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ORIGINAL ARTICLE

Alternations in the liver enzymatic activity of Common carp, *Cyprinus carpio* in response to parasites, *Dactylogyrus* spp. and *Gyrodactylus* spp.

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Abstract The present study was carried out to investigate the effects of parasites, monogenea, *Dactylogyrus* spp. and *Gyrodactylus* spp. on some enzymatic and biochemical components of liver in healthy and infected common carp, *Cyprinus carpio*. For this purpose, 10 healthy and 10 infected fish were collected from farm. The blood samples were taken and after separation of serum, the values of Aspartate aminotransferase (AST), Alanine aminotransferase (ALT) enzymes activities as well as Creatinine and Urea were measured. Based on obtained results, the values of AST, ALT enzymes activities as well as Creatinine and Urea were higher in the infected fish compared to non-infected fish. In conclusion; our results reveals that infection with external parasites, *Dactylogyrus* spp. and *Gyrodactylus* spp. can causes some dysfunctions in liver and kidney of common carp.

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Introduction

Parasites are the most pathogenic cues in carp aquaculture which affect adversely health and other biological aspects of fish such growth, osmoregulation, reproduction and etc. (Kennedy et al. 1987; Andersson 1994; Barber et al. 1995; Krause and Godin 1996; Ochoa and Jaffe 1999). Monogenea are a group of parasites which attack usually the gills, skin or fins of fishes and lower aquatic invertebrates by a series of hooks and fed on dermal mucus and gill debris. About 100 families of monogenean Parasites have been identified on fishes of both fresh and salt waters. Most of Monogenea 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 (Petrushevski and Shulman 1961; Smith 1972; Bakke et al. 1990; Cognetti-Varriale et al. 1992; Cunningham et al. 1995a, b; Cecchini et al. 1998). *Dactylogyrus* spp. and *Gyrodactylus* spp. are respectively the most common monogenean parasites of gill and skin in freshwater fishes (Cunningham et al. 1995a, b). It is well recognized that some blood parameters serve as reliable indicators of fish health (Bond 1979; Aldrin et al. 1982; Serpunin and Likhatchyova 1998). Therefore, the changes associated with hematological parameters due to various parasites provide a database, which could be used for health condition of fish in relation to parasitic pollutions (Adhikari and Betal 2004). In this respect, (Ranzani-paviva et al. 2000) demonstrated alterations in blood composition related to parasitism in fish from the Parana River, indicating that, determination of blood parameters of fishes is of great importance in evaluation of disturbance that caused by

parasitism. Also, (Restiannasab et al. 2014) some hematological indices of grass carp including haemoglobin, red and white blood cells alter in fish infected by *Dactylogyrus* spp. and *Gyrodactylus* spp. Therefore, this study was aimed to investigate the impact of Monogenea (*Dactylogyrus* spp. and *Gyrodactylus* spp.) on some physiological parameters related to liver of common carp.

Materials and methods

Twenty adult common carp (10 healthy and 10 monogenean infected) were collected from a carp culture farm, located in Guilan province, 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. Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) activities in serum were determined according to (Reitman and Frankel 1957). Creatinine value was determined according to Rock et al. (1987). Urea concentration was measured based on method suggested by Pathson and Nauch (1977). All these biochemical analyses were conducted calorimetrically using spectrophotometer and purchased kits. 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

According to results, there were significant differences in terms of ALT, AST, Urea and Creatinine between infected and non-infected carps ($P < 0.05$). In this regard, the values of ALT (Fig. 1), AST (Fig. 2), Urea (Fig. 3) and Creatinine (Fig. 4) were significantly ($P < 0.05$) higher in monogenean infected fishes compared to healthy individuals.

Discussion

Haematological parameters have been introduced as biomarkers of health status of fish in numerous pathological and ecotoxicological studies. Monogenean is a group of parasites that have adverse effect on fish health in the fish farms. Until now, few studies were conducted regarding the histopathological and haematological effects of Monogenea on fish. But, the examined haematological parameters such as haematocrit, haemoglobin, red and white blood cell counts had high variations in a certain species. In the present study some physiological parameters related to liver of common carp including Alanine aminotransferase, AST, Urea and Creatinine were investigated in two experimental groups i.e. healthy fish and infected individuals. According to obtained results, the blood serum AST, ALT enzymes activities, Creatinine and Urea values were

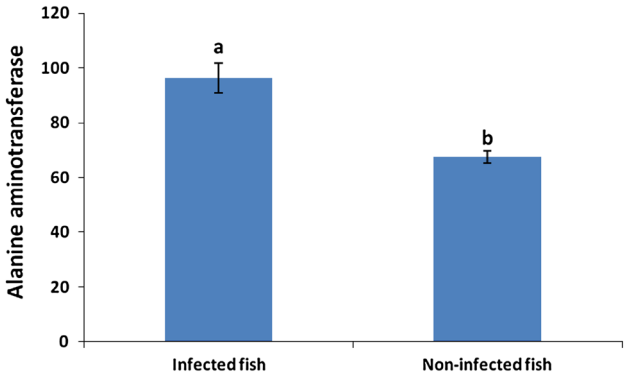

Fig. 1 Comparison of Alanine aminotransferase (U/L) between healthy and infected common carp. *Different letters* indicate significant differences ($P < 0.05$)

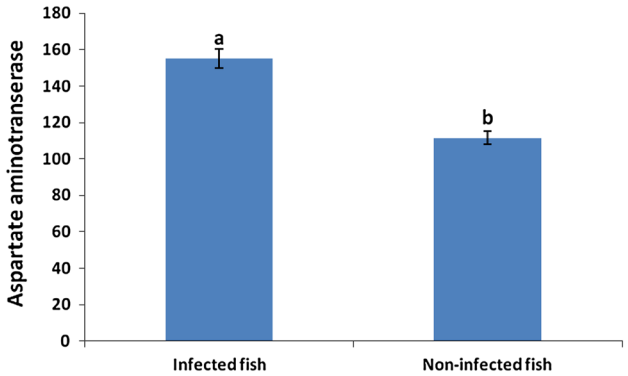

Fig. 2 Comparison of Aspartate aminotransferase (U/L) between healthy and infected common carp. *Different letters* indicate significant differences ($P < 0.05$)

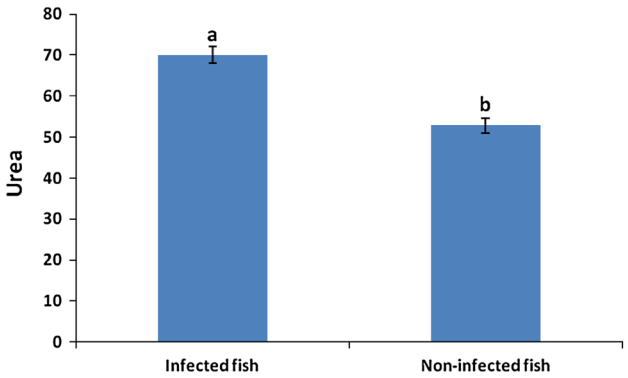

Fig. 3 Comparison of Urea (mg/dl) between healthy and infected common carp. *Different letters* indicate significant differences ($P < 0.05$)

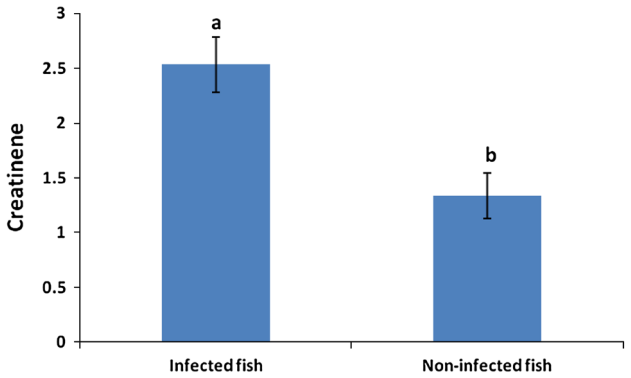

Fig. 4 Comparison of Creatinine (mg/dl) between healthy and infected common carp. *Different letters* indicate significant differences ($P < 0.05$)

elevated in the infected carps with external parasites compared to the non infected fishes. Such elevation shows that parasitic pollution with Monogenea stimulates the activities of AST and ALT enzymes as well as both Urea and Creatinine. In agreement with our results, other studies have been recorded the elevation of these enzymes in response to parasitic pollutions such as external protozoa and monogenetic trematodes in Nill tilapia, *Oreochromis niloticus* (Younis 1999). This may be due to hepatic cells injury or increased synthesis of the enzymes by the liver (Yang and Chen 2003). Aspartate aminotransferase catalyzes the reversible transfer of an α-amino group between aspartate and glutamate and, as such, is an important enzyme in amino acid metabolism. AST is found in the liver, heart, skeletal muscle, kidneys, brain, and red blood cells. Serum AST level, serum ALT level, and their ratio (AST/ALT ratio) are commonly measured clinically as biomarkers for liver health. Alanine aminotransferase is found in plasma and in various bodily tissues, but is most commonly associated with the liver. It catalyzes the transfer of an amino group from L-alanine to α-ketoglutarate, the products of this reversible transamination reaction being pyruvate and L-glutamate. Significantly elevated levels of ALT (SGPT) often suggest the existence of other medical problems such as viral hepatitis, diabetes, congestive heart failure, liver damage, bile duct problems, infectious mononucleosis, or myopathy. Serum Creatinine (a blood measurement) is an important indicator of renal health because it is an easily measured byproduct of muscle metabolism that is excreted unchanged by the kidneys. If the filtration in the kidney is deficient, Creatinine blood levels rise. Therefore, Creatinine levels in blood and urine may be used to calculate the Creatinine clearance, which correlates with the glomerular filtration rate. The elevation in the Urea level in the infected fish may be due to gill dysfunctions as the Urea excreted mainly through the gills (Murray et al. 1990).

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