Impact of Ectoparasites on Haemato-Biochemical Indices of Snakeheaded Fishes

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Abstract: The present investigation was carried out to study the effect of parasitic infection on the haematological and biochemical parameters of fishes. For this study total 110 fish of Channa punctatus and Channa striatus were examined for parasites. The parasites recovered were protozoans (Trichodina sp., Ichthyoptherius sp., and Myxobolus sp.) and crustaceans (Ergasilus sp., Lernea sp., Lamproglena sp. and Argulus sp.) with a total prevalence of 64.54 % and mean intensity of 4.47. The result of the present investigation showed that RBC, PCV and Hb% decreased whereas WBC increased significantly in infected fish. The result also showed that aspartate aminotransaminase (AST) and alanine aminotransferase (ALT) enzyme activities as well as creatinine and urea levels were increased in the infected fishes. However, serum glucose level was decreased in parasitic infected fishes. Thus, the result of the present study revealed that infected fish suffer from anemia and tissue damages caused by parasitic invasion.

Keywords: Ectoparasites, Population dynamics, Haematological, Biochemical parameters, Channa punctatus, Channa striatus


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Introduction

Fishes are the aquatic vertebrates found both in marine as well as fresh water and beneficial for human health. Fish is an essential component of the daily diet of many people in our country. It is also an important nutritional resource (especially protein) of human beings (Prakash and Verma, 2020). Like humans and other animals, fish suffer from diseases and are infected with parasites. Parasitic diseases are the limiting factors in fish culture, because of increased density of fish in lentic water bodies and water pollution in lotic water bodies where the fish pathogens can easily transmit from one fish to another. These pathogens may cause nutrient devaluation, alteration of biology and behavior, lowering of immune capability, induction of blindness,
morbidity, growth and fecundity reduction and mechanical injuries depending on the parasitic species and load (Omeji et al., 2018). Pollutants may also affect the immune system of fish either directly or by changing water quality; that in turn may reduce the fish immunity to parasites and cause fish mortality and resulting in economic loss. Thus to prevent the economic loss and to prevent fish production, fish parasitological research and proper fish health management is necessary.

Haematological and biochemical parameters are an important tool to diagnose and monitor the response of organisms to stressors and thus it reveals the health status under such adverse conditions. These haemato-biochemical variables relate to metabolic levels (energetic), respiration (haemoglobin), and defense mechanisms, acting as physiological indicators to changing external conditions (Chandra, 2019). They also offer a comprehensive assessment of an organism’s health status, which over time manifests in weight changes; consequently, the variations in haemato-biochemical indices brought on by different parasites create a database that may be used to diagnose diseases and direct the application of treatment or preventive measures. The present study therefore, aimed to investigate the variations in the haematological parameters and biochemical composition of selected infected and non-infected snakeheaded fish, Channa punctatus and Channa striatus, which would form a baseline data for assessment of fish health.

Materials and Methods
Total 110 live fishes comprising 55 each of Channa punctatus and Channa striatus of different sizes and sexes were collected randomly from the polluted lotic water bodies of Balrampur, India. Fishes were transferred to the laboratory by using small containers containing water from Sawan nallaha with aeration. In order to check for ectoparasites, the skin, fins, and gills of the fishes were brushed into a petri dish containing 0.7% saline solution. Each fish’s skin, fins, and gills were scraped, and then smeared on glass slides for examination of ectoparasites.

The collected parasites were identified under a compound light microscope with the help of standard literature (Lucky, 1977; Kabata, 1985; Mukherjee et al., 2019). Prevalence of parasitic infection was calculated by using the following the formula (Margolis et al., 1982):

\[
\text{Prevalence} \% = \frac{\text{Total no. of infected fishes}}{\text{Total no. of fish examined}} \times 100
\]

\[
\text{Intensity of Infection} = \frac{\text{Total no. of parasites collected}}{\text{Total no. of infected fish examined}}
\]

Haemato-biochemical assay of fish sample:
Blood was collected from 110 live fishes from the caudal peduncle and heart using 2 ml plastic syringe and needle treated with anticoagulant as described by Lucky (1977). Blood samples for haematological studies were preserved in EDTA (ethylene diamine tetra acetate, an anticoagulant) embedded bottles and that for enzymes, Aspartate aminotransaminase (AST), Alanine aminotransferase (ALT) and Creatinine and Urea analysis in heparinized bottles. The blood parameters like total RBC, WBC, Hb% and PCV were analyzed according to the methods of Dacie and Lewis (1977). The heparinized blood samples were centrifuged at 3000 rpm for 10 min and the serum collected for biochemical analysis. AST and ALT were analyzed according to the method of Oser (1979); glucose was analyzed according to the method of Mendel et al. (1954); urea and creatinine according to the method of Bessey et al. (1946). The data obtained were subjected to statistical analysis using SPSS software.

Results and Discussion
Total 110 live snakeheaded fishes (55 Channa punctatus and 55 Channa striatus) were collected randomly from freshwater polluted lotic water bodies of Balrampur district. Out of 110 examined
Table 1: Population Dynamics of fish ectoparasites of fresh water snakeheaded fishes

<table>
<thead>
<tr>
<th>Name of Fish</th>
<th>No. of Fishes Examined</th>
<th>No. of Parasites Collected</th>
<th>Prevalence (%)</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channa punctatus</td>
<td>55</td>
<td>38</td>
<td>176</td>
<td>69.09</td>
</tr>
<tr>
<td>Channa striatus</td>
<td>55</td>
<td>33</td>
<td>142</td>
<td>60.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>110</strong></td>
<td><strong>71</strong></td>
<td><strong>318</strong></td>
<td><strong>64.54</strong></td>
</tr>
</tbody>
</table>

Table 2: Distribution Pattern of ectoparasites in fishes, *Channa punctatus* and *Channa striatus* collected from polluted freshwater lotic waterbodies of Balrampur

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Group</th>
<th>Name of Parasites</th>
<th>Site of Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protozoa</td>
<td>Ciliate</td>
<td><em>Trichodina</em></td>
<td>Gills and Skin</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Ichthyoptherius</em></td>
<td>Gills and Skin</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Myxozoan</td>
<td><em>Myxobolus</em></td>
<td>Gills</td>
</tr>
<tr>
<td>(Crustacean)</td>
<td>Copepod</td>
<td><em>Ergasilus</em> (Gill Lice)</td>
<td>Gill</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Lernea</em> (Anchor worm)</td>
<td>Skin</td>
</tr>
<tr>
<td></td>
<td>Branchiura</td>
<td><em>Argulus</em> (Fish Lice)</td>
<td>Skin, Fin base</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Lamproglena</em></td>
<td>Gill</td>
</tr>
</tbody>
</table>

71 fishes were found infected with a total 318 parasites (Table 1).

Total 110 freshwater snakeheaded fishes (*Channa punctatus* and *Channa striatus*) were examined for identifying their ectoparasites. Out of 110 examined fishes, only 71 fishes were found infected with ectoparasites (Table 1). Ectoparasitic protozoans were commonly found on the gills and skin whereas ectoparasitic crustaceans were found on gill, skin and fin base of host fishes. The infected fishes showed the following clinical sign: swim rapidly and rub their bodies against the substratum; the fish come on the surface gasping for oxygen and become lethargic and eventually stop feeding. The rate of prevalence and intensity of infection was high in *Channa punctatus* in comparison to *Channa striatus* (Table 1). Among the collected ectoparasites three were identified as protozoan ectoparasites (*Trichodon, Ichthyoptherius* and *Myxobolus*) and remaining four were crustaceans ectoparasites (*Ergasilus, Lernea, Lamproglena* and *Argulu*) (Table 2). The result of the present investigation correlated with the finding of other researchers (Kabata, 1985; Mukherjee et al., 2019; Prakash and Verma, 2020; Prakash et al., 2021).

The prevalence, intensity and density of parasites depends on many factors such as the nature of parasites and its life cycle, host, feeding habits and the physico-chemical factors of the water body where the fish inhabited (Prakash and Verma, 2017). Ectoparasitic prevalence increased when water temperature and hardness decreased. Due to the presence of these parasites, the physiological activities of the host fishes are hindered and their developmental growth is retarded which cause economic loss to the fishery industry and piscine culture (Prakash and Singh, 2020).

The results of the present investigation regarding haemo-biochemical parameters of *Channa punctatus* and *Channa striatus* are shown in Table 3.

The haematological parameters like RBC, PCV and Hb were significantly decreased in the infected fish samples of both species than the uninfected fishes. However, the WBC values were higher in the infected fishes than in the uninfected ones. Statistical analysis revealed significant differences (P<0.5) between the haematological indices of the infected and uninfected snake-
Table 3: Haemo-biochemical parameters of infected and uninfected fish, *Channa punctatus* and *Channa striatus* collected from polluted lotic waterbodies of Balrampur

<table>
<thead>
<tr>
<th>Parameters</th>
<th><em>Channa punctatus</em></th>
<th><em>Channa striatus</em></th>
<th>P-value</th>
<th><em>Channa punctatus</em></th>
<th><em>Channa striatus</em></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uninfected</td>
<td>Infected</td>
<td></td>
<td>Uninfected</td>
<td>Infected</td>
<td></td>
</tr>
<tr>
<td>RBC (Cells/mm³)</td>
<td>7.25±0.21</td>
<td>4.72±0.02</td>
<td>0.001</td>
<td>7.09±0.01</td>
<td>4.52±0.03</td>
<td>0.001</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>37.75±0.42</td>
<td>25.02±0.03</td>
<td>0.001</td>
<td>36.8±0.03</td>
<td>24.12±0.01</td>
<td>0.001</td>
</tr>
<tr>
<td>Hb (%)</td>
<td>10.78±0.41</td>
<td>7.24±0.02</td>
<td>0.001</td>
<td>10.51±0.31</td>
<td>7.09±0.01</td>
<td>0.001</td>
</tr>
<tr>
<td>WBC (Cells/mm³)</td>
<td>65.14±0.15</td>
<td>88.75±0.22</td>
<td>0.001</td>
<td>62.46±0.32</td>
<td>85.21±0.15</td>
<td>0.002</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>71.13±0.03</td>
<td>93.25±0.06</td>
<td>0.001</td>
<td>71.16±0.02</td>
<td>91.65±0.05</td>
<td>0.001</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>91.25±0.23</td>
<td>124.55±0.12</td>
<td>0.001</td>
<td>92.25±0.31</td>
<td>122.76±0.12</td>
<td>0.001</td>
</tr>
<tr>
<td>Urea (U/L)</td>
<td>23.97±0.33</td>
<td>35.42±0.32</td>
<td>0.000</td>
<td>22.52±0.12</td>
<td>34.11±0.14</td>
<td>0.001</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>0.33±0.2</td>
<td>0.66±0.21</td>
<td>0.001</td>
<td>0.30±0.1</td>
<td>0.62±0.21</td>
<td>0.001</td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>110.40±0.3</td>
<td>60.22±1.4</td>
<td>0.002</td>
<td>102.77±1.21</td>
<td>572.12±1.3</td>
<td>0.002</td>
</tr>
</tbody>
</table>

headed fishes (Table 3). Similar results were also reported by other investigators (Shahi *et al.*, 2013; Ugbor *et al.*, 2015; Omeji *et al.*, 2018; Chandra, 2019). However, it was found in other research that parasites can trigger the early phases of stress and have an impact on PCV. When a parasite infects a host, catecholamine is released, which may cause red blood cells to be mobilized from the spleen or cause swelling in the RBCs as a result of fluid shifting into the intracellular compartment (Omeji *et al.*, 2018). The significant reduction in RBC, PCV and Hb% suggest that infected fishes were suffering from anemia. WBC plays an important role during parasitic infection by stimulating the haemopoietic tissues and the immune system by producing antibodies and chemical substances working as defense against infections (Lebelo *et al.*, 2001). In the present study significant increase in WBC in infected fishes was due to response of cellular immune system to parasitic infection.

Alanine aminotransferase is remarkably specific for liver function since aspartate aminotransferase is mostly present in the kidney. In the present study, enzymatic activities of AST and ALT were found to be significantly (P<0.05) higher in the infected fishes than in the uninfected ones (Table 3). Younis (1999) showed the significant increase in AST, ALT and urea in the fish infected with external protozoa and monogenetic trematodes where as Mahmoud *et al.* (2011) reported that serum AST, ALT, urea and creatinine levels were increased in *Trichodina* infected fish. The increased levels of serum AST, ALT, urea, and creatinine in the parasite-infected fish in the present study showed that the parasites had an impact on parenchymous tissues and skeletal muscle, which may have changed the permeability and integrity of cell organelles (Ugbor *et al.*, 2015). Increased activity of AST and ALT in the infected fishes is the indication of liver cytolysis, indicating the alteration in the structure of cell organelles like endoplasmic reticulum (ER) and membrane transport system. Changes in the activity of these enzymes may negatively impact the tissues' metabolism of amino acids and, as a result, the intermediates required for gluconeogenesis.

The levels of glucose, creatinine and urea showed significant differences (P<0.05) in both infected and uninfected fish species (Table 3). Mahmoud *et al.* (2011) also observed the increased level of blood urea and creatinine in the fishes infected with protozoan parasites. This increased level of creatinine in infected fish may be a result of the alteration of the muscles structure of parasitic infected fishes where as the increased value of blood urea may be due to gill dysfunction (caused by protozoa mainly found in the gills) as urea are mainly excreted through the gill (Ugbor *et al.*, 2015). In the present study the serum glucose level was significantly decreased in the infected fish which revealed that parasites take glucose from the host and also during stress.
conditions fishes consume more energy to counteract the adverse effect of parasites and chemical substances released by parasites.

**Conclusion**

From this study, it can be inferred that protozoans and crustaceans are the common ectoparasites in *Channa* species of this specific area. As it is related to alteration in haematological indices, serum enzymatic activity, creatinine and urea level in blood, so liver, kidney and gills dysfunction can be caused by any abnormalities in the structure of these organs. Thus it can be concluded that the prevalence and intensity of ectoparasite in combination, altered the haematological and biochemical parameters of infected fishes. The protozoans and crustaceans infection can also affect the nutritional quality of fish thereby decreasing the food value and marketability of fish.

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**References**


