ESTIMATION OF TOTAL CARBOHYDRATE, LIPID AND PROTEIN CONTENT IN THE HEMIUROID DIGENEAN, STOMACHICOLA MURAENESOCIS INFECTING THE STOMACH OF THE MARINE EEL, CONGRESOX TALABONOIDES (BLEEKER) FROM BAY OF BENGAL

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ABSTRACT
The common eel, Congresoxtalabonoides one of the few species of marine eels commercially exploited because of its export value. An in-depth parasitological examination of this eel, collected off the coast of Visakhapatnam, Bay of Bengal was undertaken over a two year period during January, 2005 and December, 2006 and subsequently in 2018. Infection with the hemiuroid digenean, Stomachicolamurénescosis very common in the stomach of the eel and it was associated with marked stomach pathology. Altogether 739 fish were examined out of which 639 were infected with S. muraenesocis. In this study, the total Carbohydrate, Lipid and Protein content of the parasite, S. muraenesocis were estimated. Changes in the levels of these biochemical parameters in the infected and uninfected stomach tissue of the eel were studied. The findings from this study indicated higher protein and lipid levels in the infected stomach tissue compared to the uninfected tissue.

Key Words: Stomachicolamurénescosis, Congresoxtalabonoides, Carbohydrates, Lipids and Proteins

INTRODUCTION
Trematodes and other parasitic helminths share many interesting properties in their biochemistry. They all have remarkable functioning because of their mode of life within the host. At some stage in their life cycle, all trematodes exhibit an anaerobic energy metabolism which is often forced on them by the lack of oxygen in a particular habitat. On the other hand, between two successive parasitic stages, they have free living stages in the life cycle. Transition between aerobic and anaerobic and vice versa also occur. The metabolism of various stages of trematodes is adapted to the environment of that moment. Among other chemical and physical parameters, the availability of food and oxygen varied widely and exert considerable influence on the biochemical pathways in the parasite.

Trematodes take up carbohydrates, lipids and amino acids mostly through their tegument. In contrast to their hosts, adult parasitic helminths are dependent on carbohydrates for their metabolism. Since adult parasites have limited aerobic oxidative property, their metabolism has to be mainly fermentative. The main polysaccharide in trematodes is glycogen which closely resembles mammalian glycogen. Several studies have demonstrated that many endoparasites have pronounced carbohydrate metabolism. Glucose is said to be an important energy source for helminths inhabiting the alimentary canal of vertebrates. It is reported that helminths absorb glucose against a concentration gradient and use their endogenous carbohydrates.
Several workers in the past have analysed the biochemical parameters of the digeneans and other helminths. The effect of infection on carbohydrate, lipid and protein metabolism in host tissues attracted the attention of researchers. Notable contributions from India include those of Maqbool and Nizami (1984) and Laxma Reddy (2006). The present study has therefore been undertaken with a view to investigating the carbohydrate, lipid and protein content of the hemiurid digenean, *Stomachicolamuraenesocis* inhabiting the stomach of the marine eel, *Congresoxtalabonoides*. Differences in the levels of these biochemical parameters in the infected and uninfected stomach tissue of the eel were also studied.

**MATERIAL AND METHODS**

The total carbohydrate, lipid and protein content in the digenean, *Stomachicolamuraenesocis* and in the stomach tissue of the marine eel, *Congresoxtalabonoides* was estimated. Live fish caught off the coast of Visakhapatnam and Kalingapatnam, Bay of Bengal, during the period between January, 2005 and December, 2006 and subsequently in 2018, were transported to the laboratory and used for the biochemical study. Out of 10 fish examined, 8 were found to harbour infection with *S. muraenesocis*, with an overall prevalence of 80%. The alimentary canal of the fish was carefully dissected and the stomach portion was separated. The stomachs were examined for helminth infections. Pieces of the stomach from both infected and uninfected fishes were used for the study. Stomach tissue from the uninfected fish was used as control. Specimens of *Stomachicolamuraenesocis* were collected from the stomach of the infected fish. The wet weight of the worm tissue was recorded. The tissue was made into powder with the aid of a mortar and pestle after drying it in an oven for 24 hours. For estimation of proteins, Lowry's method was followed. For estimation of carbohydrates, the method of Caroll et al., (1956) was employed and the values were expressed as µg/mg dry weight of tissue. Lipid content was estimated following sulphophosvanillin method of Barnes and Blackstock (1973). The optical density was measured at 520 nm in a Spectrophotometer (CECIL, Model 2000). The values were calculated against cholesterol standard and presented as µg/mg dry weight of tissue.

**RESULTS**

The data about the total proteins, carbohydrates and lipids in the trematode parasite, *S. muraenesocis* was furnished in Table.1. It is evident that the carbohydrate content (342.23±9.78 µg/mg) in the whole worm extract was relatively higher when compared to the proteins and lipids. The total protein content in the worm tissue is 180.48±11.26 µg/gm, and lipids 108.98±2.65 µg/mg (Fig.1).

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Proteins (µg/gm)</th>
<th>Carbohydrates (µg/gm)</th>
<th>Lipids (µg/gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Stomachicolamuraenesocis</em></td>
<td>180.48±11.26</td>
<td>342.23±9.78</td>
<td>108.98±2.65</td>
</tr>
</tbody>
</table>

The results pertaining to total carbohydrates, lipids and proteins recorded from stomach tissue of both uninfected and infected fish, *Congresoxtalabonoides* are shown in Table. 2
Estimation of Total Carbohydrate, Lipid and Protein Content in the Hemiurid Digenean, Stomachicolamuraenesocis Infecting the Stomach of the Marine Eel, Congresoxtalabonoides (Bleeker) from Bay of Bengal

Table 2: Total Proteins, Carbohydrates and Lipids in the Uninfected and Infected Stomach Tissue of C.talabonoides

<table>
<thead>
<tr>
<th>Host (Congresoxtalabonoides)</th>
<th>Uninfected Tissue (mg/100mg)</th>
<th>Infected Tissue (mg/100mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proteins</td>
<td>23.14 ± 2.1</td>
<td>29.26 ± 2.5</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>36.28 ± 2.6</td>
<td>31.66 ± 2.8</td>
</tr>
<tr>
<td>Lipids</td>
<td>19.14 ± 1.5</td>
<td>21.14 ± 1.8</td>
</tr>
</tbody>
</table>

The protein content in the stomach tissue of the uninfected fish was 43.14 ± 0.37 mg/100 mg whereas in the infected tissue it was found to be 49.26 ± 0.16 mg/100 mg. It is evident that there is a considerable difference in the protein content between uninfected and infected tissues.

The total carbohydrate content in the stomach tissue of uninfected fish was 36.28 ± 0.26 mg/100 mg and in the infected tissue, it was 31.66 ± 0.18 mg/100 mg (Fig. 2).

The total lipids also showed a considerable difference in the uninfected and infected tissues. In the uninfected tissue, the lipid content recorded was 19.14 ± 0.05 mg/100mg, whereas in the infected tissue it was 21.14 ± 0.52 mg/100mg.

Figure 1: Carbohydrate, Lipid and Protein content in Stomachicolamuraenesocis C.talabonoides

Figure 2: Total Proteins in the stomach tissue of in Stomachicolamuraenesocis C.talabonoides
DISCUSSIONS

The pathological consequences of parasitic effects in fishes were well documented and parasites certainly influence the fish health causing mortality in some instances. The extent of damage and the pathogenesis caused depends on the number of invasive parasites and the site of infection in the fish. The changes caused in the host depend on the physiological state of the host or the mechanical damage or the release of toxins by the parasite. Often these changes interfere with the physiology, metabolism and the functioning of the organ or tissue concerned.

The studies of Kumar and Singh (1971), Cheng and Snyder (1972) and Watson et al., (1992) demonstrated an alteration in the biochemical components of the host as a consequence of helminth infection. Marked changes in the biochemical parameters such as proteins, carbohydrates and lipids were reported. The increase in protein content in the infected tissue was attributed to the increased supply of nutrients to the affected organs as reported by Maqbool and Nizami (1984). Banerjee et al., (2006) reported changes in the total protein, carbohydrate and lipid levels by histochemical studies in the intestine of fresh water fish, *Clariasbrachus* harbouring the trematode, *Genarchopsisgopp*. The increase in the levels of the biochemical parameters was attributed as a kind of protective response by the host against the parasite. Hasan et al., (2015) quantified the carbohydrate, protein and lipid content in the liver and muscles of Koshar fish, *Epinephelussumunna* in relation to trematode infection and reported that infection with the parasite affected the total concentration of carbohydrates in the fish tissue. These authors opined that the increase could be due to any one of the following: inflammation, formation of antibodies, leucocytic infiltration and tissue fibrosis by the deposition of excessive connective tissue. Furthermore, the host tries to defend itself by using all the mechanisms at its disposal.

In this study, a decrease in the carbohydrate content was recorded in the stomach tissue of the infected fish. Since the digenean, *S. muraenesocis* is predominantly anaerobic and the amount of energy released in anaerobic metabolism is
much less, to obtain the required energy, it is likely that the parasite draws more nutrients from the host tissue. As a consequence of the lesions formed due to infection, the host tissue is expected to deposit excessive connective tissue leading to the consumption of energy and a decrease in the carbohydrate content. The study demonstrated that stomach tissue of the parasitized eel showed clear manifestations of the disease with elevated levels of lipid and protein and a decrease in the content of carbohydrates. It may be inferred that the parasite affected tissue showed a considerable change in the biochemical composition of the host.

REFERENCES


