LIPID COMPONENTS IN SIX DIGENETIC TREMATODES

(Received March 26, 1992; Accepted June 2, 1992)

S.C. Nigam
Department of Zoology, University of Lucknow, Lucknow-226 007, India

In the present investigation, biochemical estimations of the total lipids and their components in six digenetic trematodes namely Fasciolopsis buski, Gastrodiscoides hominis, Gastrothylax crumenifer, Paramphistomum cervi, Fasciola gigantic and Isoparorchis hypselobagri have been made. The results show that the lipids and their components differ from species to species, depending upon the habitat and source of lipid.

Although the chemistry of tapeworm and nematode lipids has been the subject of several studies as reviewed by Read and Simmons¹, Smyth² and Von Brand³, relatively little progress seems to have been made in the characterization of lipid and its components in trematodes⁴-⁶. In this investigation an attempt has been made to determine the total lipids and their components in six digenetic trematodes viz. Fasciolopsis buski from small intestine, Gastrodiscoides hominis from caecum of pig Sus scrofa; Gastrothylax crumenifer from rumen, Paramphistomum cervi and Fasciola gigantic from liver of Indian water buffalo Bubalus bubalis, and Isoparorchis hypselobagri from the air bladder of cat fish Wallagonia attu.

MATERIALS AND METHODS

The mature adult flukes of F. gigantic, P. cervi, G. crumenifer, F. buski and G. hominis were brought from the local slaughter houses in a thermos flask containing saline water and those of I. hypselobagri, were obtained from the swim bladder of the freshly killed fishes. The flukes of each species so recovered, were washed several times with physiological saline, wiped over whatman filter paper no. 1 and then dried at 80-100°C in an hot air oven. The dried material in each case was separately subjected to vacuum drying till constant weight. This was finally pulverized and the weighed quantity for each species was separately subjected to extraction for total lipids and lipid fraction following double extraction method of Nigam et al⁹.
Lipid Components in Trematodes

The phospholipids recovered were further purified by preparative layer chromatography using solvent system as described by Buteau and Fairbairn. For the isolation of the neutral lipids, the ether-acetone filtrate left above was dried over anhydrous sodium sulphate and filtered. The filtrate was evacuated under vacuum till constant weight to yield the neutral lipids, the identity of which was ascertained by method of Fried and Pucci. The unsaponifiable matter, esterified cholesterol, and the fatty acids of glycerides were isolated from the neutral lipids as per details already described by Nigam and Premvati.

RESULTS AND DISCUSSION

The percentage of the total lipids on the dry weight of the worm tissue and various lipid fractions on the total lipids of all the six species of trematodes are summarized in Table 1.

Table 1—Total lipids and lipid fractions of six digenetic trematodes (Mean values of six determinations).

<table>
<thead>
<tr>
<th>Lipid &amp; fractions</th>
<th>F. buski</th>
<th>G. hominis</th>
<th>G. crumenifer</th>
<th>P. cervi</th>
<th>F. gigantica</th>
<th>I. hypselobagri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total lipids*</td>
<td>12.6</td>
<td>5.5</td>
<td>5.9</td>
<td>6.5</td>
<td>8.6</td>
<td>12.3</td>
</tr>
<tr>
<td>Free cholesterol**</td>
<td>15.2</td>
<td>11.0</td>
<td>13.7</td>
<td>7.9</td>
<td>9.7</td>
<td>13.6</td>
</tr>
<tr>
<td>Free fatty acids**</td>
<td>1.5</td>
<td>4.5</td>
<td>4.1</td>
<td>5.3</td>
<td>5.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Phospholipids**</td>
<td>19.6</td>
<td>17.9</td>
<td>19.9</td>
<td>24.0</td>
<td>26.0</td>
<td>15.7</td>
</tr>
<tr>
<td>Unsaponifiable matter**</td>
<td>1.9</td>
<td>17.4</td>
<td>13.7</td>
<td>16.6</td>
<td>17.9</td>
<td>12.5</td>
</tr>
<tr>
<td>Esterified cholesterol**</td>
<td>2.5</td>
<td>3.4</td>
<td>3.9</td>
<td>3.1</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Fatty acids of glycerides**</td>
<td>23.2</td>
<td>32.0</td>
<td>29.8</td>
<td>26.6</td>
<td>20.8</td>
<td>41.7</td>
</tr>
</tbody>
</table>

*Total lipids mean free steroids, free fatty acids and hexane extract (% on dry wt. tissue); **% on total lipids.

**Total Lipids**: In the trematode parasites examined here, the percentage of total lipids on the dry weight of the worm tissue have been found to vary from species to species most likely due to different hosts and habits. The observed values of the total lipids in the respective species (Table 1), are neither in agreement with those of the high values for the same or other species, reported earlier for *F. gigantica* (12.9%)⁴, *F. buski* (50.4%) and *I. hypselobagri* (29.5%)⁶, *Schistosoma mansoni* (34.1%)⁸ nor with those of the lower values reported in *G. crumenifer* (1.4%) and *P. explanatum* (4.5%)⁴.

These variations may be accounted for different techniques employed in extraction and washing procedures, as is also apparent from large quantities of unidentified lipids in some
of the trematodes studied by earlier workers. The percentage of total lipids observed here in *F. buski* from the small intestine of pig and lower percentage in *G. hominis* from the stomach of the same host could be explained on account of their location in different niches of the gastrointestinal tract. Comparatively, the small percentage of total lipids in *G. crumenifer* and *G. hominis* observed in the present study as well as previously could be perhaps explained due to their specific habitats in rumen and caecum respectively. However, extremely high percentage of total lipids (50.4%) observed by Yusufi and Siddiqui in *F. buski* is rather unusual as it seems very unlikely that any living organism has such a high lipid content. The percentage of total lipids in significant amounts in *I. hyselobagri* inhabiting the air bladder of fish observed here is thought to be on account of the rich supply of oxygen, as also suggested by Yusufi and Siddiqui. High percentage of triglycerides have also been reported for *S. mansoni* which lives in oxygen-rich habitat. This also suggests that the parasites' lipids are not confined only to dietary fats, bile or other secretions, but may be the blood also.

**Unsaponifiable matter:** In earlier studies the percentage of unsaponifiable matter on total lipids have been reported to be 25.0% in *G. crumenifer* and 32.4% in *S. mansoni*. In the present study the percentage values were found to be 8.9% in *F. buski*, 17.4% in *G. hominis*, 13.7% in *G. crumenifer*, 16.6% in *P. cervi*, 17.9% in *F. gigantica* and 12.5% in *I. hyselobagri*. The variations amongst these species may be on account of their different habitats and physiological requirements, whereas variations from the same species studied earlier, may be accounted for differences in techniques employed.

**Cholesterol:** In previous studies the percentage of cholesterol have been reported to be 7.5% in *Cotylophoron cotylephorum*, 4.8% in *G. crumenifer*, and 5.1% in *G. explanatum*, 4.1% in *Echinostoma malayanum*, 14.1% in *F. buski* and 9.2% in *I. hyselobagri* by Yusufi and Siddiqui and 8.0% in *G. hominis*. In the present investigation the percentage values of free and bound cholesterol were found to be 15.2 and 2.5% in *F. buski*, 11.0 and 3.4% in *G. hominis*, 13.7 and 3.9% in *G. crumenifer*, 7.9 and 3.1% in *P. cervi*, 7.9 and 3.5% in *F. gigantica* and 13.6 and 3.4% in *I. hyselobagri* respectively. The non-availability of similar data for trematode species studied earlier precludes from further comparison.

**Phospholipids:** The phospholipid contents on total lipids were found to be 19.6% in *F. buski*, 17.9% in *G. hominis*, 19.9% in *G. crumenifer*, 24% in *P. cervi*, 26.0% in *F. gigantica* and 15.7% in *I. hyselobagri*. Although these values in six species differ from each other but are in close proximity with the values reported for the same species by earlier workers.

**Fatty acids:** The values for the free fatty acids and fatty acid of glyceroles on total lipids were found to be 1.5 and 23.2% in *F. buski*, 4.5 and 32.0% in *G. hominis*; 4.1 and 29.8% in *G. crumenifer*, 5.3 and 26.6% in *P. cervi*, 6.3 and 20.8% in *F. gigantica* and 5.6
Lipid Components in Trematodes

and 41.7\% in _I. hypselobagri_ respectively. In all these species, the free fatty acids were present in much smaller concentration than fatty acids of glycerides. These observations are in accordance with those reported for the trematodes species studied earlier, and with those of other helminth parasites.

ACKNOWLEDGEMENTS:

The author thanks to Dr. S.K. Nigam and Dr. Gopal Misra of N.B.R.I., Lucknow, for G.I.C. analysis and helpful suggestions.

REFERENCES


