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Effect of parasitic infection on alteration in glycogen content in the vector snail Lymnaeaacuminata during patency periodfrom Aurangabad, (M.S), India.

Nagare K.R. Department Of Zoology, Indraraj ACS College, Sillod.Dist. Aurangabad.

Rane M.S Deparment of Zoology, D.N. College, Faizpur. Dist. Jalgaon.

ABSTRACT *The primary aim of the investigation to observe the glycogen content of different body components like foot, mantle, hepatopancreas, gonads and male and female accessory sexual organs from both infected and non-infected snail Lymnaeaacuminata during patency period. The results are reported in mg/100 mg dry weight of tissue. In present investigation, the glycogen contents in infected snails were found to be decreased as compared to non-infected snails.*

KEYWORDS : glycogen content, infected non-infected, snail, Lymnaeaacuminata, patency.

Introduction

In invertebrates, the glycogen is the most suitable storage product. Stetten and Stetten (1956) observed that in *Siphonoria japonica* notable percentage of glycogen was observed in the whole body. Chief carbohydrate in the tissue is glycogen, while glucose is an utilizable sugar found in the tissue of the body fluids. Glycogen is reversibly converted into glucose under the influence of hormonal mediated enzyme activities which constitute the major segment of carbohydrate metabolism. Thus this metabolism has gained an importance as far as the physiology of animal is concerned.

In order to fulfill the demand of energy requirement of parasite's internal tissues, glucose must be transported inwards and all tissues must possess glucose transfer protein (GTPs) to facilitate sugar movement across membranes. While the trematode parasites like Schistosomes lack a circulatory system, most systosome tissues and not just the tegument are syncytial in nature (Spence and Silk, 1971). Syncytial organization might be essential for the movements of small molecules in organisms that depend on diffusion as a mechanism for substrate distribution. To allow free sugar to diffuse to dipper tissues, it is important that not all of the imported glucose is metabolized rapidly. The first step in glucose catabolism is its phosphorylation by hexokinase the rate limiting for glycolysis (Skelly et al., 1998). Maintaining low hexokinase levels might be one way by which the adult parasites ensure that sufficient free glucose exist to feed the entire organism by diffusion. Glycogen degeneration and replenishment occur through the body of parasite (Tielens et al., 1989). This metabolism of glucose 'through glycogen' should help maintain a low internal free glucose concentration and so promote sufficient glucose diffusion to dipper tissues.

In general, glycogen is most suitable substrate for anaerobic and aerobic metabolism as an immediate source of energy and maintenance of this animal reserved food material as essential features of normal metabolism (Meenakshi, 1958 and 1964 and Meenakshi and Shear, 1968 and 1969). Thompson et al., (1974) stated that the hepatopancreas or mid-gut gland serves as site for the storage of metabolic reserves and provides energy during the period of physiological stress in addition to its role in ingestion of food.The primary object of the present study is to undertake investigations on biochemical analysis of glycogen of different body components of the snail *Lymnaeaacuminata*, in both infected and non-infected snails during patency period.

Material and Method

Collection of snails *Lymnaeaacuminata* was done during the months from September to October period of both years (2009-2010). Infected snails of normal sized (20± 2 mm shell length) were maintained in separated trough for biochemical study. Food material consisted of lettuce and algal material was provided *adlibitum* and maintained in dechlorinated water for total period of patency.

A batch of non-parasitized snails was maintained simultaneously as control animals. Total period of cercarial release lasts for 7 days is called period of patency. This period is divided into three different phases as per the cercarial release:

- Initial phase of patency (1st and 2nd day)
- Peak period of patency (3rd ,4th and 5th day)
- Last phase of patency (6th and 7th day)

A batch of 5 snails after every phase of patency were sacrificed in order to remove their different body components VIZ foot, mantle, hepatopancreas, gonad and male and female accessory sex organs (MASO and FASO) of both infected and non-infected snails. These tissues were dried in the thermostat oven adjusted at 65- 70^0 C. The oven dried tissues were grinded in order to get prepared dry powdered form and then subjected for glycogenestimation.

Estimation of glycogen:- The amount of glycogen present in different body components or tissues was estimated by Anthron reagent method (De Zwaan and Zandee, 1972). The results are expressed in mg/ 100mg in dry weight basis.

Observation and Result

In non-infected snails least glycogen was noted in mantle (i.e. 10.172±0.124) and maximum in hepatopancreas (25.468±1.443). In parasitized snails, there decrease in the glycogen content in almost all muscles. There is a significant decrease in glycogen content of hepatopancreas throughout the period of patency. During last phase patency, the glycogen content of hepatopancreas of infected snail is (12.153±0.977) almost half the content over non-infected snails (24.772±1.904). Similar type of trend is observed in the alteration of glycogen content of parasitized snail gonad (11.754±0.800) over non-infected (20.089±1.339) control snail's glycogen. The results are summarized in following table.

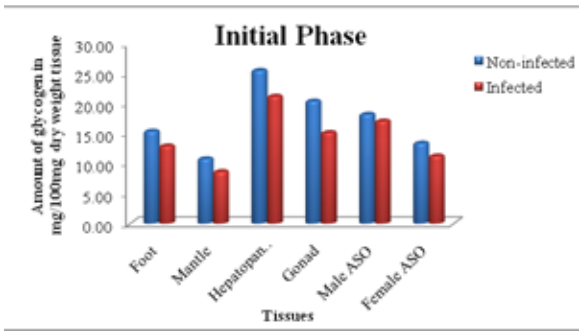
Table

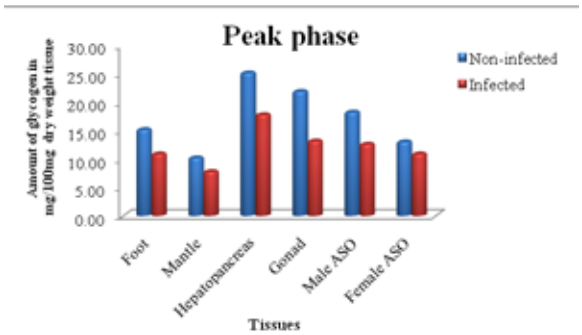
Effect of parasitic Infection on glycogen content of different body tissues of the snail *Lymnaeaacuminata*during different phases of patency.

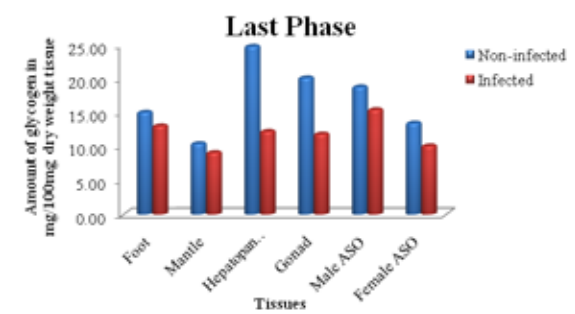
Snail category	Amount of glycogen in mg/100mg tissue ± S.D. on dry weight basis during initial phase of patency.					
	Foot	Mantle	Hepatopancreas	Gonad	Male ASO.	Female ASO.
Non-infected	15.275±1.187	10.661±0.108	25.468±1.443	20.326±1.953	18.117±1.732	13.283±1.032
Infected	12.812±1.150	8.529±0.330	21.127±1.521	15.055±1.339	16.983±1.101	11.138±0.395
	Peak phase of patency.					
	Foot	Mantle	Hepatopancreas	Gonad	Male ASO.	Female ASO.
Non-infected	15.153±1.514	10.172±0.124	25.127±1.122	21.868±1.001	18.222±0.047	12.995±1.064

Infected	10.875±1.46	7.767±0.332	17.772±1.326	13.139±0.830	12.571±1.811	10.875±0.103
	Last phase of patency.					
	Foot	Mantle	Hepatopancreas	Gonad	Male ASO.	Female ASO.
Non-infected	14.992±1.166	10.333±0.897	24.772±1.904	20.089±1.339	18.763±0.617	13.386±1.111
Infected	12.972±0.953	9.009±0.121	12.153±0.977	11.754±0.800	15.373±1.435	10.008±0.512

Graphical representation of the above table.







Discussion

The most comprehensive investigations on metabolic alterations during parasitic infection involve larval trematode pathogen infected intermediate gastropod snail hosts. The present freshwater gastropod snail *Lymnaeaacuminata* found invaded by various larval trematode parasites during infection period. After getting naturally infected by these pathogens there are severe alterations in biochemical metabolites in different body components or tissues of the snail. During different phases of patency i.e. at the time of cercarial release period various metabolites in particular glycogen level gets depleted throughout the period of cercarial release. Reader (1971) reported that the glycogen stores in the digestive gland of *Bithamiatentaculata* infected by sporocystsof *Cercariahelvetica* or rediae of *Cercariacystogenata* were depleted and the decrease in glycogen level was accompanied by increased phosphatase activity.

During the period of patency it has been observed that the present intermediate host snail, *L.acuminata*'s body components like hepatopancreatic-gonadal complex found invaded by matured rediae with various stages of cercarial development within them. Majority of the snail were found infected with various larval forms of *Fasciola hepatica*. Occasionally found invaded by other trematode larval forms judged by their cercariae such as *Trichobilharzia, Diplostomum*-trematode species. The glycogen level in the hepatopancreas was found depleted to nearly half the level of non-infected snails. Hence it was concluded that intermediate host's glycogen may serves as an essential primary substrate for energy production by parasite larvae and the glycogen may be ingested directly by rediae or broken down within the digestive gland cells and resulted glucose molecules are absorbed or ingested by sporocyst and rediae present within the hepatopancreatic-gonadal complex of the snail *L. acuminata*. At this juncture it can be concluded that an energy phosphatase which is responsible for the breakdown of glycogen may get activated as a consequence of parasitic infection there by causing glycogen depletion in the hepatopancreas which serves as depot tissue. Similar type of glycogen depletion due to elevated phosphatase activity during infection was reported in the digestive gland of *Flumenicolavirens* parasitized by rediae of *Plagioporusvirens* (Porter, 1970). The present findings are in accordance to the earlier reports of altered glycogen levels were reported by Robson and Williams (1971) in the digestive gland as well as foot of periwinkle, *Littorinalittorea*, but the specific changes depended on the parasitic species involved.

Ishak et al., (1975) also observed decreased in the glycogen content of the infected snails *Biomphalariaalexandrina* and *Bulinustruncatus*. The decrease in glycogen content of the infected snail tissues may result either from an increased rate of glycogen breakdown (glycogenolysis) or due to a decreased rate of glycogenesis.

Many effects of parasites on the host's metabolism are known but they are difficult to generalize. Often results found using one mollusc species and its trematode cannot be repeated with other host parasite relationships. Even studies using the same species do not always give identical or even similar results. This may be due to strain differences and to differences in the way animals are kept (Carlos and Coelho 1978; Chernin and Michelson, 1975, Coles, 1973).

Thompson and Lee (1986) stated that the glucose concentration in the heamolymph of snail host is very precisely regulated by homeostatic mechanisms, which maintain the glucose level in a small range of variation. This allows the snail to retrieve the glycogen deposits located in the digestive gland and muscles to restore the natural haemolymphatic glucose level, thereby significantly reducing the concentration in these sites, as observed in the present study. There is reduction in glycogen content of haepatopancreas up to 50% in infected snail during period of patency. Recently, Pinheiro et al., (2009) reported *Echinostomaparaensei* infected *Lymnaeacolumella* a maximal reduction of 37.19% at the end of prepatent period. Our results are also corroborated by the results of Malanodo et al.,(2001a) comparing the intramolluscan larval development in *Biomphalariaglabrata*, *Physamarmorata* and *L. columella* in which the major cercarial shedding was observed by the *L.columella* species. The present Lymnaeid snail, *L. acuminata*, during period of patency cercarial shedding is intense, may be due to this noted fact the high consumption of carbohydrates as an energy source by the larvae depletes the snail glycogen.

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