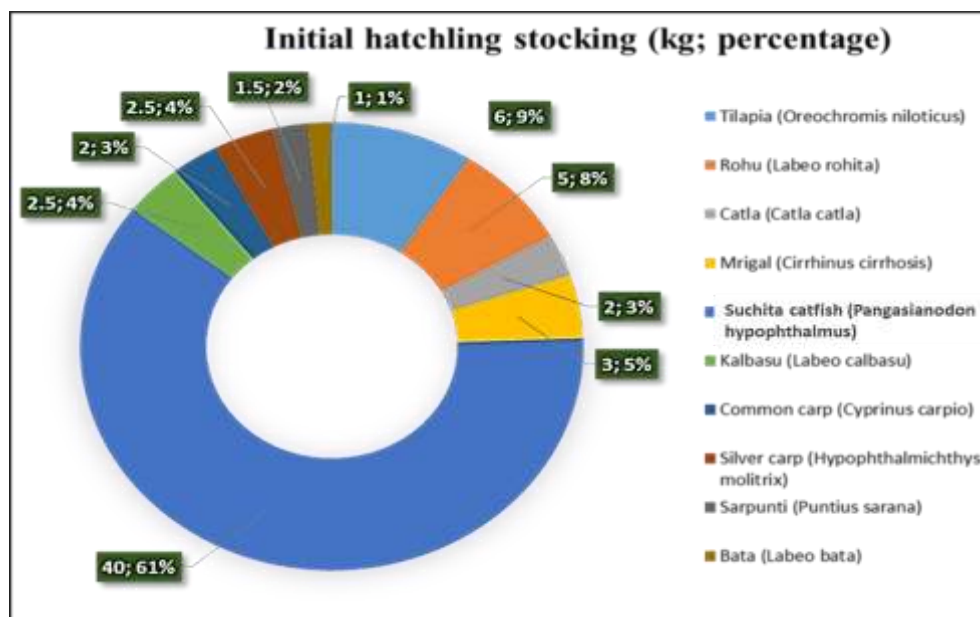

Figure 2. Initial stocked hatchling population of ten types of fishes

They also lacked white spots or blemishes on their bodies, had healthy scales devoid of injury or fungal growth, and did not have bulging eyes. Based on the physical characteristics of the diseased fish and the observations made by farmers, fish diseases were identified. If any disease or abnormality was seen, proper medication and preventive measures were taken. Fishes were fed both commercially bought feed and handmade customized feed in different stages of life. During hatchling or fry stage, commercial nursery 1 and nursery 2 feed were supplied. Then commercial young grower feed was supplied during juvenile stage. After that, handmade feed made with wheat bran, broken crushed maize, til oil cake, vitamins and minerals and water was given to adults. All the commercial feed and other feed ingredients were bought from well-known sources. Feed was given twice daily at the rate of 25kg per pond. During winter, feed was given once per day and during heavy rainy day or too much gloomy weather, feed was totally avoided.

Diagnosis and treatment

Diagnosis of the diseases or abnormalities found in the fishes throughout the cultivation period was done based on clinical signs and physical appearance observed in fishes. In some cases,

the changes in the water color and its turbidity also indicates abnormalities in environment of pond which causes disease or death of fishes. Medication of the affected fishes or affected pond was carried out properly according to the need. In Table1 there is shown the diseases recorded during the study with their applied medication.

Data management and statistical analysis

All data were entered, stored and managed in Microsoft Excel 2013 (15.0.4420.1007). Then the data were transferred to STATA-13 (Stata Corp, LLC, MP-Parallel Edition, College Station, Texas 77845 USA) for performing statistical analysis. Amount of chemicals used for prevention and preparation of pondwere expressed in a bar chat where prevalence of disease was shown in a pie chart. Percentage of use of different types of medicines was expressed in a histogram. Mean of survivability and mortality rate were calculated using STATA. Finally, a two sample T-test was carried out to observe the significance of mean of survival or health rate of two groups of fishes at the level of 5% significance. The result was expressed in mean and p-value.

Table 1. Disease or abnormalities, their sign or appearance and medication or preventive measures of studied population.

Name of disease or abnormality	Sign or appearance	Medication or preventive measure
Argulosis	Lice is seen in fish Reddish spot found around affected area	-Application of lime -Application of potash
Epizootic Ulcerative Syndrome (EUS)	Ulcerative lesions were found in body Floating of fish over water surface was seen	-Application of Timsen (n-Alkyl dimethyl benzyl ammoniumchloride, stabilized urea)
Gill Rot	Lethargic fishes seen close to the surface of water with swollen gill	-Preparation of tetracycline
Chilodonella infestation	Brownish mucous material was seen on the skin of fish Abnormal movement of fishes	-Potash application
Hypoxia	Open mouth breathing and surface respiration	-Oxyren/ oxyflow

3. RESULTS AND DISCUSSION

Maintaining of aquatic animal health is prioritized in many studies. Factors related to this topic are described and examined in previous studies and the outcomes are similarly corresponded to present study.

Precaution and preparation of pond

Disinfectant, antiseptics and fertilizers those were mostly used during pond preparation as precaution and preventive measure of disease control as well as health measure are shown in Figure3. These chemicals were also used during culture period. Mostly used material is lime or calcium carbonate which was used as 100kg per acre of area. Amount of potash was very less, about 0.5kg per acre. Among fertilizers, amount of urea is more that is 40kg per acre than the amount of TSP that was used. Health of aquatic animals are affected by the fact that whether preventive measure to control disease and to keep good health is taken or not. In this study, lime, potash, salt, urea, TSP are mostly used chemicals and among them amount of lime is the highest. Assefa and Abunna (2018)also agreed to this fact.
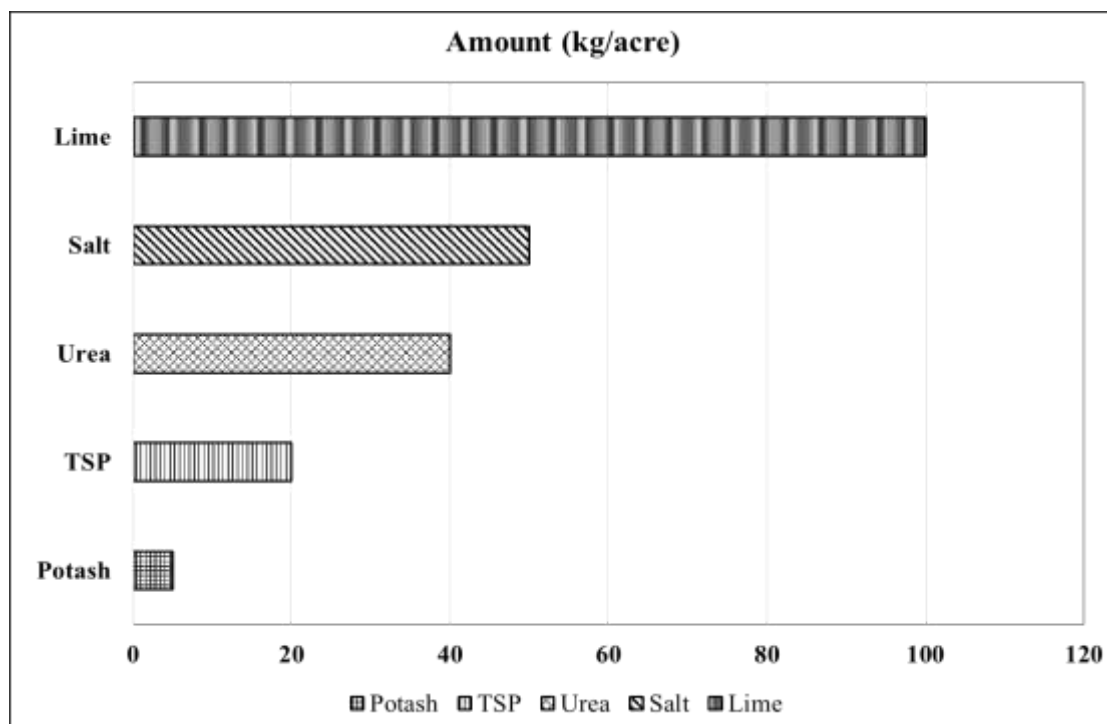
Prevalence of disease

Figure4 shows a pie chart that represents prevalence of different diseases found in the study population. In this study, it is seen that, epizootic ulcerative syndrome or EUS is the most occurred disease in fishes in study area. About 29.17% cases among total diseases, is EUS. The second more occurred disease is dropsy that covers 18.75%. Besides these most common diseases, there also occurs chilodonella infestation, argulosis, gill rot and hypoxia atthe rate of 16.67%, 14.58%, 12.50% & 8.33% respectively.

Although, fishes can be affected by several types of diseases, the present study explored that, prevalence of epizootic ulcerative syndrome is highest and the rate is 29.17% in studied population. This finding is almost similar to the literature of Kawsar et al.(2022a). Besides, dropsy, chilodonella infestation, argulosis, gill rot and hypoxia also occurred in studied population at a certain rate which is supported by Sharma et al.(2012).
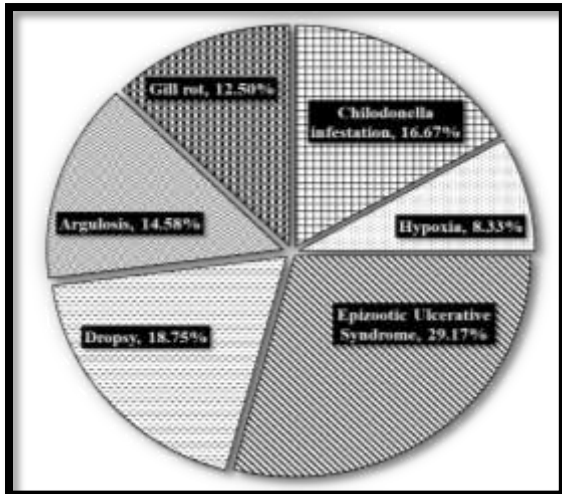

Figure 3. Amount of disinfectants, antiseptics and fertilizers used during pond preparation as preventive measure.

Figure 4. Percentile presentation of prevalence of assorted diseases found in fish population.

Categories of medicine

To treat the diseases many kinds of medicinal products had been used which categorization has been presented in a histogram in Figure5. This figure shows that, among all categories, antiseptic and disinfectant at the rate of 62.5% had been used to cure disease or abnormalities, which is the highest. Antibiotic was used at 25% rate and oxygen enhancer was used at 12.5%
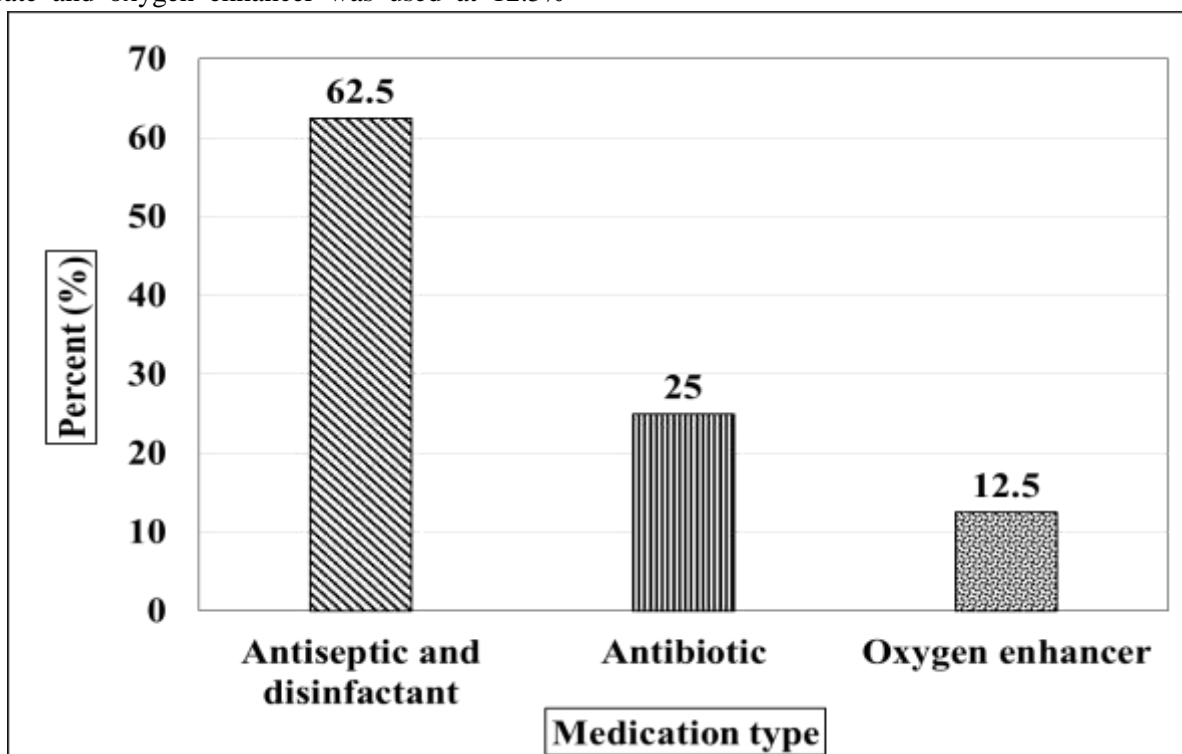
rate in treatment of the diseases. Present study shows that, in treatment of fish diseases, antibiotics, disinfectants oxygen enhancer are being used which comply with the study of Kawsar et al.(2022b). As antibiotic oxytetracyclin, tetracycline is used. Lime, potash, timsen are used as disinfectant. These findings are supported by Kawsar et al.(2022b).

Survival rate and mortality

In current study, different level of survival rate was seen in different species of fishes which is presented in Table2as percentage. Mortality rate of different species of fishes due to different diseases and abnormalities is also shown in Table2.Table 3 presents statistical analysis of mean of survival rate and mortality rate. From this analysis it is seen that, mean of survival or health rate is 67 that is quite higher than the mortality rate that is 33, which assures that the survival of studied fish population is more than death. The mean of survival rate is 67 and mean of mortality rate is 33which means, rate of survivability is more than the mortality rate which is supported by many prior studies.

Figure 5. Graphical representation of percentage of used medication components to cure different disease and health conditions of fish.

Table 2. An overview of calculated mean± standard deviation of survival rate and mortality rate of studied population.

Variable	Observation	Mean	Std. Error	Std. Deviation
Health/survival rate	10	67	4.73	14.94
Mortality rate	10	33	4.73	14.94

Comparison of health

From the observation of survival rate data shown in Table2, it is determined that there are two types of fish survivability on this study. Thus, all the fish species were divided in two categories. Fish species having more than 50% survival rate were denoted as group A and less than or equal 50% survival rate were denoted as group B. According to Table2, tilapia, rohu, mrigal, kalbasu, common carp, silver carp, sarpunti and bata are the fishes in group A and catla, sutchi catfish are in group B. Finally, a t-test were performed to observe the mean of both groups and to calculate the significance level of difference of mean which has been represented in Table4.

Table 4 describes that health status of group A is significantly (P< 0.05) higher than the health status of group B. Therefore, fishes like tilapia, rohu, mrigal, kalbasu, common carp, silver carp, sarpunti and bata are healthier and the fishes like catla, sutchi catfish are less healthy in this mix culture system. The culture system of this study is mix culture which was made up with tilapia, rohu, mrigal, kalbasu, common carp, silver carp, sarpunti, bata, catla and sutchi catfish. In case of culture system selection of fish species is a major concern as it is related to the production rate and health of fish. Because some fishes stay healthy and their production become high when they are cultured together, whereas other fishes do not poses this synergistic criteria. From the observation of our study, the mean of survival or health rate of the fishes of first group is 71.8, that is significantly (P< 0.05) differ and higher than the mean of survival rate of the fishes of second group that is 47.5. Supporting our result, Selvamani and Mahadevan(2008) reported that when rohu, carp fishes, mrigal are cultured combined, their production and health remain to notch. Ultimately, it is proved that, all these combined factors or characteristics affect health of aquatic animals like fish.

4. CONCLUSION

Aquatic animal health is a highly concerned issue during this modern safe demanding consumer food era. So maintaining of health of aquatic animal, especially of fishes is a mandatory thing. Current study implies that this matter is not engaged to a single factor, rather related to collective issues or factors like as fish selection, pond preparation, preventive measures, disease diagnosis and treatment. Although, data of individual fish was not considered and chemical analysis was not done, it revealed that, all these factors influence efficiently to maintain the health. Therefore, a well combination of all aspects which is related to health, from pond preparation and fish selection to harvesting period is convenient to meet up ongoing demand of maintenance of aquatic animal health.

Table 3. Tabular representation of estimated values obtained from comparison of health between two groups of fishes.

Groups	Observation	Mean	Std. Error	Std. Deviation	[95% Conf. Interval]
Group A	8	71.875	4.32	12.22	61.65 - 82.09
GroupB	2	47.5	2.5	3.53	15.73 - 79.26
Combined	10	67	4.72	14.94	56.30 -77.69
Difference		24.375[a]	9.09		3.39 - 45.35
					t = 2.6793

[a] means values have significance difference (P< 0.05)

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