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Impact of water quality on haematological parameters of *Labeo rohita* at Govindgarh Lake, Rewa

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Abstract
Water quality assessment of Govindgarh Lake in district Rewa was made to understand the effect of pollutants on haematological parameters of fresh water fish *Labeo rohita*. The results revealed, increasing trend in WBC count (TLC), Haemoglobin concentration (Hb %), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC) and a decreasing trend in RBC count (TEC), Packed cell volume (PCV) and Mean corpuscular volume (MCV). These changes are due to the effect of variations in water quality *viz*., pH, DO, CO_2, BOD, Hardness, Chloride and Ammonical nitrogen.

Keywords: Haemoglobin, haematological parameters, ammonical nitrogen

Introduction
Surrounding waters play an important role in the functioning of ecosystems because they are receptors of pollutants that can have serious consequences on biota over time; It is only at this point that changes at the population or ecosystem level may become apparent. It may be too late to measure positive response (Bhagde *et al*., 2020) [1]. Many of the chemicals that people use in agriculture (such as chemical fertilizers, fertilizers) enter large amounts of water, lakes and ponds. Many of them have been found to be toxic not only to fish but also to bacteria in fish meal (Kaur and Mishra, 2019) [2]. Fish are frequently exposed to pesticides through skin absorption or direct absorption through any route, and these exogenous chemicals can cause organ failure such as hematological changes in fish (Prakash and Verma, 2020a, b) [3-4]. Since ancient times, most of the world's food has been obtained from fish, and it is important to keep fish healthy (Verma and Prakash, 2020) [5]. Changes in environmental quality due to the harsh environment will have an impact on the health of fishing equipment in the water body.
Blood forms a unique compartment between the external and internal environment in fishes and therefore any physical or chemical change in the environment induces changes in the nature of blood (Wilson and Taylor, 1993) [6]. Pollutants or any other stressor is reported to induce changes in the haematological parameters of fish (Joshi and Harish, 2002 and Luskova, 1997) [7-8]. Blood parameters of a fish, therefore, provide information not only about the health status of the fish but also the quality of water in which they are living (Wilson and Taylor, 1993 and Pampatwar, 2007) [6, 22]. In the present study attempts have been made to assess the relationship between water quality and the haematological profile *Labeo rohita* in different environments.

Materials and Methods
Study site: The Govindgarh lake is one of the unique water body in M.P. and located in south of Rewa district at a distance of 20 km. with a longitude 81°15'0" and latitude 24°20'25". It comes under the Rewa district and in Huzur tehsil. The lake is connected with Rewa-Shahdol and Satna-Sidhi road. The lake was formed by impounding of small nalla originating from Kaimore hill. With a view to storing rain water, the Maharaja of Rewa at that time built a bandh across the nalla to form a tank in 1958.
Various species of fishes were bred in this lake and feed of gram and small pills of wheat flour was given to them twice a day from the budget sanctioned by Rewa state. Fishing in the lake was totally prohibited.

This practice continued till it was handed over to the M.P. Government. Now fisheries department looks after it and exports fishes worth several thousand rupees every years.

Data Analysis

Water samples were collected from both water bodies and analyzed their Physico-chemical characteristics as per the method described by APHA (1985) [10]. The freshwater teleost, *Labeo rohita*, weighting 500-800g were collected randomly from Govindgarh lake both site using gill net and brought to the laboratory alive. For haematological studies, blood was collected in vials by puncturing the heart with the help of glass syringe. Total RBC and WBC count was made using Naubauer's double haemocytometer. While Haemoglobin concentration was determined using Sahli's haemometer, Packed Cell Volume (PCV) or Haematocrit values (Ht) were determined using Wintrobe's tube. All these parameters were determined using the method described by Wintrobe (1975) [11]. From the above values erythrocyte constants were calculated.

Statistical assessment was carried out using the statistical percentage for the social science (Version 16) computer programme. All the data were first tested for normally using Kolmogorov-Smirnov and Shapiro wilk tests to meet statistical demand.

Results and Discussion

The results of the present study provide basic information on the effect of pollutants present in the both site on haemotological parameters of *Labeo rohita*. Haematological values and cell structure of *Labeo rohita* from the two habitats are given in table 1. Significant variation between the study areas were detected in all the haematological values.

Table 1: Physico-chemical parameters of Govindgarh Lake, Rewa

Parameters	Site A	Site B	Average	Standard deviation
Water temperature (°C)	22.23	21.08	21.66	0.81
pH	7.2	7.4	7.30	0.14
Conductivity (µmhos/cm)	196.28	172.13	184.21	17.08
Dissolved Oxygen	8.61	9.24	8.93	0.45
Biochemical Oxygen Demand	5.8	6.2	6.00	0.28
Fire Carbon dioxide	55.256	67.324	61.29	8.53
Alkalinity	122.5	134.6	128.55	8.56
Hardness	126.8	121.6	124.20	3.68
Chloride	96.91	85.82	91.37	7.84
Ammonical nitrogen	1.04	0.88	0.96	0.11

N.B.: all the parameters are expressed in mg/L.

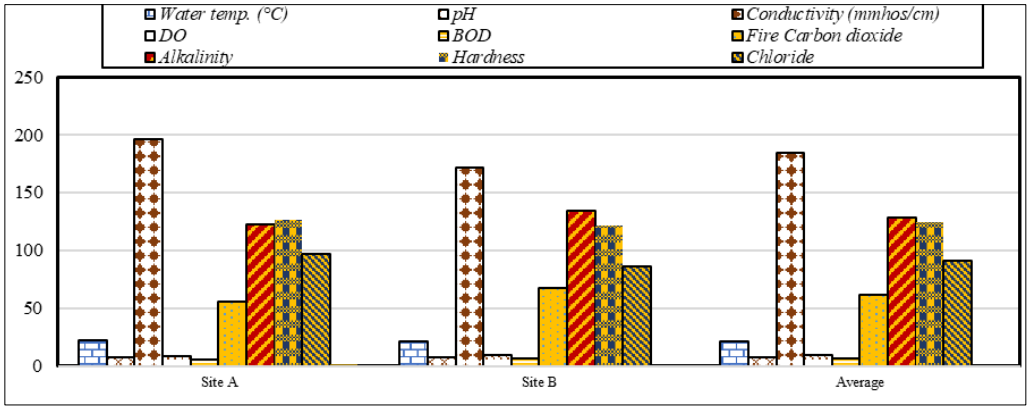

Fig 1: Graph analysis of Physico-chemical parameters of Govindgarh Lake, Rewa

Similar results have also been obtained by Mcleay (1973) [12] that increase in total RBC count (TEC) in fishes collected from polluted water bodies is because haemopoeisis is stimulated in fishes exposed to toxicants caused by higher demands of oxygen and carbon dioxide transport in the polluted media.

Leucocytosis is also evident in fishes collected from Site A and Site B (Table 2). Similar findings have also been reported by Hemavathi and Rao (2000) [13] in *Channa punctatus* exposed to lead. Joshi *et al.* (2002) [7] have reported mercuric chloride to cause increase in TLC in Clarias batrachus which is primarily a defense mechanism to combat pollution.

Table 2: Haematological parameters of *Labeo rohita* from Govindgarh lake, Rewa

Parameters	Site A	Site B	Average	Standard deviation
TEC (106 /mm^2)	8.22	7.94	8.08	0.20
TLC (103 /mm^3)	36.18	38.46	37.32	1.61
Hb (%)	4.8	6.5	5.65	1.20
Ht (%)	9.9	8.6	9.25	0.92
MCH (pg)	6.21	18.16	12.19	8.45
MCHC (%)	62.54	106.64	84.59	31.18
MCV (cu.µ)	16.4	12.8	14.60	2.55

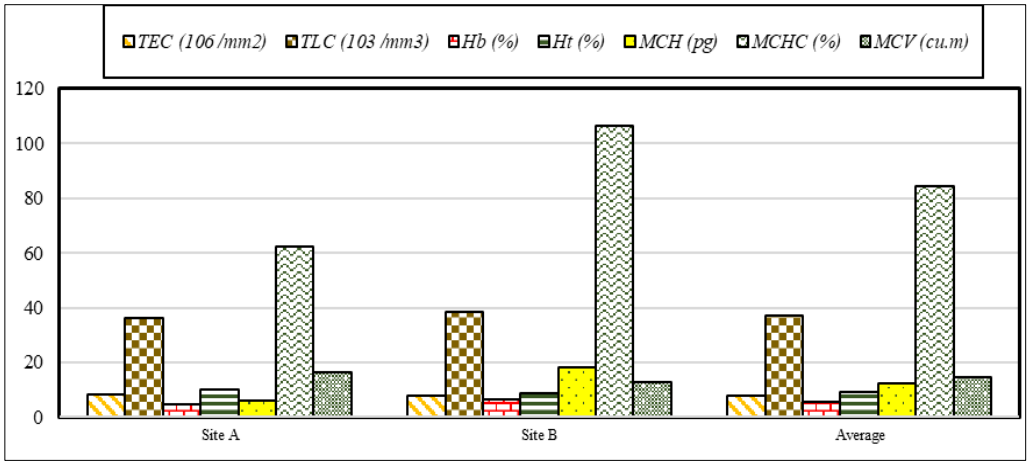

Fig 2: Graph analysis of Haematological parameters of *Labeo rohita* from Govindgarh lake, Rewa

The haemoglobin content (Hb) was also observed to be higher in fishes collected from site A and B. Similar observations have also been made by Hrubec *et al.*, (1997) [14] that increase in Hb is due to reduction in the erythrocytes and liberation of haemoglobin content into the cell. A significant elevation in haemoglobin has also been reported in *T.mossambica* exposed to sumithion and sevin (Koundinya and Ramamurhti, 1980) [15]. *Channa striatus* exposed to metasystox (Natarajan, 1984) [16] and in *Notopterus notopterus* exposed to chlordane (Gupta, 1995) [17]. The decline in Hb content of *Cyprinus carpioz* was also observed by Chauhan *et al.*, (1994) [18] & Ramesh and Sarvanan (2008) [19].

This study, further, revealed reduction in Ht in fishes collected from site B when compared to those collected from site A which may be due to increased rate of erythropoiesis as well as haemolysis; Similar results were also observed in the flounder *Cyprinus carpio* var subjected to cadmium intoxication (Qayoom *et al.* 2016) [20].

Alterations in erythrocytes constant have been attributed to direct or feedback responses, structural damage, impairment in haemoglobin synthesis, stress related release of RBC from the spleen and hypoxia, and exposure to pollutions (Shah, 2006) [21].

Conclusion

Studies have confirmed that pollutants affect water quality and support the hypothesis that physiological changes in fish are associated with the importance of one or more hematological parameters. Therefore, an important factor responsible for individual differences in fish hematology is water quality.

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