



## Research Paper

### Effect of Strigeoid Diplostomulum infection on the respiration of *Heteropneustes fossilis* (Bloch)

Md. Mansoor Alam and N. K. Dubey

Department of Zoology, J. L. N. College, (Veer Kunwar Singh University, Ara, Bihar) Dehri-On-Sone, Rohtas,

Department of Zoology, L. N. Mithila University, Darbhanga, Bihar, India

Corresponding author email: [mmalamphd@gmail.com](mailto:mmalamphd@gmail.com)

Received: 03/07/2021

Revised: 08/07/2021

Accepted: 23/07/2021

**Abstract:** Oxygen plays vital role in metabolism of living organisms. Oxygen consumption increases in Diplostomulum infected *Heteropneustes fossilis*. The rate of increase is dependent on the intensity of infection. The percent increase in a given grade of infection is more in surfacing prevented than in surfacing allowed condition.

**Keywords:** Oxygen, Diplostomulum, *Heteropneustes fossilis*, Infection.

#### Introduction:

Fish, being master of aquatic environment are more prone to parasitic diseases. The various factors that affect the oxygen consumption in fish are age and body size (Kramer, 1972; Munshi and Dubey, 1973; Ojha and Munshi, 1975; Munshi et al; 1976; Ojha et. al., 1977), temperature (Beamish, 1964; Raja Gopal and Kramer, 1974) and season (Privolnev, 1948; Pandey, 1978). Strigeoids are the members of the superfamily Strigeoidea, which have fish as their second intermediate host. A number of works have been published on the life cycle of fish Strigeoids and effect

of Diplostomulum infection on various organs and physiology (Dubey, 1980; Alam, 2008; Alam & Dubey, 2012; Alam et al 2013; Alam et ai., 2015, Alam, 2019; Alam & Dubey, 2019, Alam & Dubey, 2020).

The effect of various pollutants on the respiratory physiology of fishes has been investigated by several workers (Waiwood and Jonson, 1974; Hughes, 1975; Lunn et al., 1976; Singh and Singh, 1979). But the effect of parasitic infection on the oxygen consumption of the fish host has not been properly investigated (Lester, 1971) although parasitism may affect the energy requirement of fish in the form of food uptake and oxygen requirement from water. This altered bioenergetics of fish may threaten the economics of pond management and husbandry. The present work was undertaken to record the influence of Diplostomulum infection on the oxygen consumption of *Heterpneustis fossilis* (Bloch) with a view to gain a better understanding of the pathophysiological response of the host to Diplostomulum infection.

**Materials and Methods:**

Normal and parasitized *H. fossilis*, averaging about 55g each, were collected from the derelict swamps of Darbhanga. The animals were sorted out on the basis of visual and autopsy examination, into slightly, mildly and heavily infected groups. These fishes were maintained in plastic pools and were daily fed with properly cleaned pieces of goat liver. The details of the method employed in the determination of VO<sub>2</sub> through gills and skin under experimental conditions in which surfacing either prevented (free

access to air not allowed) or allowed (free access to air allowed) were those of Munshi and Dubey (1973). The concentration of dissolved oxygen in water samples was determined by Winkler’s volumetric method (Wetch, 1948). Five animals from each group, were used to determine the rate of oxygen consumption. The feeding of the animals was stopped 24 hours before the experiment. Student’s t-tests at a level of 5% were applied to the parameters analyzed to record the difference of significance.

**Results:**

**Table 1 : Rate of the oxygen consumption in control on Diplostomulum infected Heteropneustes fossilis at water temperature of 32±1<sup>0</sup>C (n = 5; ± Standard Deviation)**

Condition	Surfacing Prevented		Surfacing Allowed	
	VO <sub>2</sub> ml/kg/h	%	VO <sub>2</sub> ml/kg/h	%
Control	103.12 ± 3.26	-	80.32 ± 3.01	-
Slightly Infected	114.47 ± 3.01	11.01	85.52 ± 2.86	0.47
Mildly Infected	117.44 ± 2.98	13.89	87.03 ± 2.91	8.36
Heavily Infected	121.31 ± 3.12	17.64	88.01 ± 3.20	0.32

The results of oxygen consumption have been show in Fig. 1. The VO<sub>2</sub> under the influence of Diplostomulum infection on

the oxygen consumption of Heteropneustes fossilis

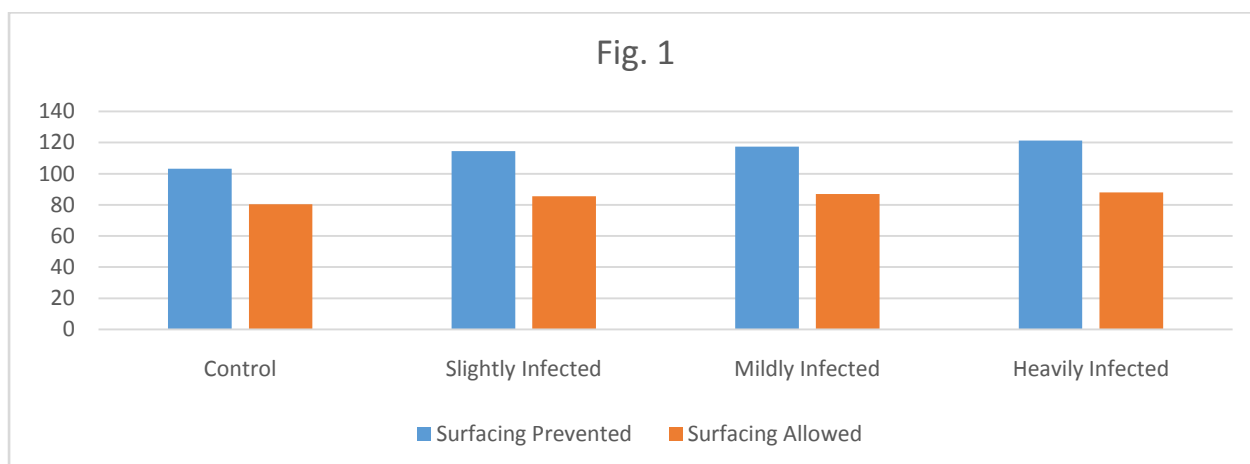


Figure 1. The VO<sub>2</sub> under the influence of Diplostomulum infection on the oxygen consumption of *Heteropneustes fossilis*

Surfacing prevented condition in control animals were 103.12 ± 3.26, which significantly increased to 117.44 ± 2.98 and 121.31 ± 3.12 respectively in mildly

and heavily infected animals. Under surfacing allowed condition also, the  $VO_2$  increased in all the infected groups (Table-1, Figure-1). But these increase were non-

### Discussion:

The measurement of metabolic rate as expressed in terms of oxygen consumption, provides estimates of the energy requirement of fish. The oxygen consumption of *H. fossilis* has been related with respiratory surface area (Munshi et al. 1976), body size (Munshi et. al., 1978), season (Pandey, 1978) and an organophosphate pollutant, malathion (Choudhary, 1980). Review of literature indicates that a number of factors operate together, influencing the rate of oxygen consumption and it is difficult to single out of factor of prime importance.

In fishes the respiratory areas the gas exchange machinery is smaller in comparison to terrestrial animals. In *H. fossilis*, the gills and skin are supplemented with a pair of air – sacs which help in extracting oxygen directly from air. The oxygen consumption in case of air – breathing fish, is measured under surfacing prevented condition to ascertain whether the gills alone are efficient to extract adequate oxygen for the survival of the fish when the accessory respiratory organs are not allowed to function. Munshi et. al., (1976) observed in *H. fossilis*, that the efficiency of gills and skin in gaseous exchange mechanism, under normal condition, is more than in prevented condition. Choudhary (1980) reported the effect of an organophosphate, malathion on the rate of oxygen consumption in *H. fossilis* and observed a decrease in  $VO_2$  in both the conditions of the experiment.

In the present work the oxygen consumption increased in *Diplostomum* infected *H. fossilis*, the rate of increase being dependent on the intensity of infection. However, the percent increase in any considered grade of infection, was

significant. The rate of increase in oxygen consumption was more under surfacing prevented than in surfacing allowed condition.

more, in surfacing prevented than in surfacing allowed condition. This observation may be an important finding considering the report of Munshi et. al. (1976) on the same fish regarding the efficiency of the respiratory organs in the two experimental conditions. The results of the present work appear to be in conformity with the work of Lester (1971) on *Gasterosteus* sp. Infected with *Schistocephalus plerocercoides*.

The difference in the efficiency of oxygen extracting capacity seems to be imposed by parasitism and it is probable that the *Diplostomum* metacercariae exert an extra stress on the fish host which begin consuming more oxygen in order to maintain the equilibrium of host-parasite relationship.

### References:

- Kramer E. (1972). Respiration of carp in relation to body size and temperature, Pol. Arch. Hydrobiol. 19, 325-331.
- Munshi J. S. D. and Dubey, S.C. (1973)  $O_2$  uptake capacity of gills in relation to body size of the air-breathing fish. *Anabas testudineus* (Bloch). Acta Physiol. Acad. Sci. Eung. 44, 113-123.
- Ojha J. and Munshi J. S. D. (1975).  $O_2$  consumption in relation to body size and the respiratory area of fresh-water mud eel. *Macrogathus aculeatus* (Bloch). Ind. J. Exp. Biol. 13, 353-357.
- Munshi J. S. D., Sinha A. L. and Ojha J. (1976) Oxygen uptake capacity of gills and skin in relation to body weight of the air-breathing siluroid fish, *Clarias batrachus* (Linn.). Ibid 48, 23-33.
- Ojha J., Dandotia, O. P. and Munshi J. S. D. (1977). Oxygen consumption of an Amphibious fish *Colisa fasciatus* in

- relation to body weight. Pol. Arch. Hydrobiol. 24, 547-553.
- Beamish F. W. H. (1964) Seasonal changes in the standard rate of oxygen consumption of fishes. Can. J. Zool. 42, 189-194.
- Raja Gopal P. K. and Kramer R. H. (1974) Respiratory metabolism of Utah Chub *Gila atraria* and speckled dace *Rhinichthys osculus*. J. Fish. Biol. 6 : 215-222.
- Privolnev, J. L. (1948) Respiration of fish as a factor determining their distribution in body of water. IZV. JNIOK 25, 124-148.
- Pandey B. N. (1978) Seasonal variation in oxygen consumption of *Heteropneustes fossilis* (Bloch); Z. Tierphysiol., Tierernhr. Futtermittelkdge. 40, 165-170.
- Dubey N. K. (1980) Studies on some pathological aspects of certain freshwater fish, Ph.D. Thesis L.N. Mithila University, Darbhanga.
- Alam M. M. (2008) Studies on some aspects of fungal and strigeoid diseases of fish, Ph.D. Thesis, L. N. Mithila University, Darbhanga.
- Alam M. M. and Dubey N. K. (2012) Immunomodulation of *Heteropneustes fossilis* to *Diplostomulum* infection. Environ & Ecol. 30 (4A), 1603-1604.
- Alam M. M. and Dubey N. K. and Kumar U (2013) Histopathological effect of *Diplostomulum* infection on gills of *Heteropneustes fossilis* (Bloch). Uttar Pradesh J. Zoo., 33(1), 117-118.
- Alam M. M., Shashi S. B, Dubey N. K. (2015) Effect of *diplostomulum* infection on freshwater fish *H. fossilis* in Darbhanga, Bihar, A global problem. International Journal of Global Science Research 2 (3), 183-186.
- Alam M. M. (2019) Biochemical and Histopathological analysis of *Heteropneustes fossilis* (Bloch) infected to *Diplostomulum*. Environ and Ecol. 37 (4A), 1313-1316.
- Alam M. M. and Dubey N. K. (2019) Study of *Diplostomulum* infection on various somatic and visceral organs of *Heteropneustes fossilis* (Bloch), Uttar Pradesh Journal of Zoology. 40(4), 245-249.
- Alam M. M. and Dubey N. K. (2020) Effect of *Diplostomulum* infection on endocrine organs of *Heteropneustes fossilis* (Bloch), Biospectra. 15(2), 15-18.
- Waiwood K. G. and Jonson P. H. (1974) Oxygen consumption and activity of the white sucker (*C. Commersoni*) in lethal methoxychlor, Wat. Res. 8, 401-406.
- Welch P. S. (1948) Limnological Methods. McGraw Hill, New York.
- Hughes G. M. (1975) Coughing in the rainbow trout (*Salmogairdneri*) and the influence of pollutants. Rev. Suisse Zool. 82,47-64.
- Lunn C. R., Toews D. P. and Pree D. J. (1976) Effects of three pesticides on respiration coughing and heart rates of rainbow trout (*Salmogairdneri* Richardson). Ibid. 54, 214-219.
- Singh S. R. and Singh B. R. (1979) Changes in O<sub>2</sub> consumption of a siluroid fish (*Mystus vittatus*) put to different concentrations of some heavy metal salts. Ind. J. Exp. Biol. 17, 274-276.
- Munshi J. S. D., Pandey B. N. and OJha J. (1978) Oxygen uptake capacity of gills and skin in relation to body size of an air-breathing siluroin fish, *Saccobranchus* (*-Heteropneustes*) *fossilis*. J. Zool. Lond. 184, 171-180.
- Choudhary B. P. (1980) "Effect of an Organophosphate (Malathion) on the metabolism of a fresh water air-breathing fish, *Heteropneustes fossilis* (Bloch)". Ph.D. Thesis, Bhagalpur University.
- Lester R. J. G. (1971) The influence of *Schistocephalus plerocercoides* on the respiration of *Gasterosteus* and a possible resulting effect on the behavior of the fish. Can. J. Zool. 49, 361-366.