DISTURBANCES IN GLYCOGEN METABOLITE OF FEW FRESH WATER SNAILS INFECTED WITH LARVAL TREDMATODES

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The study revealed that the glycogen content in the hepatopancreas of infected snails viz. Melanoides tuberculatus, Lymnea luteola and Vivipera bengalensis decreased with highly significant difference as compared to uninfected forms. The observations in case of foot of infected snails as compared to uninfected ones showed considerable differences which were however not consistent.

Digenean trematodes and their mulluscans hosts are known to metabolize and store glycogen as major source of energy to meet the metabolic requirements. Although many important histochemical and biochemical studies1-12 have shown that infection of the mulluscans hosts by digenean larvae generally bring about mild to severe changes in the glycogen concentration of different tissues especially the hepatopancreas and foot, the precise mechanism by which the digenean larvae utilize the glycogen of their host is still to be fully explained. The aim of present study was to carry out investigations using biochemical methods on the disturbances in glycogen content of freshwater snails namely Melanoides tuberculatus, Lymnea luteola and Vivipera bengalensis infected in natural course with larval digenean trematodes.

MATERIALS AND METHODS

Fresh water snails were collected from river Gomti in Lucknow and were immediately brought to laboratory. The snails of each species namely, M. tuberculatus, L. luteola and V. bengalensis were sorted out and washed thoroughly with running tap water. Each snail was kept in a 100 ml beaker containing dechlorinated water for a period of 30 days. The snails releasing cercariae were considered infected and others uninfected snails. The snails either infected or uninfected were washed thoroughly with chilled double distilled water. Hepatopancreas and foot were carefully examined for the particular type of infection. The
foot of infected snails was found to be always free from larval trematodes. Hepatopancreas and foot from uninfected snails were also examined to ensure that they were free from infection. Each of the above tissues was thoroughly teased out and washed to remove the haemolymph. In the case of infected tissues, larval forms were also removed, besides the haemolymph. For each set of experiment the tissue from 8 snails of a group was pooled together, wiped dry on whatman filter paper No. 1, weighed and then homogenised in cold glass homogenizer using chilled double distilled water. The homogenate was diluted in the ratio of 10 mg/ml and was used for the determination of glycogen following the method of Montgomery\[13].

RESULTS AND DISCUSSION

The glycogen content in the hepatopancreas and foot of infected (I) and uninfected (U) snails of each species, and their statistical analysis among different I and U groups are given in Table 1. During present study the comparison of the estimated values of the glycogen content of hepatopancreas of uninfected snails with that of infected ones has revealed that in general there was a significant depletion of glycogen content in infected snails. The percentage decrease differed from species to species. The depletion in case of M. tuberculatus infected with monostome cercariae of Ephimera group was to the tune of 60\(^\circ\) _P<0.001_, in L. luteola infected with aphyraneal broviferoco monostome cercariae of Lophocercal group being 31\% _P<0.001_ and in V. bengalensis infected with Xiphidiocercariae of Microcotylae group to the tune of 30\% _P<0.001_. Similar trend of decrease in glycogen content of the hepatopancreas of different molluscan hosts parasitized with different digenean larval trematodes has been observed for Helisoma trivolvis\[1,2_, Plagioporus virens\[3_, Littorina littorea\[4_, Lymnea acuminata and Indoplanorbis exustus\[5_, Lymnea luteola\[6_, Biomphalaria alexandrina\[7_, Lymnea stagnalis\[8_ and Goniobasis virginica\[9_.

The decrease observed in the glycogen content of hepatopancreas of infected snails by earlier workers has been interpreted differently. The decrease is supposed to be due to utilization of the hydrolyzed product of host's glycogen by developing larval trematodes in H. trivolvis\[9_, B. alexandrina\[7_, B. glabrata\[10_ and L. littorea\[11_. The depletion in glycogen might be due to its utilization by the parasites by the direct ingestion of glycogen containing cells as reported in case of H. trivolvis\[1, P. virens\[3_ and L. littorea\[4_. In the present study, the observed significant depletion (_P<0.001_) of glycogen content in the hepatopancreas of snails of all the three species may be on account of following reasons: (i) direct ingestion of the glycogen-containing cells by developing larvae (ii) utilization of the hydrolyzed product of glycogen by developing larvae resulting in more hydrolysis of host glycogen into the monosaccharides (iii) physiological impairment of glycogen synthesizing machinery due to accumulation of toxic substances either secreted or excreted by the parasite or due to production of extensive nacroic lesions in the digestive gland.
Glycogen Metabolite in Infected Snails

A limited number of studies dealing with disturbances in the glycogen metabolism of the foot of molluscan host parasitized by larval trematodes have been carried out so far. Robson and Williams reported that interference in digestion due to destruction of digestive gland and gonads probably accounts for reduced level of glycogen in foot. On the other hand, the increase in the glycogen content of foot and mantle tissue of infected L. luteola as observed by Manohar and Rao has been thought to be due to the production of excess of glycogen in the foot to meet the nutritive requirements of the larvae developing in the hepatopancreas of the same host. In the present investigation, the comparison of the estimated values of glycogen content in foot of uninfected snails of respective species with that of infected ones did not reveal any consistency. The glycogen content in the infected snails of M. tuberculatus increased by 62.5% (P < 0.001). Contrary to this, it decreased in case of L. luteola, where the decline was only 3.0% (P > 0.001) and in V. bengalensis, the drop was 48% (P < 0.001).

Table 1— Glycogen content (fresh weight basis) in the hepatopancreas and foot of uninfected (U) and infected (I) fresh water snails (Values are Mean ± S.E. of 8 determinations each).

<table>
<thead>
<tr>
<th>Snail</th>
<th>Hepatopancreas</th>
<th>Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Glycogen</td>
<td>% Change U→I Ratio</td>
</tr>
<tr>
<td>M. tuberculatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(U)</td>
<td>0.83 ± 0.02</td>
<td>-60 2.5 : 1 (P &lt; 0.001)</td>
</tr>
<tr>
<td>(I)</td>
<td>0.33 ± 0.01</td>
<td>0.89 ± 0.01</td>
</tr>
<tr>
<td>L. luteola</td>
<td>3.33 ± 0.09</td>
<td>-31 1.5 : 1 (P &lt; 0.001)</td>
</tr>
<tr>
<td>(U)</td>
<td>2.30 ± 0.11</td>
<td>2.51 ± 0.15</td>
</tr>
<tr>
<td>(I)</td>
<td>2.30 ± 0.11</td>
<td>2.51 ± 0.15</td>
</tr>
<tr>
<td>V. bengalensis</td>
<td>3.63 ± 0.08</td>
<td>-30 1.4 : 1 (P &lt; 0.001)</td>
</tr>
<tr>
<td>(U)</td>
<td>2.54 ± 0.07</td>
<td>1.30 ± 0.04</td>
</tr>
<tr>
<td>(I)</td>
<td>2.54 ± 0.07</td>
<td>1.30 ± 0.04</td>
</tr>
</tbody>
</table>

Significant difference given in parenthesis.
The observed depletion of glycogen content in the foot of infected \textit{V. bengalensis} and \textit{L. luteola} is thought to be either due to inhibition of glycogen synthesizing machinery of foot as an indirect effect of parasitic infection or due to excessive drainage of the foot-glycogen via haemolymph in the hepatopancreas to meet out the excessive nutritive requirements of the developing larvae. The possible explanation for the increase of glycogen content in the foot of infected \textit{M. tuberculatus} is that the glycogen of the foot is not being drained out and at the same time its synthesis has been increased which at this level of investigation remains unexplained. Irrespective of the fact whether the changes in glycogen content of the foot of infected snails is towards an increase or decrease, it is apparent that even after the absence of the larval trematodes from the foot, its metabolic machinery is disturbed. This indicates that the physiology of the other parts of the same host, which are not directly infected can be affected more or less like the directly infected organs.

Besides this, the present study observed that the variations encountered in the glycogen content of the hepatopancreas and foot amongst the uninfected snails of all the three species are thought to be on account of (i) the specific difference of the host species (ii) the variations in the nature of diet of host species and (iii) variations in the specific requirement of the metabolite for general metabolism of host. Similarly the variations encountered in the glycogen content of the hepatopancreas and foot amongst the infected snails of all the three species, are thought to be due to (i) species' specific differences of the larval trematodes, which might be having different metabolic requirements (ii) difference in the intensity of infection and (iii) duration of infection, besides the factors mentioned above in case of uninfected snails.

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REFERENCES


