Comparative Uptake of Labelled Hexoses and Synthesis of Macromolecules by *Litomosoides carinii*

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**Summary.** *Litomosoides carinii*, the filarial parasite of cotton rat (*Sigmodon hispidus*), utilized labelled glucose and mannose for procuring energy while fructose and galactose were not helpful in this purpose. Studies on the rate of labelled glucose and mannose showed that these sugars led to the synthesis of glycogen.

**Introduction**

Earlier investigations of Bueding (1949) indicate that *Litomosoides carinii*, the filarial parasite of cotton rat (*Sigmodon hispidus*) consumed glucose, mannose, fructose or galactose more or less at the same rate. However, according to Srivastava et al. (1970b) galactose or fructose could not serve as the carbon source for the in vitro maintenance of the parasite. The reports from this laboratory show that *Chandlerella hawkingi* (Srivastava et al., 1968; Srivastava and Ghatak, 1974) and *Setaria cervi* (Anwar et al., 1975), the filarial parasites of Indian jungle crow and water-buffalo respectively preferentially utilize glucose and mannose for meeting their energy requirement when kept under in vitro conditions.

The present communication deals with the comparative uptake of radioactive sugars (glucose-\(^{14}C\), mannose-\(^{14}C\), fructose-\(^{14}C\) and galactose-\(^{14}C\)) and synthesis of macromolecular constituents by the adult *Litomosoides carinii*.

**Materials and Methods**

Motile worms, collected from the pleural cavity of freshly decapitated rats were incubated aerobically in Kreb's Ringer bicarbonate (KRB) medium (DeLuca and Cohen, 1964), pH 7.4, fortified with 1 \(\mu\)Ci of uniformly labelled hexoses (Radiochemical Centre, Amersham, UK) in the presence of carrier hexoses (27.7 \(\mu\)moles/100 mg wet weight of worms) at 37°C for 2 h. At the end of the incubation period, the worms were removed from the medium, washed with KRB buffer containing carrier hexoses for removing adhering radioactivity, homogenized with water (1:10, w/v) under chilled conditions and used for the separation of glycogen, lipid, nucleic acids and protein. Glycogen was isolated by the method of Good et al. (1933) and the cold perchloric acid (PCA) soluble fraction, lipid, RNA, DNA

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and protein were obtained according to the procedure of Schmidt and Thannhauser (1945). The radioactivity in all the fractions was counted according to the method of Hadi and Krishna Murti (1967) in a Packard Tricarb liquid scintillation counter.

Results

Results of the present study indicate that maximum incorporation was achieved with glucose-U-14C followed by mannose-U-14C while the uptake values were much lower with fructose-U-14C and galactose-U-14C (Table 1). Nearly 18–22% of the radiocarbon could be recovered in the glycogen fraction when labelled mannose or glucose was used as the carbon source, while the corresponding values for fructose and galactose were 6.6% and 4.5% respectively. Therefore it appears that *L. carinii* could synthesize glycogen from the exogenous carbohydrate(s), an appreciable amount of the glycogen being derived from glucose or mannose. The worms remained motile for more than 24 h in a mineral medium fortified with glucose or mannose whereas fructose and galactose were not helpful in this respect.

Since among the four sugars used glucose showed the highest incorporation into the worm, further experiments were conducted for studying the fate of this sugar. Table 2 represents the data regarding the incorporation of glucose-U-14C into various macromolecular constituents of *L. carinii*. About 60% of the total radioactivity was recovered in the cold PCA soluble fraction (containing polysaccharide, free pool of amino acids, organic acids and unidentified glycolytic intermediates) while only traces of the radioactivity could be detected in lipid, RNA, DNA and protein. About a quarter of the total recovered radioactivity was in the form of glycogen (isolated either separately or from the cold PCA soluble fraction) thereby showing that the glucose incorporated into the body of the worm was channelled towards the synthesis of the polysaccharide.

Discussion

*Litomosoides carinii* is equipped with most of the enzymes of the glycolytic pathway including the kinases responsible for the phosphorylation of all these sugars (Srivastava et al., 1970a). The higher rate of glycogen synthesis from exogenous mannose in this study suggests the functioning of an active phosphomannose isomerase (EC. 5.3.1.8) in this parasite. Further, mannose may also be present in the tissues of the host.

Similar results regarding the favoured uptake of glucose and mannose have been observed with the bovine filarial parasite (Anwar et al., 1975). Glycogen synthesis from exogenous carbohydrate has been observed earlier in several helminths. For example, *Ascaris* can synthesize glycogen from fructose, sorbose, maltose and saccharose (Cavier and Savel, 1952) while *Moniliformis dubius* can synthesize it from fructose, mannose and maltose (Laurie, 1959). Read (1967) reported the synthesis of the polysaccharide by *Hymenolepis diminuta* both under aerobic and anaerobic conditions in presence of 5% carbon dioxide.

The pathways of utilizing monosaccharides by a variety of helminths are obviously quite diverse. However, no explanation or information is available as to why a parasite should be capable of handling different sugars. It is assumed that the milieu of the host has somehow trained the parasite in utilizing sugars which it can offer to the parasite. Hence studies on the above lines could prove rewarding in explaining the host specificity of the parasite.