JBS
Research Article

Journal of Biological Studies
eISSN: 2209-2560

V. 6, N. 2:258-263, 2023

Haematological alterations of mullet *Planiliza abu* (Heckel, 1843) naturally infected by *Ergasilus mosulensis* Rahemo, 1982 (Copepoda: Ergaslidae) in a private fish farm from Basrah Province, Iraq

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Received 20 May |Accepted 26 June| Published 30 June 2023

Abstract

Generally, there is no previous information about haematological parameters of parasitized fish maintained in fish farms in Al- Mashab area, Basrah, Iraq. In this study, the effects of parasitism by the copepod *Ergasilus mosulensis*. on haemoglobin (Hb), haematocrit (HCT), red blood cells (RBCS), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and leucocytes were analysed in infected *Planiliza abu*. The high level of parasitism found in infected fishes was responsible for alterations in blood picture Hb, HCT, RBCS, MCV, MCH, MCHC, and leucocytes ($P < 0.05$). This is the first report regarding hematology of cultivated freshwater fish which are infected with parasitic copepods in Basrah Province.

Keywords: Parasitic copepod, *Ergasilus mosulensis*, cultivated freshwater fish, *Planiliza abu*

1.Introduction

As a human population increase the demand for food will dramatically grows, so fish aquaculture as a main sector of aquaculture industry can play an important role in providing food and solving this problem. *Planiliza abu* fish is a species belonging to the family: Mugilidae, it is one of the most widespread fish in the large rivers such as Shatt al-Arab, Tigris rivers, Euphrates, and southern marshes, as well as small rivers and lakes in Iraq (Coad, 2010). Naylor *et al.* (2023) stated that fish aquaculture remains surprisingly under-represented in the mainstream literature on food policy. Kabata (1985) referred that crustacean parasites can cause various diseases in fishes and affect their normal physiology. Sopinska (1983) mentioned that blood picture of each organism is adjusted to its life requirements, and any changes occurring in it are signalized very early. Haematological examination is one of methods commonly used to evaluate fish physiological status and health (Docan *et al.*, 2018 and Fazio, 2019), also haematological parameters were proved to be highly sensitive to various

environmental factors including nutrition, water quality, stress or pathogens (Witeska *et al.*, 2022). So, the present study aimed to detect the influence of the copepod parasite *Ergasilus mosulensis* Rahemo (1982), which are infected the gills of *Planiliza abu* (Heckel, 1843), upon the blood parameters of this fish species.

2. Materials and methods

Eighty five specimens of *P. abu*, which locally called (Khishni), were collected at May of 2022 from a private fish farm in Al- Mashab area (N 47˚ 40′ 57" E 40˚ 38′ 30") Basrah, Iraq, by using seine net (mesh size 15 X 15 mm). Live fish were transferred to the laboratory of Diseases of Aquatic Animals at Marine Science Centre, University of Basrah for subsequent analysis. Fish total lengths were measured in centimetres to the nearest millimetres (18.4 - 20.8 cm), also fishes were weighted to the nearest gram (38.7 - 42.8 g). Fishes were identified according to Coad (2010). Fish gills were initially examined for the presence of any crustacean parasites by naked eye or under dissecting microscope. The detected copepod parasites were removed from the gill filaments, fixed, and preserved in 70% ethanol. The parasites were identified according to (Rahemo, 1982). Prevalence and mean intensity of infection were calculated according to Bush *et al.* (1997). Blood collection and haematological examination was done according to Kefas, *et al.* (2015). All data were analysed by using the statistical program SPSS version 10. Data are presented as mean ± SD.

3. Results

Parasitological Examination

A total number of 85 fish specimens of mullets *P. abu* were examined searching for crustacean parasites, 68 specimens of those examined fishes were found infected with the parasitic copepod namely *E. mosulinses* (prevalence = 80%; mean intensity of infection = 63.4) while the remaining number (17 fish) of examined fishes were found free of any kind of infection (healthy fishes) where it considered as a control group compering with the infected group.

Haematological Analyses

According to the data shown in (Table 1) it seems that there is a significant difference ($P > 0.05$) between the infected and uninfected fish groups in respect to haemoglobin concentration (Hb), red blood cells count (RBCs), and haematocrit (HCT) levels, where the healthy fishes (control group) have a high parameters value in contrast with the infected fish. The mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV), shows insignificant differences ($P < 0.05$) between the infected and uninfected fish, with a low value in healthy fish. Regarding to the differential leukocyte count shown in (Table 1) it seems that there is a significant difference ($P > 0.05$) between the two groups, also there is a clear variation among leukocyte parameters where the neutrophils and eosinophils counts shows insignificant differences ($P < 0.05$) between infected and uninfected fish and the healthy fishes have a higher value, while the lymphocytes and monocytes count of the infected fishes owing a high value with a significant difference ($P < 0.05$) between infected and uninfected fishes.

Blood parameters	Values of uninfected fish	Values of infected fish	Probability Values
Hb (gr/dL)	12.43±0.27	9.13±0.51	0.023*
RBCs (cells/mm3)	3.11±0.32	2.3±0.67	0.032*
HCT %	47.35±0.83	35.26±4.1	0.056*
MCV (µm3)	148.88±9.47	142±20.12	0.059
MCH g/dL	57.32±3.12	48.51±1.44	0.083
MCHC g/dL	33.21±0.63	28.63±2.32	0.085
TLC (µL)	58.31± 4.5	72.14±21	0.163*
Eosinophils %	1.22±0.21	1.28±0.51	0.292
Neutrophils %	54±3.63	54.66±4.2	0.937
Monocytes %	8.3±1.06	11.23±0.67	0.025*
Lymphocytes %	43.02±1.2	58.21±3.86	0.017*

Table 1. Haematological parameters between infected and uninfected fish

* Indicates to presence of significant difference between values of the two groups under ($P < 0.05$).

Hb: haemoglobin, RBCs: red blood cells, HCT: haematocrit, MCV: mean corpuscular volume, MCH: mean corpuscular haemoglobin, MCHC: mean corpuscular haemoglobin concentration, TLC: total leukocyte count.

4. Discussion

It is well known that parasitic infection act as a stressor upon fish body leading to haematological changes (Panjvini *et al.*, 2016), which noticed when the parasitic load increase and usually causing severe illness or death. Tavares-Dias *et al.*(1999a) stated that many parasites can infect the host body with no damages, as a commensalism behaviour, but this existence may be broken due to many changes occur in the environmental conditions, parasite behaviour, and host immune system.

Variations occurred in fish blood picture depend upon many factors such as fish species, aquatic biotope, health and nutritional status, age and sexual maturity and are also highly sensitive to environmental changes such as water quality, concentration of dissolved oxygen, water temperature and salinity of water, these abiotic factors are directly reflected in blood parameters (Hrubec *et al.*, 2001; Sheikh & Ahmed 2016; Fazio et al., 2016). Moreover, blood parameters of fish are affected by some basic management factors such as feeding regime and stocking density (Coz-Rakovac *et al.*, 2005). So, according to these above facts and prior to avoid the influence of fish sex, age (length group) and season in our reading of blood parameters in this study, the fish specimens was chosen as one gender, at a restricted month (May of 2022) and in a same age (length group).

The results of the present study (Table 1) revealed significant difference ($p<0.05$) with lower values of Hb, HCT and RBCs count in infected group than uninfected one, this may be due to feeding habits of *E. mosulinses* on fish blood or due to the high load of this parasite on the individual fish, these results agreed with that mentioned by (Martins *et al.*, 2004; Correa *et al.* ,2013; Panjvini *et al.*, 2016 and Nashaat and Maghawri, 2022). Also, the results of the

present study revealed insignificant differences values ($p<0.05$) in MCV, MCH, MCHC, with lower values in infected fishes than uninfected one. This may be confirmed the occurrence of phenomena called normochromic normocytic anaemia and this finding agreed with what mentioned by Kundu *et al.* (2016) who recorded decreasing in the same parameters after being infested by nematode parasite *Eustrongylides* sp. in the intestine of freshwater fish Channa punctatus and with the results of Nashaat and Maghawri (2022).

In the current study as shown in (Table 1), the value of total leukocytes count was high in infected fish compared with healthy one and this agreed with the same results obtained by (Lebelo *et al.*, 2001). Moreover, the differential leukocyte count showed a clear variations between parameters, where the monocytes and lymphocytes percentage have a high values in infected fishes when compared with the healthy individuals with a significant difference ($p<0.05$), this elevation in infected fish may be related to the response of cellular immune system to parasitic infection and this result agreed with that mentioned by Furtado *et al.* (2019) who noticed an increase values in monocyte and lymphocyte count in *Oreochromis niloticus*, infected with *Argulus* sp. and *Lamproglena* sp. . In contrast the values of eosinophils and neutrophils in the present study was very slightly higher in infected fishes than in healthy fishes with insignificant difference ($p<0.05$) and this agreed with the results of Tavares-Dias *et al.* (1999b), Panjvini *et al.* (2016) and Nashaat and Maghawri, 2022).

Acknowledgments

We would like to thank Prof. Dr. Furhan T. Mhaisen for providing scientific information and references that facilitated this research. Also, we would like to thank the reviewers for their valuable comments and suggestions to improve paper quality.

Conflict of interests

The authors have no conflict of interest to declare.

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