**A comparative analysis of the physiological condition of *Cirrhinus reba*, Reba carp (Day, 1878) of Dhepa and Atrai Rivers, Dinajpur district, Bangladesh**

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ABSTRACT

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| **Background:** Bangladesh is enriched with huge water bodies which are considered as the gold mines fisheries sector as well as national economy. The main rivers of Dinajpur districts are: Dhepa, Punarbhaba and Atrai.**Aims:** The study aims to investigate the health condition of *Cirrhinus reba* in Dhepa and Atrai river of Dinajpur district by evaluating the water quality parameters, body indices and haematological parameters.**Methodology:** Nine fishes were randomly collected from each source for determining the body indices (hepatosomatic index, intraperitoneal fat and viscerosomatic index) and haematological parameters analysis (haemoglobin, red blood cell, white blood cell count, total platelet count, differential leucocyte count and erythrocyte sedimentation rate). The study was conductedin the Dhepa River near Hajee Mohammad Danesh Science and Technology University, Dinajpur and the Atrai River near Mohanpur Bridge, Dinajpur, for six months from October 2019 to March 2020.Fish sampling and water quality parameters (air and water temperature, depth, transparency, pH, dissolved oxygen, alkalinity and hardness) were monitored monthly.**Results:** The highest air and water temperatures were recorded in October, while the lowest were found in December in the Dhepa and Atrai rivers. The highest transparency and pH were observed in January in the Dhepa and Atrai rivers, while the lowest were recorded in October and November, respectively. The body indices result revealed that HSI (0.04-0.09%), IPF (0.17-1.47%) and VSI (14.25-20.38%) of *C. reba* were observed in both Dhepa and Atrai rivers. The lowest WBC, lymphocyte and monocyte counts were found in the blood of *C. reba* collected from both sources in December, while the highest total platelet count and ESR were recorded from the fish collected from the Dhepa River only in October. The highest levels of Hb, WBC and lymphocyte count were observed between February and March 2020 in both the Dhepa and Atrai rivers.**Conclusion:** It can be said that the health condition of *C. reba* collected from both sources are apparently healthy, and better haematological parameters were observed in the months of February and March 2020. |

*Keywords: Body indices; Cirrhinus reba; haematological parameters; health status; water quality parameters*

1. INTRODUCTION

Fisheries is one of the rich probability sectors of agriculture, and over the last three decades, aquaculture has developed to become the fastest growing food producing sector in the world, as well as in Bangladesh. The fisheries sector plays a significant role in Bangladesh's economy in terms of nutrition, income, employment and foreign exchange earnings. This is one of the significant export-earning sectors, contributing about 3.57% to the national GDP and about 1.24% of the foreign exchange earnings of the country (Azad & Azad, 2022). Bangladesh is enriched with huge water bodies, which are considered as the gold mines fisheries sector as well as the national economy. Fish constituting 80 percent of the animal protein intake for the people of Bangladesh, the fisheries sector plays a crucial role not only in economic contributions but also in ensuring food security and nutrition (Mondal et al., 2024). The main rivers of Dinajpur districts are: Dhepa, Punarbhaba and Atrai. This resource has a substantial impact on the ecology, biodiversity and socioeconomy of the surrounding localities in Dinajpur district. But at present, the status of the Dhepa and Atrai river ecosystems are not very supporting due to unplanned urban and agricultural developments, the involved anthropogenic disturbances, predominantly throwing of garbage, discharge of sewage and municipal wastes into water body, unload of sand and overexploitation of aquatic resources. The natural aquatic systems may extensively be contaminated with heavy metals released from domestic and industrial wastes, agricultural activities, physical and chemical weathering of rocks, soil erosions, as well as sewage disposal and atmospheric deposition (Gaber et al., 2013).

Moreover, some parts of the river are fully dried up during the winter season, which places the ecosystem for aquatic life under threat. Among them, *C. reba* (Hamilton, 1822), commonly known as ‘Rikhor’ or ‘Raik, ’ is a noticeable one. Although the fish is hardly available in the eastern part of the country, it is profusely available in the western and northwestern parts of Bangladesh.

*C. reba* (Reba carp) is a species of ray-finned fish in the genus *Cirrhinus* (Gupta, 1975). This commercially significant freshwater minor carp is found in large streams, rivers, lakes, and reservoirs and is native to Bangladesh, India, Nepal, and Pakistan. It is a desired table size fish as having high nutritional value with a good amount of protein, calcium and low fatty acid content. Its flesh contains not much bone and has a good flavor. It is a great target species for small and large-scale fishers of Bangladesh who use different types of traditional fishing gear such as conical traps, square lift net, and cast net to collect it.

Once reba is obtainable in almost all freshwater areas of the country, in recent days the availability of these fishes has drastically declined in open water bodies such as rivers, beels, haors and baors. One of the most important reasons for reducing these species is the outbreak of various types of diseases in open water bodies (Rahman & Chowdhury, 1999). Billions of dollars have been destroyed annually because of disease outbreaks, which have been recognized as a major threat to the sustainability of the fisheries sector. Fish production has failed to keep pace with its demand due to an increase in population, which can be tackled by the proper utilization of all thewater bodies for the culture of fish by using scientific methods.

The water quality, body indices and haematological parameters play a significant role in disease diagnosis (Heath, 2018). Knowledge of the disease pattern in reba fish is key for maintaining their availability. In Bangladesh, studies on water quality parameters, body indices and haematological parameters (Akter *et al*., 2009) are scarce, particularly in reba fish. Considering the above fact, the current study was carried out to determine the current health status of commercially important reba minor carp in the Dhepa and Atrai rivers of Dinajpur district based on the water quality, body indices and haematological parameters.

2. material and methods

**2.1 Experimental site**

The study area of the experiment was the Dhepa River near Hajee Mohammad Danesh Science and Technology University, Dinajpur and the Atrai River near Mohanpur Bridge, Dinajpur (Figure 1) and was conducted for a period of six months from October 2019 to March 2020.

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**Fig. 1.** Map showing the study area.

**2.2 Experimental design**

Nine live fishes of reba carp (*C. reba*) were collected from the Dhepa and Atrai river once in month and transported in separate plastic buckets filled with fresh water during experimental period and immediately carried to the laboratory of aquaculture, Faculty of Fisheries, Hajee Mohammad Danesh Science and Technology University, Dinajpur for investigation purposes.

**2.3 Water quality assessment**

Water quality parameters were determined once in a month. Temperature, transparency and pH were recorded by a standard mercury thermometer, secchi disc and a digital pH meter, respectively. DO, alkalinity and total hardness were measured by using a digital DO meter, an alkalinity test kit (HI 3811) and hardness test kit (HI 3812), respectively.

**2.4 Determination of body indices**

At the end of the experiment, body indices of *C. reba,* such as Hepatosomatic index (HSI), intraperitoneal fat (IPF) and viscerosomatic index (VSI), were determined by using the following formulae as previously used by Akter *et al*. (2019, 2021):

* $Hepatosomatic index (HPI \%)=\left\{{Liver weight (g)}/{Body weight (g)}\right\}×100$
* $Intraperitoneal fat \left(IPF \%\right)=\left\{{Intraperitoneal fat weight (g)}/{Body weight (g)}\right\}×100$
* $Viscerosomatic index \left(VSI \%\right)=\left\{{Viscera weight (g)}/{Body weight gain (g}\right\}×100$

**2.5 Determination of haematological parameters**

To determine the haematological parameters, the experimental fish were starved for 24 hours. Nine fish from each river were randomly selected and immediately stabilized to reduce stress during handling. Then blood was collected by inserting a 21 gauge needle attached to a 1 mL syringe and transferred to a heparinized tube to prevent the blood sample from clotting for determining the haemoglobin (Hb), red blood cells (RBC), white blood cells (WBC), total platelet count, differential leucocyte count and erythrocyte sedimentation rate (ESR) as previously described by Akter *et al*. (2019).

**2.6 Data analysis**

All data were tested using two-way analysis of variance (ANOVA). Significant results (*P* = .05) were further tested using two-way ANOVA followed by a Post Hoc Test to identify significant differences between means. The data were expressed as mean±SD, and statistical analysis was performed using SPSS version 22 and Microsoft Office EXCEL for Windows.

3. results and discussion

The water quality parameters, body indices and haematological parameters of fishes are used to diagnose various fish diseases. Suitable water quality parameters are prerequisites for a healthy aquatic environment and for the production of sufficient fish food organisms (Rahman, 1992). Water quality provides information on the health of water bodies and helps in developing strategies that facilitate better management of catchment, and changes in the nature of freshwater habitats can cause rapid changes in biodiversity composition (De Pauw & Vanhooren, 1983).

**3.1 Water quality parameters**

Water quality parameters of Dhepa and Atrai river such as water temperature, air temperature, depth, pH, DO, transparency, alkalinity and hardness were studied from October 2019 to March 2020 and ranged between 21.23 to 31.62 ºC and 20.67 to 30.34 ºC, 5.67 to 11.17 ft and 5.83 to 10.50 ft, 7.25 to 7.53 and 7.40 to 7.57, 6.58 to 8.00 mg/L and 6.68 to 8.46 mg/L, 23.15 to 30.33 cm and 18.13 to 31.17 cm, 41.33 to 54.67 mg/L and 35.67 to 54.67 mg/L, 73.00 to 90.67 and 68.50 to 84.50 mg/L, respectively (Table 1).

**Table 1. Water quality parameters in the Dhepa and Atrai rivers of Dinajpur district from October 2019 to March 2020 (mean±SD)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rivers** | **Months** | **Air Temperature (ºC)** | **Water Temperature (ºC)** | **Depth (ft)** | **pH** | **Dissolved Oxygen(mg/L)** | **Transparency (cm)** | **Alkalinity****(mg/L)** | **Hardness(mg/L)** |
| **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** |
| Dhepa | October | 31.62± 1.65 | 29.42±0.69 | 11.17±3.66 | 7.25±0.27 | 7.15±0.95 | 23.15±2.81 | 41.33±2.73 | 73.00±12.82 |
| November | 27.45± 2.73 | 23.22±0.64 | 6.83±3.06 | 7.43±0.23 | 7.82±0.89 | 23.33±6.06 | 41.33±1.63 | 78.50±16.48 |
| December | 21.23± 2.31 | 18.30±1.16 | 6.42±3.32 | 7.30±0.22 | 9.53±0.78 | 25.67±9.77 | 44.00±1.26 | 90.67±14.75 |
| January | 27.79±2.02 | 24.62±2.28 | 5.67±2.73 | 7.53±0.23 | 7.73±1.21 | 30.33±2.93 | 47.67±3.44 | 79.17±7.88 |
| February | 25.23±0.99 | 22.88±1.77 | 5.80±1.72 | 7.27±0.23 | 8.00±0.63 | 23.58±2.11 | 54.67±6.25 | 86.50±18.34 |
| March | 27.70±1.21 | 25.87±2.29 | 5.98±1.98 | 7.38±0.34 | 6.58±0.49 | 23.31±2.76 | 51.50±3.56 | 74.50±10.29 |
| Atrai | October | 30.34±2.08 | 27.77±1.05 | 10.17±3.66 | 7.40±0.11 | 6.68±0.43 | 19.60±2.82 | 43.33±3.01 | 78.67±9.05 |
| November | 25.15±2.49 | 22.58±1.86 | 7.67±3.44 | 7.49±0.22 | 8.46±0.76 | 18.13±3.30 | 54.67±6.25 | 79.00±9.80 |
| December | 20.67±1.78 | 18.83±1.53 | 5.83±3.06 | 7.55±0.27 | 7.19±0.74 | 27.40±5.69 | 47.67±3.44 | 68.50±6.12 |
| January | 21.80±1.89 | 19.42±1.38 | 9.37±3.52 | 7.57±0.16 | 7.53±0.86 | 31.17±3.55 | 44.67±1.63 | 76.50±12.11 |
| February | 27.13±1.56 | 26.03±1.52 | 10.50±4.51 | 7.45±0.24 | 7.98±0.80 | 24.70±7.17 | 51.50±3.56 | 84.50±12.50 |
| March | 28.87±0.69 | 26.07±1.11 | 9.78±3.75 | 7.42±0.25 | 7.60±0.36 | 28.75±0.82 | 35.67±3.44 | 80.00±9.03 |

In the present study, the average water temperature of Dhepa river were noted as 18.30±1.16 to 29.42±0.69 ºC, while in Atrai river 18.83±1.3 to 27.77±1.05 ºC respectively which coincides with the study of Begum *et al*., 2019 (19.1 to 19.6 ºC); Rahman *et al*., 2020 (22.8 to 30 ºC); Amin *et al*., 2021 (21.67 to 32.03 ºC). From this context, it can be said that the experimental river water temperatures were suitable for health condition of fishes.

In addition, the highest depth in the Dhepa River was observed in October and lowest water level was noted in January, while highest depth in Atrai river was observed in February, and the lowest water depth was observed in December. Similarly, Singh *et al.*, (2010) observed the highest water depth in the monsoon and the lowest in the summer season in Manipur River.

The DO content at Dhepa River was 6.58±0.49 to 9.53±0.78 mg/L; on the other hand, the range of DO at the Atrai River was 6.68±0.43 to 8.46±0.76 mg/L in October and November, respectively. Adequate DO is necessary for good water quality, survival of aquatic organisms and decomposition of waste by microorganisms (Islam *et al*., 2010). The lower DO concentrations indicate higher levels of organic pollutants and lower levels of oxygen concentration in water (Islam *et al.*,2012). Therefore, the DO content in the present study was acceptable for the health condition of the fish.

In the current study, pH values ranged from 7.25±0.27 to 7.53±0.23 for Dhepa river, while in Atrai river 7.40±0.11 to 7.57±0.16, respectively that agrees well with the study of Roy *et al*., (2002) 5 to 9.03 for carp SIS; Shariful *et al.*,(2009) 6.5 to 8.1 for benthic fauna and Rahman & Marimuthu (2010) 7.40 to 8.50 for endangered native fishes. From this context, it can be said that the experimental rivers were appropriate for the health condition of fishes.

In the present study, transparency was found to vary from 23.15 to 30.33 cm for the Dhepa River, while in the Atrai River 18.13 to 31.17 cm. The minimum values were observed to be 23.15±2.81 to 18.13±3.30 cm in October and November, and the maximum values were observed to be 30.33±2.93 to 31.17±3.55 cm in January Dhepa and Atrai rivers, respectively. According to Khan *et al.* (2007), transparency was 22.99 cm, while intheMouri River, the average value was 37.25 cm.

In the Dhepa River, the minimum alkalinity of 41.33±1.63 mg/L was recorded in November, and the maximum was 54.67±6.25 mg/L in February, while in the Atrai River, the minimum alkalinity was 43.33±3.01 mg/L in October, and the maximum was 54.67±6.25 mg/L in November. Islam *et al*. (2014) found more alkalinity in the water of the Brahmaputra River during the dry season and seasonal fluctuation in total alkalinity in the Talar River. The mean alkalinity of the Korotoa river water was 122.05 mg/L, which was within the standard limit of 150 mg/L (DoE, 2016).

The minimum hardness of Dhepa river was 73.00±12.82 mg/L in October and maximum was 90.67±14.75 mg/L in December, while in Atrai river, the minimum hardness 68.50±6.12 mg/L in December and maximum 84.50±12.50 mg/L in February which coincides with the study of Huq & Alam (2005) who recorded the mean content of hardness 75.59 mg/L in the river water. From this context, it can be said that all the water quality parameters were within the acceptable range for fish.

**3.2 Body indices**

Among the body indices, non-statistically significant *(P* = *0.05)* was exist for HSI, IPF and VSI (Table 2, Figure 2).

**Table 2. Body indices of *C. reba* collected from Dhepa and Atrai rivers from October 2019 to March 2020 (mean±SD)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Rivers** | **Months** | **HSI (%)** | **IPF (%)** | **VSI (%)** |
| **M±SD** | **M±SD** | **M±SD** |
| Dhepa | October | 0.09±0.02 | 0.18±0.13 | 14.25±5.84 |
| November | 0.08±0.01 | 0.16±0.13 | 20.38±2.70 |
| December | 0.09±0.05 | 0.93±0.47 | 15.32±1.51 |
| January | 0.08±0.01 | 0.17±0.14 | 19.01±1.47 |
| February | 0.06±0.05 | 1.28±0.11 | 14.58±0.18 |
| March | 0.06±0.05 | 1.47±0.34 | 16.00±1.28 |
| Atrai | October | 0.07±0.03 | 0.19±0.18 | 17.78±4.55 |
| November | 0.04±0.01 | 0.73±0.63 | 17.99±2.74 |
| December | 0.06±0.03 | 1.03±0.91 | 17.85±0.56 |
| January | 0.08±0.02 | 0.17±0.15 | 18.50±5.28 |
| February | 0.06±0.03 | 0.92±0.75 | 17.65±2.30 |
| March | 0.04±0.00 | 1.29±0.77 | 17.04±0.43 |

**3.3 Haematological parameters**

The health status of fish was reflected through its haematological parameters. Therefore, understanding of the haematological parameters is used as an effective index in evaluating physiological and pathological abnormalities in fish to verify their health status (De Pedro *et al*., 2005). Among the haematological parameters statistically significant *(**P = .05)* were exist for monocyte (%), eosinophil (%) and no statistically significant *(P = .05)* observed for Hb (g/dL), RBC (m/µL), WBC (cu.mm), total platelet count, neutrophil (%), lymphocyte (%), basophil (%) and ESR (mm/hr.) of *C*. *reba* were determined from Dhepa and Atrai river in different months (Table 3).

**A**

**B**

**D**

**C**

|  |  |
| --- | --- |
|  |  |

E

F

G

**Fig. 2.** A) Hb (g/dL), B) WBCX10³ (cu.mm), C) RBC (m/µL), D) total platelet count, E) neutrophil(%), F) lymphocyte (%), G) monocyte (%), H) eosinophil (%) and I)ESR (mm/hr.) of *C. reba* collected from Dhepa and Atrai river of Dinajpur district.

Fish are sensitive and very vulnerable to alterations of water quality, which is possibly reflected in their blood parameters (Blaxhall, 1972; Reddy & Baghel, 2012; Reddy & Rawat, 2013). Haematological parameters reflected the poor condition of fish more quickly than other commonly measured parameters and they respond quickly to changes in environmental conditions (Alkinson & Judd, 1978) and they have been widely used for the description of healthy fish for monitoring stress responses (Soivio & Oikari, 1976; Kocabatmaz & Ekingen, 1984) and the physiological adaptations of fishes. In the current study, the outcome of most of the body indices, including HSI, IPF and VSI, were not significantly changed in the *C. reba* in both rivers. The study on the changes of haematological parameters of fish provided valuable information in the identification of stress, environmental contamination and pathology (Elahee & Bhagwant, 2007), and changes in these indices from reference give an indication of disease.

**Table 3. The haematological parameters of *C. reba* collected from the Dhepa and Atrai rivers from October 2019 to March 2020 (mean±SD)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Rivers** | **Months** | **Hb****(g/dL)** | **WBC****X10³(cu.mm)** | **RBC****(m/µL)** | **Total platelet count** | **Neutrophil****(%)** | **Lymphocyte****(%)** | **Monocyte****(%)** | **Eosinophil****(%)** | **Basophil****(%)** | **ESR****(mm/hr)** |
| **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** | **M±SD** |
| Dhepa | October | 6.67±0.57 | 7.33±0.91 | 2.87±0.15 | 198.00±53.00 | 19.00±4.00 | 71.00±3.00 | 4.00±1.00 | 5.00±2.00 | 0±0 | 16.00±5.00 |
|  | November | 6.53±0.55 | 7.80±1.22 | 2.97±0.21 | 163.00±8.00 | 24.00±5.00 | 69.00±6.00 | 4.00±1.00 | 3.00±2.00 | 0±0 | 13.00±5.00 |
|  | December | 6.43±0.42 | 5.90±0.66 | 2.88±0.21 | 157.00±8.00 | 25.00±3.00 | 67.00±1.00 | 4.00±2.00 | 5.00±2.00 | 0±0 | 15.00±4.00 |
|  | January | 6.87±0.31 | 7.70±1.14 | 2.87±0.15 | 172.00±11.00 | 23.00±6.00 | 69.00±7.00 | 4.00±1.00 | 5.00±2.00 | 0±0 | 10.00±2.00 |
|  | February | 6.53±0.35 | 8.33±1.04 | 2.80±0.10 | 192.00±60.00 | 21.00±2.00 | 71.00±2.00 | 4.00±1.00 | 4.00.±2.00 | 0±0 | 17.00±2.00 |
|  | March | 7.53±0.25 | 6.43±1.50 | 2.93±0.12 | 183.00±12.00 | 18.00±3.00 | 72.00±3.00 | 4.00±0.00 | 6.00.±2.00 | 0±0 | 10.00±1.00 |
| Atrai | October | 7.40±0.46 | 6.90±1.68 | 2.97±0.12 | 178.00±3.00 | 19.00±3.00 | 74.00±3.00 | 4.00±1.00 | 3.00±1.00 | 0±0 | 13.00±5.00 |
|  | November | 6.80±0.20 | 7.33±1.80 | 3.20±0.61 | 149.00±23.00 | 25.00±6.00 | 68.00±7.00 | 2.00±1.00 | 4.00±2.00 | 0±0 | 14.00±6.00 |
|  | December | 6.73±0.64 | 6.27±0.97 | 3.03±0.15 | 163.00±8.00 | 25.00±4.00 | 68.00±6.00 | 2.00±1.00 | 4.00.±2.00 | 0±0 | 10.00±0.00 |
|  | January | 6.67±0.49 | 6.40±0.85 | 2.87±0.21 | 148.00±21.00 | 25.00±4.00 | 68.00±7.00 | 3.00±2.00 | 4.00±2.00 | 0±0 | 11.00±3.00 |
|  | February | 7.47±0.55 | 6.77±1.24 | 3.17±0.46 | 167.00±15.00 | 18.00±3.00 | 76.00±4.00 | 4.00±2.00 | 3.00±2.00 | 0±0 | 12.00±7.00 |
|  | March | 6.93±0.85 | 7.33±2.25 | 2.83±0.31 | 173.00±8.00 | 17.00±4.00 | 76.00±3.00 | 3.00±0.00 | 4.00±2.00 | 0±0 | 15.00±6.00 |

The highest Hb content, 7.53±0.25 g/dL, was observed in the month of March 2020 and the lowest, 6.43±0.42 g/dL in December 2019 in the Dhepa River. The highest Hb content, 7.47±0.55 g/dL, was observed in the month of February 2020 and the lowest, 6.67±0.49 g/dL in January 2020 in the Atrai River. Previously, different studies reported the level of Hb standard of Tilapia is 5.05 to 8.33 g/dL (Salasia *et al*., 2001) and 7.14 to 8 g/dL (Arfiati *et al.*,2020), which are mostly similar to the present study and the average level of Hb concentrations.

In the current study, the value of WBC count at Dhepa River was 5.90 to 8.33 cu.mm in December and February. On the other hand, the range of WBC at the Atrai River was 6.27 and 7.33 cu.mm in December and March, respectively. Singh & Tandon (2009) observed WBC 8.40 and 9.30 cu.mm. WBC plays a major role in the defense mechanism of the fish and consists of granulocytes, monocytes and lymphocytes. Granulocytes and monocytes function as phagocytes to salvage debris from injured tissue, and lymphocytes produce antibodies (Ellis *et al.*, 1978). From this context, it can be said that the experimental rivers were appropriate for the health condition of fishes.

In this study, the RBC content of *C*. *reba* collected from the Dhepa River was 2.80± 0.10 m/µL in February and 2.97± 0.12 m/µL in November. On the other hand, the range of RBC at Atrai river was 2.83± 0.31 m/µL and 3.20± 0.61 m/µL in March and November respectively. A significant difference was found between the fishes of these two rivers that agrees with the findings of Adedeji *et al.*, (2000).

The value of the total platelet content of the Dhepa River ranged from 157 to 198, while in the Atrai River ranged from 148 to 178 and has more ability to maintain haemostasis during blood loss (Srivastava, 1969). There was no significant difference in the amount of platelet between the fishes of these two rivers. The lymphocyte percentage of the Dhepa River ranged from 67% to 72%, while in the Atrai River, it ranged from 68% to 76%. According to Adedeji *et al*. (2011), the lymphocyte count ranges between 37 to 72 % with the mean value of 63.45±1.93 % in *C. gariepinus* while *C. nigrodigitatus* lymphocyte ranges between 34 to 78 % with a mean value of 52.35±3.01 %. This finding was similar to the finding of the present study, and the haematological parameters showed a statistical significance for the monocyte and eosinophil content.

In the current study, in the Dhepa river, the minimum ESR 10±1mm/hr was recorded in March, and the maximum 16±5 mm/hr was recorded in October, while in the Atrai river, the minimum ESR 10±0 mm/hr was recorded in December and maximum 15±6 mm/hr in March 2020. From this context, it can be said that the ESR of fishes from these two experimental rivers were suitable for the health condition of fishes. However, the parameters were within the satisfactory range for the healthy condition of fish (Jhingran, 1991).

4. Conclusion

The health status of *C. reba* collected from the Dhepa and Atrai rivers of Dinajpur district was evaluated and the results indicated that *C. reba* collected from both sources are apparently healthy. The better water quality parameters such as temperature, depth, pH and a higher concentration of Hb, WBC and lymphocytes, were found in the blood of *C. reba* collected from both sources, particularly in the months of February and March 2020.

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