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STUDY ON HEALTH STATUS OF FARMED SHING (*Heteropneustes fossilis*) IN MYMENSINGH REGION

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Health status investigation of shing (*Heteropneustes fossilis*) was carried out through clinical and histopathological observations. During four months from January 2018 to April 2018. The data were collected from eight fish farms. Clinical signs of fish were physical deformity, reddish whitish lesions, abrasion and reduced mucus in the months of January and February from the investigated fish farms. Clinically fish were almost normal in the months of March and April. Histopathlogically observed pathological changes in gill were lamellar missing, splitted gill lamellae, hemorrhage, hypertrophy, vaccums and presence of parasites in January and February. In case of liver the examined fish had hemorrhage, vaccums, necrosis and fat bodies also in the months of January and February. Organs of the examined fishes were almost normal in the months of March and April. The purpose of the study was to determine the health status of farmed shing. The main objectives of the study were to observe clinical and histopathological changes in liver and gill of farmed shing (*H. fossilis*) at various fish farms of Mymensingh region and to determine the health status of the shing in the investigated months. From the present study, it was found that external organs like gill were more affected compared to internal organ like liver. From the present investigation, it was also observed that the fish were more affected in the months of January and February i.e. in winter season.

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INTRODUCTION

Bangladesh has been ranked third in the world in terms of inland fish production in 2019 after ranking fifth last year, the country now only trails behind China and India, ranked first and second, respectively. In fiscal year 2019, Bangladesh earned BDT 4,309.94 crore by exporting around 68,935.72 metric tons of fish and fish products. Fisheries sector contributed 3.50 percent to the national GDP and 25.71 percent in agricultural production during the fiscal year 2018-19 (DoF, 2019). Among the commercially important fishes of Bangladesh, *Heteropneustes fossilis*, locally known as "shing", is an important air breathing catfish in Bangladesh. It belongs to the family Heteropneustidae of the order Siluriformes. The species is not only recognized for its delicious taste and market value but is also highly esteemed from nutritional and medicinal properties of view (Chakraborty and Nur, 2012). It contains high amount of iron (226 mg/100 g) and fairly high content of calcium compared to many other freshwater fishes (Saha and Guha, 1939). It is considered as a valuable food fish species and recommended as diet for the sick and convalescents. Being a lean fish it is very suitable for people to whom animal fats are undesirable (Rahman *et al.,* 1982).

In Mymensingh region, fish farmers culture most of the species including shing at very high stocking density on account of increasing production, making a large profit at a short period of time. As a result, an excessive feed, fertilizer and fish feces enhance water quality deterioration and then creates a poor environmental condition. A very wide range of diseases and parasites affects shing particularly when they are under stress from poor environmental condition and in inadequate nutrition.

Water quality is one of the most important factors that directly regulate the production of shing. Thus, control of water quality parameters has become essential task for good health maintenance and increase production. Clinical and histopathological procedures are important tools for the diagnosis of diseases in fish. Histology has been successfully used throughout the world. In Bangladesh, however, histological technique has limited application for disease diagnosis (Moniruzzaman, 2000).

Disease is one of the responsible factors in both aquaculture and wild fisheries. Various diseases cause ill health of fish, retard its growth, deteriorate the quality of fish flesh, mortality of fish and then reduce the market value. Disease of fish may be related to the water quality parameters where they live. Occurrence of disease may vary species to species of fishes and the nature of disease may also vary at various age groups of fishes and various season of the year. However, shing fish has been reported to be affected by some metazoan parasitic diseases (Sanaullah and Ahmed, 1978) and bacterial diseases (Sahoo and Mukherjee, 1997). Both farmed and wild fishes have been found to be affected by various kinds of disease in various seasons of the year. Disease has become a major problem in fish production in culture system and wild condition in Bangladesh (Rahman and Chowdhury, 1996). In fish, the obvious external clinical signs are inflammation, arrhythmias and hemorrhage of fins, skin or head, frayed eroded fins, hemorrhaged opaque eyes, open necrotic and ulcerative lesions at any location on the body, lepidorthosis of scales and extensive mucus production. A total lack of mucus, edema, nodules on the body surface, presence of yellow, white or black spots on skin, prolapsed anus and exophthalmia are all clinical signs of fish diseases (Plumb, 1994). Most common symptoms of diseases are hemorrhage, necrosis, pyknosis, hypertrophy, gill damage and different kinds of lesions (Ahmed *et al.*, 2004). Considering the above facts, the present study was conducted to attain the following objectives; to observe clinical and histopathological changes of shing (*H. fossilis*) cultured at various fish farms of Mymensingh and to determine the health status of the shing in the investigated months.

MATERIALS AND METHODS

Study area

The study was consisted of both field and laboratory investigation. The field study was conducted in eight fish farms namely Shornolata Agro Fisheries, Reliance Aqua Farm, Nuha Aqua Farm, Manju Aqua Farm, Fish Seed Multiplication Farm at Shambhuganj, Fish Seed Multiplication Farm at Maskanda, Chan Miah Fish Farm and Setu Hatchery and Aquaculture respectively in six upazilas of Mymensingh district during January 2018-June 2018. The fish farms were placed in Fulbaria, Nandail, Muktagacha, Tarakanda, Trisal and Mymensingh sadar respectively (Figure 1).

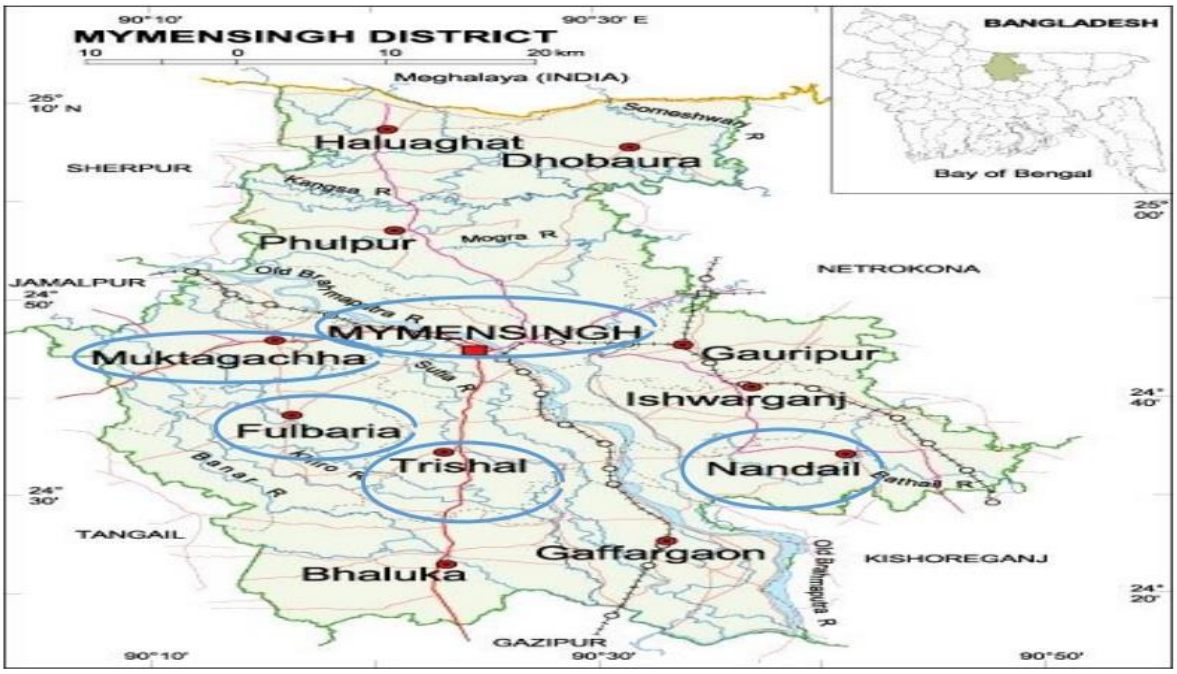

Figure 1. Selected upazilas of the study area in Mymensingh district

Data collection method

Data was collected through the questionnaire interview from 16 fish farmers. A set of questionnaire was prepared. The questionnaire focused mainly on the status of farming systems of *H. fossilis*. For questionnaire interview a set of questionnaire was developed composed of open form of questions.

Sample collection from the six sampling station for health check

The sampled fishes were examined just after taking out of the container to observe external signs and record any injury, infection and other abnormal conditions of fish body through naked eye. In the laboratory the collected fishes were anaesthetized by giving strong blow over the head. Samples from gill and liver were collected by sharp scalpel and forceps. For liver and gill, fishes were dissected and then portion of liver was collected. Samples were taken by a sharp sterile scalpel and forceps and fixed in 10% buffred formalin. Then samples were dehydrated, cleared and infiltration through an Automatic Tissue Processors (Citadel-1000), sectioned and stained with hematoxylin and eosin stains. The sections were examined under a photomicroscope.Thus comparisons were made based on seasons and areas following health status of shing.

RESULTS

Clinical observations of H. fossilis in winter season

In case of *H*. *fossilis* physical deformities and red whitish lesions were recorded from Nuha Aqua Farm and Setu Hatchery and Aquaculture (Figure 2 and 3) whereas deformity and severe lesions at lateral side of the body in the month of January were observed in fish of Fish Seed Multiplication Farm, Shabhuganj (Figure 6). Deformed and reddish white lesions at various parts of the body in January from Nuha Aqua Farm, Kumargata, Muktagacha (Figure 4). Almost normal shing was noticed in April from Reliance Aqua Farm, Boilor, Trishal (Figure 5).

Figure 2. Deformed, red whitish lesions (↑) were recorded in the month of February from Setu Hatchery and Aquaculture, Tarakanda; **Figure 3.** Almost normal shing was found in March from Fish Seed Multiplication Farm, Maskanda; **Figure 4.** Deformed and reddish white lesions (↑) at various parts of the body in January from Nuha Aqua Farm, Kumargata, Muktagacha; **Figure 5.** Almost normal shing was noticed in April from Reliance Aqua Farm, Boilor, Trishal

Abrasion, lesions and some opaque areas at surface of the body were found in the month of January from Manju Aqua Farm (Figure 7). Lesions and loss of mucus throughout the fish body were observed in the fish of Chan Miah Fish Farm (Figure 8).

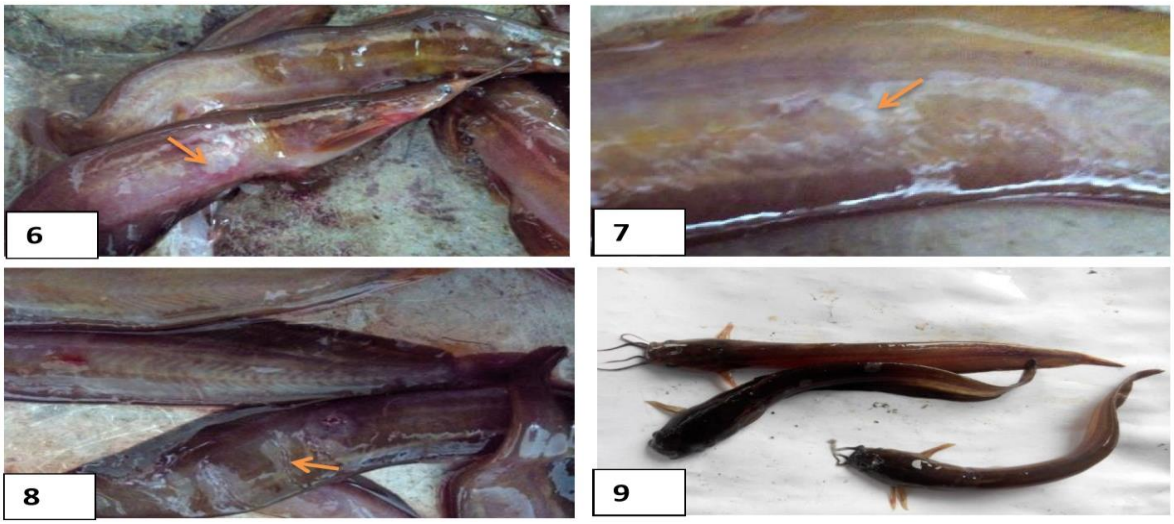

Figure 6. Physical deformities, severe lesions at lateral side of fish (↑) were observed in the month of January from Fish Seed Multiplication farm, Shambhuganj; **Figure 7**. Abrasion, lesion and some opaque areas (↑) were recorded at the surface of the body in Ferbuary from Manju Aqua Farm, Kumargata, Muktagacha; **Figure 8**. Lesions and loss of mucus (↑) was observed throughout the fish body in March from Chan Miah Fish Farm, Nandail; **Figure 9**. Normal shing fish was noticed in April from Shornolata Agro Fisheries Farm, Radhakanai, Fulbaria

Clinical observations of H. fossilis in summer season

In summer season, comparatively healthy fish (Figure 15) were observed in various fish farms of the greater Mymensingh. Almost healthy fish were observed in Fish Seed Multiplication Farm, Maskanda and Reliance Aqua Farm in the month of April (Figures 9 and 11).

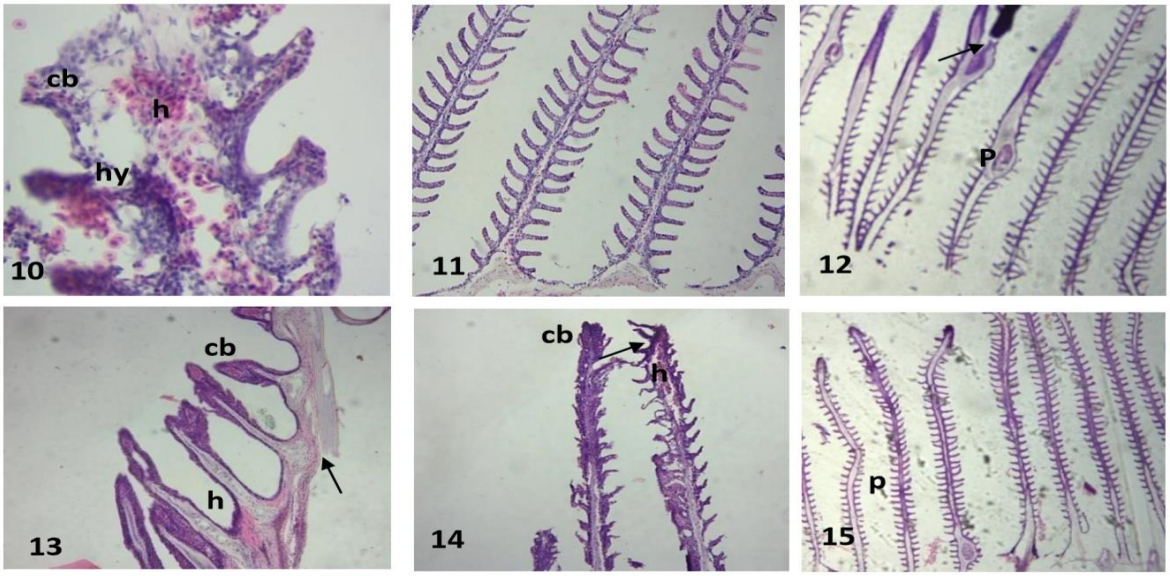

Figure 10. Section of gill of *H. fossilis* from Shornalata Agro Fisheries in January having hemorrhage (h), clubbing (cb) and hypertrophy (hy). H & E× 125; **Figure 11.** Cross-section of gill of *H. fossilis* from from Shornalata Agro Fisheries in April was almost normal gill. H & E × 125; **Figure 12.** Photomicrograph of gill of *H. fossilis* from Reliance Aqua Farm in February having few lamellar missing (↑) and presence of parasite (p). H & E × 125; **Figure 13.** Section of gill of *H. fossilis* from Nuha Aqua Fram in January having lamellar missing (↑), clubbing (cb) and hemorrhage (h). H & E × 125; **Figure 14.** Photomicrograph of gill of *H. fossilis* from Manju Aqua Farm in January having lamellar missing (↑), clubbing (cb) and hemorrhage (h). H & E × 125; **Figure 15**. Cross-section of gill of *H. fossilis* from Manju Aqua Farm in April was almost normal gill except presence of parasite (p). H & E × 125

Histopathological observation of gill in winter season

In the gill of *H. fossilis*, hemorrhage, clubbing and hypertrophy were found from Shornolata Agro Fisheries Farm in the month of January (Figure 10). Lamellar missing and clubbing were observed gradually from Shornolata Agro Fisheries, Farm Fish Seed Multiplication Farm, Shambhuganj, Chan Miah Fish Farm and Setu Hatchery and Aquaculture (Figures 11, 14, 20 and 21) April, January, March and April, respectively.

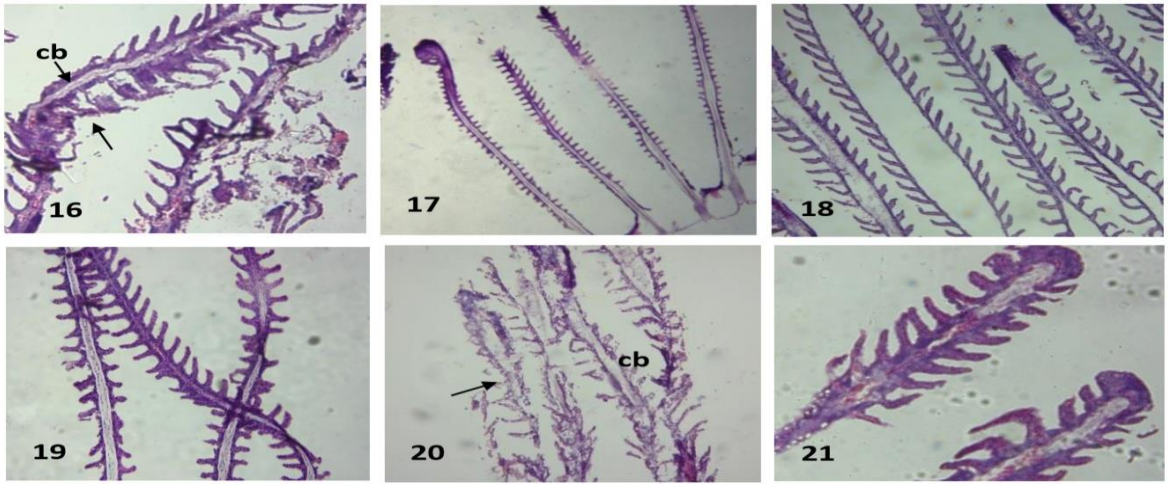

Figure 16. Section of gill of *H. fossilis* from Fish Seed Multiplication Farm, Shambhuganj in January having lamellar missing ( ), clubbing (cb) and H & E × 125; **Figure 17.** Cross-section of gill of *H. fossilis* from Fish Seed Multiplication Farm, Shambhuganj in April was almost normal gill. H & E × 125; **Figure 18.** Photomicrograph of gill of *H. fossilis* from Chan Miah Fish Farm, Maskanda in March showing almost normal gill lamellae. H & E × 125; **Figure 19.** Cross-section of gill of *H. fossilis* from Fish Seed Multiplication Farm, Maskanda in April was almost normal gill. H & E × 125; **Figure 20.** Section of gill of *H. fossilis* from Chan Miah Fish Farm in March having lamellar missing ( ) and clubbing (cb). H & E × 125; **Figure 21.** Cross-section of gill of *H. fossilis* from Setu Hatchery and Aquaculture in April was almost normal gill. H & E × 125

However, few lamellar missing and presence of parasites were recorded from Reliance Aqua Farm in the month of February (Figure 4). However, lamellar missing, clubbing and hypertrophy were also recorded in fishes of Nuha Aqua Farm (Figure 13). Besides, lamellar missing, clubbing and hemorrhage were also found from the fishes of Manju Aqua Farm (Figure 14).

Histopathological observations of gill in summer season

Histopathologically, in *H*. *fossilis* almost normal gill was observed from Shornolata Agro Fisheries, Fish Seed Multiplication Farm at Shambhuganj, Maskandaand Chan Miah Fish Farm in the month of April (Figures 11, 17, 19 and 21). Splitted primary gill lamellae splitted were found from Nuha and Chan Miah Aqua Farm in the month of March (Figure 18). However, almost normal gill except presence of parasites was recorded from Manju Aqua Farm in the month of April (Figure 15).

Histopathological observations of liver in winter season

Histopathologically, liver of *H*. *fossilis* had hemorrhage and vaccum in the month of February from Shornolata Agro Fisheries Farm and Fish Seed Multiplication Farm, Shambhuganj (Figures 22 and 29). Hemorrhage, vaccum and fat bodies were also found in the month of January from Reliance Aqua Farm, Nuha Aqua Farm (Figures 24 and 25) whereas hemorrhages and fat bodies were recorded in the month of January and February in fishes of Manju Aqua Farm (Figure 26).

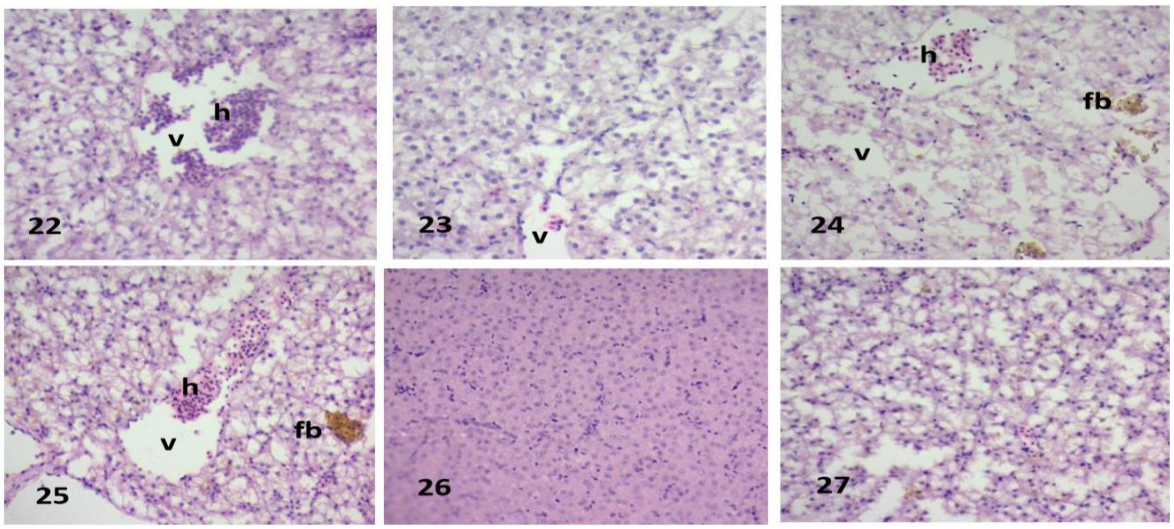

Figure 22. Section of liver of *H. fossilis* from Shornolata Agro Fisheries in February having hemorrhage (h) and vaccum (v). H & E × 425; **Figure 23.** Cross-section of liver of *H. fossilis* from Shornolata Agro Fisheries in March having almost normal liver except vaccum (v). H & E × 125; **Figure 24.** Photomicrograph of liver of *H. fossilis* from Reliance Aqua Farm in January having hemorrhage (h), vaccum (v) and fat bodies (fb). H & E × 125; **Figure 25.** Cross-section of liver of *H. fossilis* from Nuha Aqua Farm in January having hemorrhage (h), vaccum (v) and fat bodies (fb). H & E × 425; **Figure 26.** Section of liver of *H. fossilis* from Manju Aqua Farm in April was normal liver. H & E × 125; **Figure 27.** Cross-section of liver of *H. fossilis* from Manju Aqua Farm in April having almost normal liver. H & E × 125.

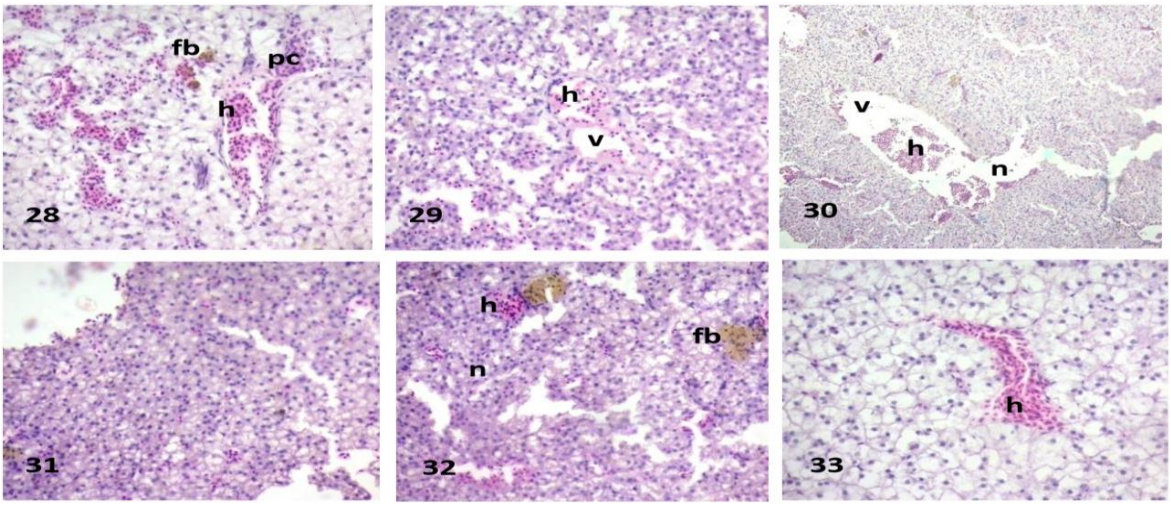

Figure 28. Section of liver of *H. fossilis* from Fish Seed Multiplication Farm, Shambhuganj in January having severe hemorrhage (h), pyknotic cell (pc) and fat bodies (fb). H & E × 425; **Figure 29.** Cross-section of liver of *H. fossilis* from Fish Seed Multiplication Farm, Shambhuganj in February having hemorrhage (h) and vaccum (v). H & E × 125; **Figure 30.** Photomicrograph of liver of *H. fossilis* from Fish Seed Multiplication Farm, Maskanda in January having hemorrhage (h), necrosis (n) and vaccum(v). H & E × 425; **Figure 31.** Section of liver of *H. fossilis* from Fish Seed Multiplication Farm, Maskanda in March was almost normal liver. H & E × 125; **Figure 32.** Cross-section of liver of *H. fossilis* from Chan Miah Fish Farm in January having hemorrhage (h), necrosis (n) and fat bodies (fb). H & E × 125; **Figure 33.** Photomicrograph of liver of *H. fossilis* from Setu Hatchery and Aquaculture in February having hemorrhage (h). H & E × 425

Severe hemorrhages and fat bodies were also observed in the month of January from Fish Seed Multiplication Farm, Shambhuganj. Besides, Mild hemorrhage and fat bodies were also recorded in fishes of Nuha Aqua Farm in the month of February (Figure 25). Moreover, Hemorrhage, necrosis and vaccum were observed in the month of January in fishes of Fish Seed Multiplication Farm, Maskanda (Figure 30).

Histopathological of liver in summer season

In liver of *H*. *fossilis* from Nuha Aqua Farm had a normal liver in the month of April (Figure 26). Having almost normal liver was also observed from Manju Aqua Farm in the month of April (Figure 27) whereas more or less normal with vacuum were recorded in fishes of Shornolata Agro Fisheries and Reliance Aqua Farm in the month of March (Figures 23 and 24).

DISCUSSION

Various research works had been conducted in our country on the health status of catfishes like as shing (*H*. *fossilis*) based on clinical and histological methods as diagnosis tools. In the present study, health status of shing from eight fish farms of greater Mymensingh was studied. The result of the study is being discussed as below compared with the previous work related to this field.

The fish samples were collected from eight selected fish farms of greater Mymensingh. Clinically, fishes in the months of January and February were severely affected of the eight farms. During this period, *H*. *fossilis* was observed to have weak body, physical deformities, loss of mucus, many whitish and reddish lesions and ulcers. Similar results were reported by many authors like Ahmed *et al*. (2004) who examined through clinical, parasitological and histopathological observations of three small indigenous fishes and found that many of the fishes were affected during the month of December and January. According to Ahmed *et al*. (2012) *Channa striatus* had rough skin, scale loss, rough skin, body discolouration and deep ulcer in January. In January and February, clinical signs such physical deformities, abrasion, skin discoloration, loss of mucus; reddish and whitish lesions were observed in Nuha Aqua Farm, Manju Aqua Farm, Fish Seed Multiplication Farm at Shambhuganj respectively. Similar result was also observed by Ahmed *et al.* (1998). Ahmed *et al*. (2007) also observed that scale loss, ill body and rough skin, minor ulcer and small red spots in January. Hossain *et al*. (2009) reported that fish were affected with scale loss, rough skin, body discoloration and deep dermal ulcer during winter season i.e. in January and February. Clinically it was found apparently healthy and normal in appearance during the months of March and April in all farms such as Reliance Aqua Farm, Shornolata Agro Fisheries and Fish Seed Multiplication Farm at Maskanda. According to Chakma (2002) clinically fishes were found to have less affected during the months of March. Similar results were reported by many authors like Monowara (2003) and Ahmed *et al*. (2009).

In the present study, hypertrophy of epithelium having partly missing primary and secondary gill lamellae, presence of parasites, necrosis and clubbing of secondary gill lamellae were the common pathology of gill of fishes of in Reliance Aqua Farm, Nuha Aqua Farm, Manju Aqua Farm and Fish Seed Multiplication Farm in the month of January and February. Akter *et al.* (2009) observed that several gill pathologies such as pyknosis, hypertrophy, hyperplasia and hemorrhage were found in winter seasons i.e. in January and February. According to Hossain *et al.* (2009) observed that in months of December and January gill of fish were affected with monogenic trematode, clubbing, loss of primary and secondary gill lamellae, hemorrhage and necrosis. In the present study almost normal gill was found in March and April in all farms. Similar result was found by Ruksana (1998) who observed that the gills of catfish like *Clariasbatrachus* had almost normal gill structure in the month of March and April. However, during March almost normal gills except split of gill lamellae in few places were observed in Fish Seed Multiplication Farm, Maskanda. Almost similar pathology was observed by Ahmed in Indian major carps, Ahmed and Hoque (1999) and Moniruzzaman (2000). Gills were also more affected in fish of Shornolata Agro Fisheries Farm than fishes of Chan Miah and Setu Hatchery.

Histopathologically, complete loss of epidermis and dermis, separation of dermis from muscle, necrosis, melanocytes and vaccum were the common pathological features of skin and muscle of Reliance Aqua Farm, Nuha Aqua Farm, Manju Aqua Farm, and Fish Seed Multiplication Farm respectively in January and February. Similar result was also observed by Ahmed *et al.* (2000) and Ahmed *et al*. (2007) mentioned that total loss of epidermis and dermis, many fungal granuloma, fungal hyphae, wide empty spaces, with necrotic muscles in Thai *A. testudineus*, in January. Akter *et al.* (2006) reported that loss of epidermis and dermis, necrotic muscle cells and hemorrhage were found in EUS affected *C. punctatus, M. tengara* and *H. fossilis* during winter season i.e. in January and February. In March, skin and muscles were observed more or less recovered in Chan Miah Fish Farm. In the present study it was found that skin and muscle had more or less normal structure in March and April in all the farms. However, in the month March almost normal structure except loss of epidermis and some vaccums were found in Chan Miah Fish Farm and Nuha Aqua Farm. During February skin and muscle had some recovery except some vacuums and necroses were found however but epidermis was yet to be healed up in both Chan Miah Fish Farm and Nuha Aqua Farm. Histologically skin and muscle of shing of Fish Seed Multiolication Farm, Maskanda were found to be severely affected than the fishes of Chan Miah Fish Farm and Reliance Aqua Farm. The highest prevalence of injury in skin and muscle was recorded in January and February while lowest in the months of March and April.

During January and February, pathologically liver had hemorrhage, vacuums, necrosis in *H. fossilis* of Nuha Aqua Farm whereas hemorrhage, vacuums, and necrosis in *H. fossilis* of Manju Aqua Farm. Hossain *et al.* (2009) observed necrosis, pyknosis, vaccums and hemorrhage in liver of fish in January. Akter *et al*. (2006) also observed vacuoles, hepatic necrosis, fungal granuloma and pyknotic cells in the liver of *Channa punctatus, Heteropneustes fossilis* and *Mystus tengara*. Rozario (2002) mentioned that pyknotic nuclei, fungal granuloma, melanomacrophage center, hemorrhage, inflammatory cell and vacuums were observed in Thai Pangas. In the present experiment more or less normal liver of shing were observed in March and April in all farms. From the research findings of Ahmed *et al.* (2011) it was observed that structures of liver was almost normal in *C. carpio* during April and May. During April normal distribution of hemorrhage and vaccum were observed in Shornolata Agro Fisheries Farm and Setu Hatchery and Aquaculture. During the months of March liver pathology were recovered most in all farms. According to Ahmed *et al*. (2012) liver pathology was recovered during March.

Precisely, the present study indicated that clinically and histopathologically the examined fishes of the various fish farms had more pathology during the months of January and February compared to March and April. Barua (1994) also gave similar opinion that fish under stress from environmental changes usually do not want to eat, become weak and more susceptible to disease. However, in the months of January and February the temperature was low. As a result, metabolic activity of fishes also reduced and immunity of fishes decreased. Thus the fishes were subjected to be stressed and diseased. However, necessary preventive measures should be taken during January and February.

CONCLUSION

The present investigation it was found that the fishes were more affected during winter season i.e. in the months of January and February. On the contrary, in summer season included March and April had almost normal and healthy fish. As per as histopathological observation severe pathological changes were found during winter season in gill and liver organs of the fish body. Both the above mentioned organs in fish body were found normal during summer season (March and April). It showed that the most prominent pathologies were in January and February. Therefore, more precautionary measures need to be taken at the onset of winter season to prevent diseases. So, attention should be given to stock fish with appropriate stocking density.

CONFLICT OF INTEREST

The authors declare that there has no conflict of interest about this manuscript.

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