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COMPARATIVE STUDIES ON THE EFFECTS OF DIFFERENT POLLUTION LEVELS AND PARASITISM ON THE HAEMATOBIOCHEMICAL PARAMETERS OF *SCHIZOTHORAX*

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ABSTRACT

In India, fish management has occupied an important place, especially in the agricultural economy, where the value and usefulness of fish as a cheap source of protein-diet, has been greatly realized and emphasized. According to Thatcher (1981) many parasites can live in a host, sometimes causing damage, sometimes not; therefore, the changes associated with haematobiochemical parameters due to various parasites establish a data base and allow precise diagnosis, guiding the implementations of treatment or preventive measures which are indispensable in fish farming and fish industry (Roberts and Janovy, 1981). However, in India, the comparable studies on the effect of helminth parasites in relation to haematobiochemical abnormalities, especially in Kashmir so far made are only few (Satpute and Agrawal, 1974; Sinha and Sircar, 1974). All these studies indicate the macrocytic anaemia in the fishes. Keeping in view the increasing importance of fish as a cheap source of protein rich diet, helminth infections in fresh water fishes has drawn attention of the fish biologists, ichthyologists and parasitologists under fish pathology. Considering these impacts of pollution and parasitic burden on the fish health, present study on two freshwater bodies of Kashmir, one lotic (river Sindh) and one lentic (Shallabugh wetland) was undertaken for a period of 2 years, from 2011 - 2013. During this study the influence of trophic status of two different study sites Shallabugh wetland and river Sindh on the pattern of helminth infection in *Schizothorax* spp. and effect of the helminth burden on the haematobiochemical parameters was conducted, so that necessary steps are taken to improve the health condition of these economically important fish fauna.

KEY WORDS: Fish, *Schizothorax*, Parasitism, Pollution, Shallabugh wetland, river Sindh, Haematobiochemical parameters, Kashmir.

INTRODUCTION

The pathogenicity due to parasitism has been reported to cause extensive damage to the host leading to the lower production of the fish (Rai, 1986). In certain studies the parasite has been found to be responsible for the death of the host (Bookmer *et al.*, 1981). Present study was conducted on two different water bodies to study the impact of different levels of pollution on haematobiochemical profile of indigenous fish inhabiting two water bodies one lotic and one lentic.

MATERIALS AND METHODS

For the present study, two water bodies were selected, one being lentic (Shallabugh wetland) and other lotic (River sindh). Shallabugh wetland is located in north of Srinagar, situated in the deltaic region of the Sindh nallah. It harbours rich diversity of resident and migratory avifaunal species as well as fish fauna of high importance. The wetland gets water from Anchar lake. River Sindh originates from the Machoi glacier, 8km away from Sonamarag, meets the Shallabugh wetland at the ghat and merges with the Jhelum at Shadipora, Sumbal. The flow of water is determined by the season. Pollution wise, river Sindh is less polluted than Shallabugh wetland and this is the rationale of selecting the two water bodies which could help us in determining the role of pollution in parasitism and subsequently fish health.

Collection of fishes

Fishes were collected with the help of local fishermen. After blood collection, external surface of the fish was examined following Turget *et al.* (2006). Endoparasites were collected following Methodology of Geets *et al.* (1997)

Haematology

For haematology following parameters were worked out:

Hemoglobin (Hb) Estimation (ICSH 1973): It was done by Sahli's Acid Hematin Method.

Total Leucocyte Count (TLC) (Beaker and Silverson, 1982): Neubar's Haemocytometer was used for conducting this test.

Erythrocyte Sedimentation Rate (ESR) (Dacie and Levis, 1975): Estimation was done by using Wintrobe's tube method.

Biochemistry

Among the biochemical tests, Total Protein Estimation by (Feridinand Rose, 1883) was done using Biuret method and estimation of two liver enzyme molecular markers SGOT and SGPT{SGOT(serum glutomate oxaloacetate transaminase / AST (aspartate transaminase), SGPT (serum glutomate pyruvate transaminase / ALT (alinine transaminase)}was done using DNPH method.

RESULTS

During the entire period of study, a total of 732 fishes were examined in Shallabugh wetland out of which 260 were found infected; whereas 166 fishes out of 706 were found to be infected from river Sindh; thus, showing a prevalence of 35.51% in Shallabugh wetland and 23.51% in river Sindh (Table 1).

Table 1 Showing overall prevalence of four species of *Schizothorax* in Shallabugh wetland and river Sindh in Kashmir (September 2011- August 2013)

Particulars	Shallabugh Wetland			River Sindh		
	NE	NI	%	NE	NI	%
S. niger	207	77	37.19	185	44	23.78
S. esocinus	169	64	37.86	166	39	23.49
S. labiatus	174	59	33.90	193	36	18.65
S. curvifrons	182	60	32.96	162	38	23.49
Total	732	260	35.51	706	166	23.51
DF = 2, P-Value = 0.000						

NE = Number Examined; NI = Number Infected

Table 1 clearly shows that the overall prevalence of infection is 35.51% in Shallabugh wetland and 23.51% in river Sindh. Further in case of *S. niger*, prevalence is 37.19% in Shallabugh wetland (SW) and 23.78% in river Sindh (RS). In case of *S. esocinus* it is 37.86% in SW and 23.49% in RS. Similarly in *S. labiatus* it is 33.90% and 18.65% in SW and RS respectively. Finally, when prevalence of infection was calculated in *S. curvifrons*, it was found that infection is more in SW as compared to river Sindh as in other species.

Our results are in accordance with Skinner (1982) who stated that the parasitic infection can increase from moderate to severe levels depending upon the quality of water. Sures (2004) also reported that the pollution of water bodies have led to more parasitic infestation of the host due to the presence of more intermediate hosts which subsequently affected the growth, development and survival of fish. Maclntyre *et al.* (2008) also stated that quality of water has

a potential to affect the health of a fish directly. Kirse and Sarah (2010) while working on Tenderfoot lake and Morris lake also found that, Tenderfoot lake being more polluted has much higher content of chlorophyll A, providing a much better habitat for snails which act as the intermediate hosts for most of the parasitic diseases, thus having more parasitic infection as compared to Morris lake. Francis and Kester (2013) also stated increase in parasitism in the channid fish species due to increase in the organic pollution status of the river. They stated that human impacts on the aquatic environment affect the health of the resident fish fauna, eventually causing disease and associated mortalities. They reported an increase in prevalence and intensity of acanthocephalans in the Cunner - *Tautogolabrus adspersus* exposed to municipal and industrial effluents in Orogodo river of Nigeria.

Further to confirm our result, same fish species of the same lengths but of two different water bodies were correlated **(Table 2)**. When the same fishes of the same lengths but of two different water bodies were correlated it was again found **that infection was higher in fishes of Shallabugh wetland as compared to river Sindh. When the different length groups were correlated it was found that prevalence of infection increases with increase in length.** Higher infection in the fishes of Shallabugh may be due to more pollution in Shallabugh as compared to river Sindh. Another reason for this could be that larger fish provide more surface area and hence a higher tendency of getting infected with parasites. The increase in infection with increase in length may also be due to ageing factor of the fish (Nie and Kennedy, 1991; Koskivaara, 1992). These variations in the infection within different classes may also be as a result of food consumed by the fish at that age, supplemented by the host feeding preferences for the invertebrates which act as intermediate hosts for the parasites. Another possible reason may be that adults as expected would be more active than the juveniles, as such, they are able to compete better for food than the other age groups. Thus, our results are in accordance with studies of El-Naggar & Khidr (1986); Khidr (1990), who observed that infection increases with increase in length and this could be due to the exposure time of infection. Nie and Kennedy (1991) while working on dynamics of *Pseudodactylogrus anguilla* in eel, *Anguilla anguilla* (England) found that there exists a positive correlation between host size and parasitic burden. They found higher infection levels in larger fish.

Hagras *et al.* (1995) found that the prevalence of helminth parasites increases with the increase in length of fishes and there is a highly significant difference in prevalence among the three classes of fishes (class I- upto 12cm, class II- 13 to 20cm and class III- over 21cm).

Table 2 showing correlation between mean length and parasitism.

Length Groups		10.5-15.5			**15.5-20.5**			**20.5-25.5**			25.5-30.5		
Hosts	**Study sites**	**No. Examined**	**No. Infected**	**%**	**No. Examined**	**No. Infected**	**%**	**No. Examined**	**No. Infected**	**%**	**No. Examined**	**No. Infected**	**%**
S. niger	SW	50	7	14	56	17	28.57	46	20	41.3	55	33	54.54
	RS	51	4	7	49	7	14.28	45	13	28.88	40	20	50.00
S. esocinus	SW	40	4	10	38	8	21.05	42	19	45.23	49	33	67.34
	RS	41	2	4.8	43	6	13.9	34	9	26.47	48	22	45.8
S. labiatus	SW	36	5	13.8	36	7	19.4	51	18	35.2	48	29	60.4
	RS	42	1	2.3	38	2	5.2	50	11	26	66	22	33.3
S. curvifrons	SW	45	6	13.3	52	10	17.3	41	12	29.2	44	28	63.6
	RS	41	4	9.7	43	6	13.9	39	9	23.0	39	20	51.2

Investigation made by Guegan and Morand (1996) are in accordance with our results. The investigations of these scientists made on maximal infracommunity parasite richness, showed that a positive relationship exists between host size and external parasite richness across different African Cyprinid fish species. Oniye and Aleen (1999) also reported increase in the abundance of parasites with host size.

Marcogliese *et al.* (2001) found positive relationship between abundance of *Diplodistomum* spp. and fish length, mass, gonad mass, condition index and gonadsomatic index.

Mohamed *et al.* (2003) made a general survey on certain helminth parasites infecting some Nile fishes at ElMansoura, Egypt, and found that the length of the fishes is positively correlated with the prevalence of infection. That means, with increase in length there is a corresponding increase in the prevalence of infection. Mohammed *et al.* (2009) reported that prevalence was found to increase as the fish grows, and that could be attributed to the longer time of expose to the environment by body size.

Kaur *et al.* (2012) observed that increase in the size of fish host was accompanied with an increased parasitic infection. The large fishes (>15 cm) were more heavily infected than the smaller fishes (<10 cm). The increase in the invasion index and mean intensity with the increased size (length) of the host is attributed to two factors. One is the increased volume of food ingested by large fishes including the intermediate hosts and secondly due to the accumulation of plerocercoids in fish as they grow and it is accepted that the plerocercoids may survive in fish for several years.

Haemato-biochemical parameters have been recognized as valuable tools for monitoring fish health. Haematological and serum biochemical parameters were studied and compared with

the different feeding behaviour of fishes. The blood from the hosts was screened for the haematological parameters including Hb, ESR, WBC count etc. Definite variations were detected in these haematological and biochemical values between infected and uninfected fishes, suggesting that in the intensive helminth infection, elevated variations in haematological and biochemical parameters are observed in the fish as shown in **Table** 3.

Table 3.Showing the effect of parasitism on various Haematobiochemical Parameters

	Shallabugh Wetland		**River Sindh**	
	Uninfected	**Infected**	**Uninfected**	**Infected**
Hb	9. 8±0.3	5.8±0.10	9.8±0.15	6.3±0.14
WBC Count	1.32±0.3	4.70±0.15	1.39±0.22	3.7±0.35
ESR	1.12±0.12	4.5±0.08	1.0±0.41	3.1±0.3
Total Protein	4.54±0.12	2.19±0.50	4.96±0.72	3.54±0.77
SGOT	101±0.41.	297±0.56	121±0.31	223±0.51
SGPT	97±0.50	254±0.09	79±0.54	156±0.03
	P= 0.007			

Our results are in accordance with the studies of Kurovskaya (1998) who worked on dynamics of parasite abundance and contents of protein in blood plasma of infected carps in experimental conditions. He collected carp of 1 and 2-year age used for experiments in winter time. Content of proteins in blood plasma of both age groups of carps reliably decreased when the number of parasites increased.

Adhams (2002) also suggested that the blood serum Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) enzyme activities, Creatinine and Urea values were more higher in both *Oreochromis niloticus* and *Clarias gariepinus* that examined from river Nile branch (more polluted locality with heavy metals than infected fish spp. taken from drainage canal and fish farm (less polluted with heavy metals). This indicated that exposure of fish to parasitic infection in the presence of heavy metals is more powerful in stimulating the activities of ALT and AST enzymes. This may be due to hepatic cells injury or increased synthesis of the enzymes by the liver (Yang and Chen, 2003). Radovan *et al.* (2006) studied the biochemical parameters of common carp and found that the total protein and albumin decreases in infected fishes, whereas globulin, SGOT and SGPT increases in fishes infected with cyanobacteria. Osman *et al.* (2009) found by clinical examination of naturally infected catfish (*Clarias gariepinus*) which showed a marked decrease in total protein, albumin and quite significant increase in globulin, SGOT and SGPT. Haider and Ansari (2013) showed the increase of serum AST and ALT activities in infected fish. They suggested that it is perhaps due to hepatic cells injury and increased release of the enzyme by the liver. They

found that Aspartate transeaminase (AST) was often raised in other salmonid viral diseases that revealed anaemia such as infectious Salmon Anaemia. Ali *et al.* (2013) made comparison of haematological and biochemical indices in healthy and Monogenean infected common Carp - *Cyprinus carpio.* They found blood parameters including Hb, PCV and RBC were found higher in healthy common carp. The lower value of these parameters in monogenean infected common carp pointed out the erythrocyte count of fish infected with parasite was significantly lower in comparison to those in non-infected fish. They also found that leucocytes, neutrophils and monocytes have been increased ($P < 0.05$) in monogenean infected common carp. The elevated levels of serum transaminases (SGOT and SGPT) markers of liver functions, were observed in monogenean infected *Cyprinus carpio.* This increased level of serum transaminases related to disruption of normal metabolism which is due to extensive alterations in the liver histology and indicates liver damage.

CONCLUSION

In conclusion, we may say that pollution has a great impact on parasitism. When the fishes of two water bodies having different level of pollution were compared, it was found that the prevalence of infection is higher in fish of Shallabugh wetland than in river Sindh. When the fishes of same length were compared in two water bodies, fishes again showed more infection in shallabugh wetland as compared to river Sindh. Therefore, in order to increase fish production, all aspects of fish health need a thorough investigation.

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