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Impact of Helminth Parasitism on Fish Haematology of Anchar Lake, Kashmir

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Abstract: The present investigation carried out seasonally from March 2004 to February 2006 is an attempt to study the impact of helminth parasitism on fish haematology of Anchar Lake, Kashmir. The fish fauna viz., *Schizothorax* spp. and *Cyprinus* spp. inhabiting the lake carried cestode, trematode and acanthocephala infestations either singly or mixed. The result showed a mean significant decrease from 9.39±0.18-7.39±0.14 g% in *Cyprinus* spp. and 10.57±0.23-7.62±0.13 g% in *Schizothorax* spp. for haemoglobin. Further, a decrease from 2.07±0.03-1.66±0.05 ($\times10^6$ mm^3) in *Cyprinus* spp. and 2.32±0.02-1.69±0.04 ($\times10^6$ mm^3) in *Schizothorax* spp. for RBC count in summer season was observed. However, a significant increase in WBC count was observed with a mean increase from 1.58±0.16-3.93±0.33 ($\times10^4$/mm^3) in *Cyprinus* spp. and 1.56±0.10-2.76±0.27 ($\times10^4$ mm^3) in *Schizothorax* spp. in summer season. Furthermore, a well marked increase in eosinophils was observed in all the helminth-infected fish fauna. The haematological manifestation of the infected fish are suggestive of *anaemia* and the *eosinophilia* may be believed to be associated with defensive and immunological responses of the fish.

Key words: Helminth parasitism, haematology, fish, anchar lake

Introduction

For the last few decades, fishes have been extensively used as a protein rich diet for human consumption in India and thus, contribute a lot to its economy. It is estimated that about 10 million tons of fish is required annually to meet the present day demand of fish protein in India against an annual production of only 3.5 million tons (Shukla and Upadhyay, 1998).

In India the fish management has occupied an important place especially, in the agricultural economy, when the value and usefulness of fish is a cheap source of protein-diet have been greatly realized and emphasized. According to Tatcher (1981) many parasites can live in a host, sometimes causing damage, sometimes not. Therefore, the changes associated with haematological 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, 1981).

However, in India, the comparable studies on the effect of helminth parasites in relation to haematological abnormalities especially in Kashmir so far made are only few (Satpute and Agrawal, 1974; Sinha and Sircar, 1974; Dubey, 1980). 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. Therefore, the present study was designed to study the haematological abnormalities on seasonal basis in the fish fauna of Anchar Lake, Kashmir arising due to helminth infections so that necessary steps are taken to improve the health condition of these economically important fish fauna.

Materials and Methods

This study was conducted on 320 live fish specimens belonging to family Schizothoracinae and Cyprinidae with both infected and uninfected hosts in equal numbers. Live fish specimens were collected from different sites of Anchar lake and were taken to the laboratory in large water containers. The fish were identified by using the key provided by Sven *et al.* (1999). The fish were acclimatized to standard laboratory conditions for 12 h and were subjected to haematological and helminth parasitic investigations. For haematological investigations, blood samples were collected from all fish hosts in glass tubes containing EDTA and were properly labeled. For estimation of haemoglobin content (Hb), routine Sahli's method was employed. The RBC and WBC counting methods were based on the dilution of obtained blood with dilution fluids (Hayem and Turk) in RBC and WBC counting pipettes (Mitruka and Rawnsley, 1977). Individual cells were then counted in the counting chamber (Haemocytometer). Giemsa's staining method was used for the differential count of WBC.

The parasitic worms were collected according to the routine parasitological techniques and proper record was maintained.

Results and Discussion

The data on the haematological values of both infected and uninfected fish specimens on seasonal basis is depicted in Table 1.

Table 1: Seasonal haematological variations of fish hosts from anchar lake recorded during March 2004-February 2006

		Parasitic infestation					
Season	Host	Adeno-scolex	Bothrio-cephalus	Diplo-zoone	Clinos-tomum	Pompho-rhynchus	Neo-echin-orhynchus
Spring	Schizothorax	41	16	5	8	35	00
	Cyprinus	18	19	3	5	29	00
Summer	Schizothorax	11	21	15	7	24	12
	Cyprinus	9	29	9	3	15	5
Autumn	Schizothorax	21	39	7	5	16	19
	Cyprinus	15	51	6	2	10	16
Winter	Schizothorax	31	7	4	1	11	2
	Cyprinus	14	14	00	00	6	1

Table 1: Continued

		Hematological values					
		Hb (g%)		RBC ($\times10^6$ mm^3)		WBC ($\times10^6$ mm^3)	
Season	Host	I	U	I	U	I	U
Spring	Schizothorax	9.11± 011	10.04± 0.15	1.86± 0.04	2.30± 0.02	2.29± 0.19	1.97± 0.18
	Cyprinus	8.52± 0.19	9.02± 0.13	1.86± 0.04	2.06± 0.07	1.96± 0.16	1.73± 0.15
Summer	Schizothorax	7.62± 0.13	8.8± 0.11	1.69± 0.04	2.06± 0.05	2.76± 0.27	2.09± 0.26
	Cyprinus	7.39± 0.14	7.67± 0.20	1.66± 0.05	1.86± 0.06	3.93± 0.33	3.49± 0.41
Autumn	Schizothorax	8.12± 0.10	8.61± 0.12	1.83± 0.04	2.07± 0.02	2.33±0.16	1.98± 0.17
	Cyprinus	7.66± 0.11	8.33± 0.16	1.72± 0.04	1.86± 0.02	3.54± 0.34	3.18± 0.33
Winter	Schizothorax	9.38± 0.11	10.57± 0.23	1.88± 0.04	2.32± 0.02	1.78± 0.14	1.56± 0.10
	Cyprinus	7.95± 0.08	9.39± 0.18	1.81± 0.04	2.07± 0.03	1.81± 0.15	1.58± 0.16

Table 1: Continued

		Thrombocytes		N		E		B		L		M	
Season	Host	I	U	I	U	I	U	I	U	I	U	I	U
Spring	Schizothorax	48	61	4	2	14	1	00	1	32	35	2	1
	Cyprinus	49	54	4	3	13	1	1	1	33	41	1	1
Summer	Schizothorax	45	55	7	4	20	1	00	1	28	38	0	2
	Cyprinus	48	53	6	2	21	1	1	00	25	41	0	3
Autumn	Schizothorax	44	58	5	2	18	1	1	00	32	37	1	2
	Cyprinus	48	59	7	2	17	1	2	00	27	35	1	3
Winter	Schizothorax	49	55	3	3	16	1	1	2	31	39	1	2
	Cyprinus	51	54	4	3	15	1	00	1	29	40	1	2

Values as mean value ± SEM, (n = 20)

During the course of investigation, the mean seasonal value of haemoglobin fluctuated from a minimum of 8.61±0.12 g% (autumn) to a maximum of 10.57±0.23 g% (winter) in uninfected *Schizothorax* spp. while as in case of infected *Schizothorax* spp. the value fluctuated from a minimum of 7.62±0.13 g% (summer) to a maximum of 9.38±0.11 g% (winter).

Similarly, the mean seasonal value of haemoglobin fluctuated from a minimum of 7.67±0.20 g% (summer) to a maximum of 9.39±0.18 g% (winter) in uninfected *Cyprinus* spp. while as in case of infected *Cyprinus* spp. the value fluctuated from a minimum of 7.39±0.14 g% (summer) to a maximum of 8.52±0.19 g% (spring).

Thus, the haemoglobin showed a negative correlation with the prevalence of infection and decreased as the intensity of infection increased. The decrease in haemoglobin content under infected conditions has been also observed by Ivasik and Virepo (1969) in carp infected by *Sanguinicolosis* in which haemoglobin content got reduced by 20% in mild infection and by 61% in serious cases; Evans (1974) in cut throat trout due to *Sanguinicola kiamathensis*; Sinha (2000) in *Clarias batrachus* due to helminthes and Yoshinaga *et al.* (2001) in Japanese flounder infected with *Neo heteriobothrium hirame*.

The reduction in the number of RBCs was found related to the intensity of infection. During the course of investigation, the mean seasonal value of RBC count fluctuated from a minimum of 2.06±0.05×10^6 mm^3 (summer) to a maximum of 2.32±0.02×10^6 mm^3 (winter) in uninfected *Schizothorax* spp. while as in case of infected *Shizothorax* spp. the value fluctuated from a minimum of 1.69±0.04×10^6 mm^3 (summer) to a maximum of 1.88±0.04×10^6 mm^3 (winter).

The mean seasonal value of RBC count fluctuated from a minimum of 1.86±0.02×10^6 mm^3 (autumn) to maximum of 2.07±0.03×10^6 mm^3 (winter) in uninfected *Cprinus* spp. while as in case of infected *Cprinus* spp. the value fluctuated from a minimum of 1.66±0.05×10^6 mm^3 (summer) to a maximum of 1.86±0.04×10^6 mm^3 (spring). The RBC count thus showed a negative correlation with the prevalence of infection and decreased with increase in the intensity of infection.

The decrease in RBC count was also observed in *Rita rita* infected with trematode (Agarwal, 1989); in Rainbow trout infected with *Proteocephalus neglectus* (Engelherdt *et al.*, 1989); in *Clarias batrachus* carrying helminth infection (Sinha, 2000) and in Japanese flounder infected with *Neo heterobothrium hirame* (Mushiake *et al.*, 2001).

The WBC count increased in all fish specimens according to the intensity of infection. The mean seasonal value of WBC fluctuated from a minimum of 1.56±0.10×10^4 mm^3 (winter) to a maximum 2.33±0.16×10^4 mm^3 (autumn) in uninfected *Schizothorax* spp. while as in case of infected *Schizothorax* spp. the WBC value fluctuated from a minimum of 1.78±0.14×10^4 mm^3 (winter) to maximum of 2.76±0.27×10^4 mm^3 (summer).

The mean seasonal value of WBC count fluctuated from a minimum of 1.58±0.16×10^4 mm^3 (winter) to a maximum of 3.49±0.41×10^4 mm^3 (summer) in uninfected *Cyprinus* spp. while as in case of infected *Cyprinus* spp. the value fluctuated from a minimum of 1.81±0.15×10^4 mm^3 (winter) to a maximum of 3.93±0.33×10^4 mm^3 (summer). Thus, the WBC count showed a positive correlation with the prevalence of infection.

Further, the Differential Leucocyte Count (DLC) value showed fluctuations. Mean thrombocyte % value fluctuated from a minimum of 55% (summer) to a maximum of 61% (spring) in uninfected *Schizothorax* spp. while as in infected *Schizothorax* spp. the value fluctuated from 44% (autumn) to 49% (winter). The mean thrombocyte % value fluctuated from a minimum of 53% (summer) to a maximum of 59% (autumn) in uninfected *Cyprinus* spp. while as in infected *Cyprinus* spp. the value fluctuated from 48% (summer/autumn) to 51% (winter). Mean eosinophil % value fluctuated from 1% uninfected to 20% in infected *Schizothorax* spp. and from 1% uninfected to 21% in infected *Cyprinus* spp. throughout the study period. Mean Lymphocyte % value fluctuated from 35% (spring) to 39% (winter) in uninfected *Schizothorax* spp. while as incase of infected *Schizothorax* spp. the value fluctuated from 28% (summer) to 32% (spring/autumn). Lymphocyte % value fluctuated from 35% (autumn) to 41% (spring/summer) in uninfected *Cyprinus* spp. while as in case of infected *Cyprinus* spp. the value fluctuated from 25% (summer) to 33% (spring). Neutrophils showed a minor increase in number in infected hosts while as basophils and monocytes were found to be least altered both in case of infected and uninfected conditions.

The increase in TLC and DLC numbers under infectious conditions are in total agreement with Denisov (1979) who observed an increase of TLC by 44% in silver carp infected with *Posthodisplostomum cuticola*.

Saxena and Chauhan (1993) found TLC increase by 2.77% in *Heteropneutus fossils* infected with *Lucknowia indica*. A higher degree of *eosinophilia* was observed in *Clarias batrachus* carrying helminth infections (Sinha, 2000).

The present study revealed that haemotological indices are more prominently altered by helminth parasite infestations showing highest alterations during hotter months than colder seasons, which may be attributed to higher level of water pollution during hotter months (Zutshi, 1980; Yousuf and Shah, 1988; Sarwar, 1999; Shamim and Pandit, 2002) and the life cycle pattern of different helminth parasites. The results also revealed that helminth infection produces *macrocytic anaemia* with decreased RBC number and increase in TLC and DLC content in fish.

Conclusion: The entire study reveals that the intensity of helminth infections is responsible for altering the haematology of fish hosts and shows the seasonal relationship of infection with the haematological alterations. It is further speculated that mechanical damage caused by *Acanthocephala* to the host intestine could cause vitamin B-12 and folic acid deficiency which are otherwise responsible for RBC maturation. The mechanical injury may also lead to side tracking of iron to affected tissues which is otherwise responsible for erythropoiesis. Increased number of TLC and DLC values may be associated with the defense mechanism and immunological responses against infectious diseases caused by helminth parasites.

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