

Changes of haematological indices of grass carp, *Ceteopharyngodon idella* exposed to monogenean parasites, *Gyrodactylus* spp. and *Dactylogyrus* spp.

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Abstract The present was carried out to investigate the effects of monogenean infection on haematological indices of grass carp, *Ceteopharyngodon idella*. In this regard, some haematological indices were measured in two adult groups of grass carp including healthy and infected fish. According to our results, the values of red blood cells (RBCs), haemoglobin (Hb) decreased significantly in infected fishes ($P < 0.05$). In contrast, the white blood cells (WBCs) values increased significantly in infected fishes ($P < 0.05$). In contrast, the WBC values increased significantly in infected fishes. In conclusion, our results showed that monogenean infection by *Gyrodactylus* spp. and *Dactylogyrus* spp. can affects health condition of grass carp through alternation of haematology.

Keywords Haematological indices ·
Monogenean infection · Grass carp

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Introduction

Diseases are the most important limiting factors in aquaculture because of increased density of fish in restricted water where the fish pathogens can easily transmit from one fish to another. Much of economic loss is however, preventable with appropriate fish health management (Kabata 1985). Monogenean is a group of parasites which are commonly found on the gills, skin or fins of fishes and lower aquatic invertebrates. About 100 families of monogenean found on fishes of both fresh and salt waters and at a variety of temperatures. Most these parasites are browsers, moving about the body surface and feeding on dermal mucus and gill debris. Monogenean has a series of hooks that enable them to attach while feeding. Most species are host-specific, requiring only one host to complete an entire life cycle. In fact, some adult monogenean will remain permanently attached to a single site on the host. *Dactylogyrus* spp. and *Gyrodactylus* spp. are the most common monogenean parasites of the fishes. *Dactylogyrus* spp. is usually attached to the gills of freshwater fishes. It reproduces by laying eggs, which are often resistant to chemical treatment. Therefore, weekly treatment over a period of 34 weeks is recommended. According to Serpunin and Likhatchyova (1998), the blood parameters of a fish species are true indicators of the state of health of the organism. Moreover, haematological tests and analysis of serum components show useful information in detection and diagnosis of metabolic disturbances and diseases in fishes (Aldrin et al. 1982). The grass carp is one of the main produced species of aquaculture in many countries including Iran. The aim of this study was to investigate the effects of monogenean infection on haematological indices of this species. Such study can help to understand the mode of the action of these parasites in the haematological level.

Materials and methods

Ten Adult healthy and 10 monogenean infected grass carp were collected from a carp culture farm, located in Guilan provinve, Iran, and kept separately in plastic tanks. Blood samples for haematological analyses were taken from the caudal vein and collected in a heparinized tube and then stored in a polyethylene cool bags until analyzed. The microhaematocrit capillary tubes were used for measurement of haematocrit (Htc) values according to Rehulka (2003). The haemoglobin (Hb) values were determined by cyanmethemoglobin according to Blaxhall and Daisley (1973). In this regard, amount of 20 μ l uncoagulated blood was mixed with 50 μ l Drabkin's solution and then placed in dark environment for 5–10 min. Then, the Hb concentration was measured by spectrophotometry in wave-length of 540 nm. Red blood cell count (RBCs) and white blood cells (WBCs) were determined with chamber method using Neubauers haemocytometer (Drabkin 1945). The SPSS software was used for data analysis. The normal distribution of data was investigated by Kolmogorov–Smirnov test. Then, Independent Samples *t* test was employed to compare the means between healthy and infected fish.

Results

The values of RBCs (Fig. 1), Hb (Fig. 2) and Htc (Fig. 3) were significantly ($P < 0.05$) lower in monogenean infected fishes compared to healthy individuals. Also, the monogenean infected fishes had higher values of WBCs (Fig. 4) compared to healthy individuals ($P < 0.05$).

Discussion

It well recognized that the haematological factors could be used as biomarkers of health status in aquatic animals

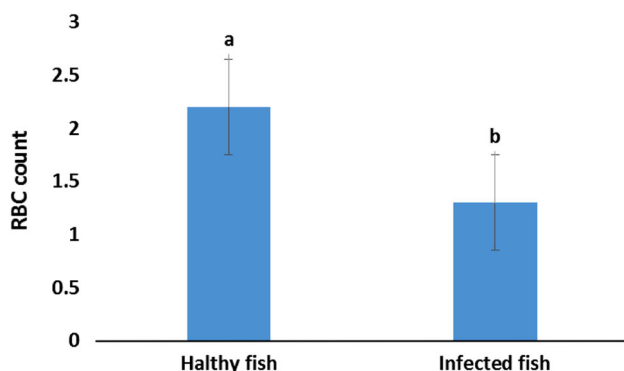


Fig. 1 Comparison of RBC count between healthy and infected grass carp. Different letters indicate significant differences ($P < 0.05$)

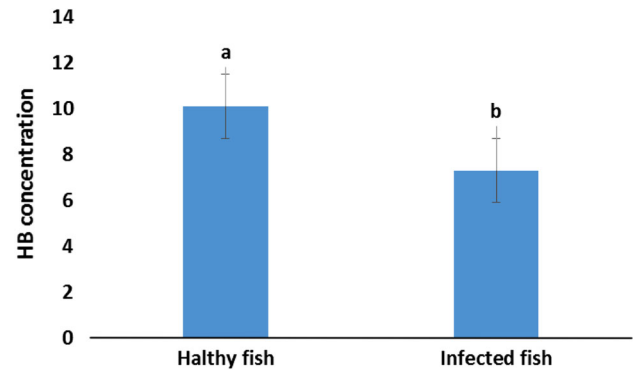


Fig. 2 Comparison of Hb concentration between healthy and infected grass carp. Different letters indicate significant differences ($P < 0.05$)

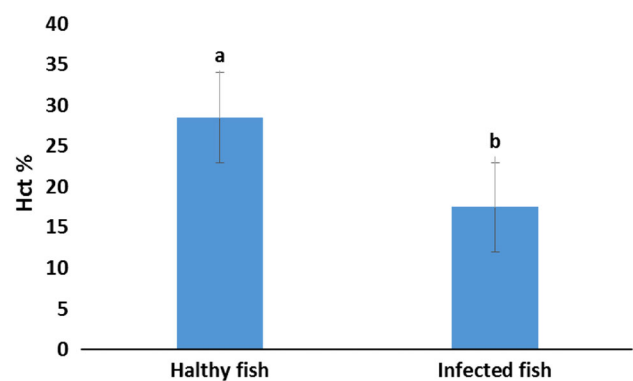


Fig. 3 Comparison of Hct % between healthy and infected grass carp. Different letters indicate significant differences ($P < 0.05$)

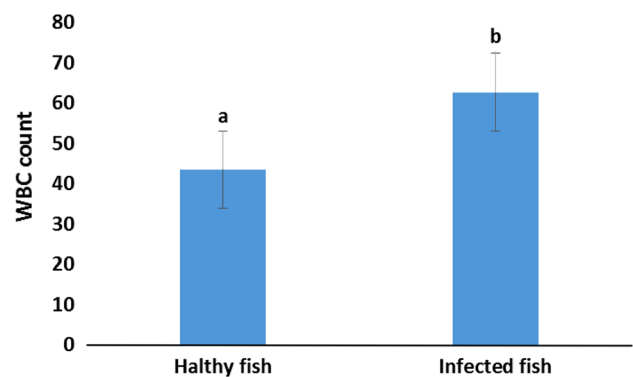


Fig. 4 Comparison of WBC count between healthy and infected grass carp. Different letters indicate significant differences ($P < 0.05$)

including fish. In intensive aquaculture systems, due to the high fish stocking rate, the risk of disease is increased subsequently. Monogenean is a group of parasites that have adverse effect of fish health in the cultural mediums. Until now, numerous studies were conducted regarding the histopathological effects of monogeneans on fish. But, there are rare information about their impacts on haematological indices. In the present study the blood parameters including

Hb, RBCs, and WBCs were investigated in two experimental groups including healthy fish and infected individuals. According to results, the lower values of Hb, Htc and RBCs were observed in infected fish compared to healthy individuals. The decreases in these factors have been reported previously in common carp, *Cyprinus carpio* infected by monogenean parasites (Genç et al. 2005; Shah et al. 2009). Also, The decrease of RBC concentration was observed in Rita rita, Rainbow trout, *Oncorhynchus mykiss*, *Clarias batrachus* and Japanese flounder infected with trematode (Agarwal 1989); *Proteocephalus neglectus* (Engelherdt et al. 1989); helminth (Sinha 2000) and *Neo heterobothrium hirame* (Mushiake et al. 2001) respectively. The reduction in Hb content has been found in common carp (Ivasik and Virepo 1969), cut throat trout (Evans 1974), *Clarias batrachus* (Sinha 2000) and Japanese flounder (Yoshinaga et al. 2001) infected by *Sanguinicola kiamathensis*, helminthes and *Neo heterobothrium hirame* respectively. In the present study, WBC counts were apparently higher in infected grass carps compared to healthy fish. Similar results have been reported for European eel, *Anguilla anguilla* (Sahan et al. 2007) and also *Schizothorax* spp. and *Cyprinus* spp. (Shah et al. 2009). It seems that the elevated levels of WBCs is a response of cellular immune system to monogenean infection. In conclusion, our results showed that monogenean infection by *Gyrodactylus* spp. and *Dactylogyrus* spp. affects health condition of grass carp through alternation of haematology.

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