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Acid phosphatase activity in the Indian apple snail, *Pila globosa* (Swainson), during aestivation and starvation stress

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Abstract. Acid phosphatase activity has been studied in hepatopancreas and foot tissues of the Indian apple snail, *Pila globosa* (Swainson), with reference to aestivation and starvation. The enzyme activity in the tissues of control snails is higher in hepatopancreas, than in foot. The activity of acid phosphatase increased in hepatopancreas and decreased in foot during starvation while it decreased in both the tissues during aestivation. The significance of these findings is discussed.

Keywords. Aestivation; starvation; acid phosphatase; *Pila globosa*.

1. Introduction

De Duve *et al* (1955) have demonstrated that acid hydrolases are segregated in cytoplasmic particulates called lysosomes in a latent state, which can be activated not only by the disruption of the particle membrane *in vitro*, but also by a number of stress conditions *in vivo*. Acid phosphatase, a typical lysosomal enzyme, was reported to be active in different tissues of American oyster, albumen vacuoles and yolk granules of pulmonates (Raven 1972). In aestivating *Pila globosa* ATPase (Raghupathirami Reddy 1967a) dehydrogenases of the citric acid cycle (Raghupathirami Reddy 1963, 1967b) and phosphorylase (Srinivasa Reddy *et al* 1974) decreased indicating altered energy state of the animal. However, no information is available on the activity of acid phosphatase which is an index of lysosomal condition. Hence, it was felt essential to study the acid phosphatase activity in two diverse states of stress-aestivation and starvation.

2. Materials and methods

Collection, maintenance of *Pila globosa* and induction of aestivation have been described elsewhere (Srinivasa Reddy *et al* 1977). One set of animals was starved for a month and the other set subjected to aestivation for one year. Freshly collected

animals (acclimated to laboratory conditions for one week) were used as controls. The hepatopancreas and foot were isolated in cold and they were homogenised in cold 0·25 M sucrose and centrifuged at 3000 rpm for 10 min to remove cell debris. The supernatant was used for enzyme assay. Acid phosphatase (orthophosphoric monoester phosphohydrolase EC 3.1.3.2) was estimated by the method of Bodansky (1932) and the liberated phosphate was estimated by the method of Fiske and Subbarow (1925).

3. Results and discussion

The activity levels of acid phosphatase were about three times higher in the hepatopancreas than in the foot tissue of control snails (figure 1). On starvation the enzyme activity increased by 72% in hepatopancreas while it decreased by 28% in the foot tissue. During aestivation acid phosphatase activity decreased in both the tissues studied. In hepatopancreas the enzyme activity decreased marginally by 13% while in the foot tissue there was a pronounced decrease (50%). The higher level of activity of acid phosphatase in hepatopancreas indicates greater prevalence of this enzyme in this tissue than foot. Similarly, high activity of acid phosphatase in hepatopancreas of snails has also been reported earlier (Baldwin 1938).

Acid phosphatase is important in transphosphorylation in the cleavage of phospholipids and phosphomonoesters. It is also known to release free inorganic phosphorus from phosphoric acid esters (Lindhardt and Walter 1963) used in the formation of high energy phosphate compounds. The present finding indicates a predominant role of the hepatopancreas tissue in the metabolism of the snail.

Similar to acid phosphatase, alkaline phosphatase also exhibited higher activity in hepatopancreas of *Pila globosa* than foot (Srinivasa Reddy *et al* 1978), suggesting that hepatopancreas is a labile store of the various phosphate esters. The enzyme activity was found to decrease in the aestivated snail (figure 1). During aestivation, the snail would be in a state of suspended animation, wherein, the locomotor, reproductive and digestive functions cease to operate (Srinivasa Reddy and Swami 1976) and the energy budget is known to alter resulting in the decreased production of orthophosphoric monoesters, which are the substrates for acid phosphatase.

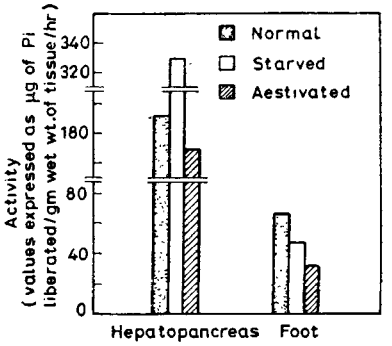

Figure 1. Activity levels of acid phosphatase in hepatopancreas and foot of *Pila globosa* (Swainson) during aestivation and starvation stress.

As stated earlier, the activity of acid phosphatase increased by 72% in the hepatopancreas of starved snail. Even in the absence of nutritive input during starvation, the normal metabolic events have to take place and the energy demands met by the reserve material. It is likely that the increased hydrolytic cleavage of phosphoric acid esters needs the energy demands during the stress period. Increased acid phosphatase activity also suggests high lysosomal activity and the preponderant catabolism since this hydrolase is a marker enzyme for lysosomes (De Duve *et al* 1955). Relatively, in *Pila globosa*, foot tissue is physiologically less active than hepatopancreas (Srinivasa Reddy *et al* 1974; Ramana Rao 1974) and the present investigation has revealed a relatively minor involvement of this tissue in starvation.

The present study indicates that the energy demands decrease during aestivation while they continue to be normal in starvation and the catabolic activity seems to predominate in hepatopancreas under starvation stress.

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