ACTIVITY OF ALANINE AMINOTRANSFERASE IN SERUM AND VENTRICULAR TISSUE OF RATS AFTER EXERCISE AS A FUNCTION OF AGE

S. ASHA DEVI AND E. RADHA

Department of Zoology, Bangalore University, Bangalore 560 001, India

ABSTRACT

This paper reports the changes in the activity of alanine aminotransferase (AAT) in ventricular tissue and serum in different ages of rats after exercise. A progressive increase in serum AAT activity was observed with a subsequent decrease in the tissue enzyme activity as the duration of exercise was increased in both the age groups. Decrease in tissue/serum ratio was observed. The factors which may relate to these striking changes in AAT activity are discussed.

INTRODUCTION

ENZYMES have a vital role in clinical medicine for their reliability in the diagnosis and continuous monitoring of various pathological states; to mention a few, myocardial infraction[7], muscular dystrophy[13], cerebral infraction[1], and malignancy[11]. Not only do serum enzymes increase in their activities during organic lesions but also during other physiological conditions like altitude[9], hypoxia[7], and physical stress[9]. The effect of exercise on tissue and serum enzymes has been the subject of intense research during the past few decades. Some of the enzymes studied so far include lactate dehydrogenase (LDH)[6], aldolase (ALD)[6], malate dehydrogenase (MDH)[6], sorbitol dehydrogenase (SDH)[6], aspartate aminotransferase (GOT)[6] and alanine aminotransferase (AAT)[12]. The effect of different durations of exercise has been reported for serum GOT[4]. But such investigations have not been reported so far for AAT. Hence, the present study was conducted to observe the changes in serum and ventricular tissue AAT activity as a function of age after exercise.

MATERIALS AND METHODS

Female albino rats of two age groups of the Wistar strain were used for the present investigation. They were maintained in polypropylene cages in groups of three at 27° C ± 3° and under 12 hr light and 12 hr dark conditions. They were fed *ad libitum* with the commercial diet and water. Exercise was provided by letting the rats swim in a (61 × 31 × 30 cm) glass tank for different durations of time. The activity of AAT was determined in serum and ventricular tissue according to the method described in Bergmeyer[2].

RESULTS AND DISCUSSION

The effects of different durations of swimming on the activity of AAT in serum and ventricular tissue are presented in Table I and the changes in the

TABLE I

Activity of AAT expressed as micromoles of pyruvate formed/hr/g wet wt of tissue and per ml serum

Age (Days)		Control	Duration of exercise: 30 min	Duration of exercise: 60 min
60	Ventricle	0·72±0·01 (3)	0·55±0·05* (3)	0·31±0·04† (3)
	Serum	0·13±0·05 (3)	0·56±0 04* (3)	0 60±0·06† (3)
180	Ventricle	0·83±0 09 (4)	0·43±0·09* (4)	0·16±0·04* (4)
	Serum	0·26±0 07 (4)	0·28±0·04 (4)†	0·305±0·1 (4)NS

*$p < 0.001$, †$p < 0.5$. Values in parentheses indicate the number of animals.

TABLE II

Tissue/serum ratio of AAT activity

Age (Days)	Control	Duration of exercise	
		30 min	60 min
60	5·53	0·91	0·50
180	3·60	1·53	0·50

tissue/serum ratio in Table II. The data were statistically analysed and the significant changes between the mean of control and experimental were calculated using student *t*-test and the *p*-values are presented.

The activity of AAT in both serum and tissue was higher in 180-day-old rats than in the 60-day-old rats. Swimming for 30 min and 60 min resulted in a significant increase in the serum AAT in the 60-day-old rats ($p < 0{\cdot}001$). Serum AAT showed an increase in the 180-day-old rats too, during both the durations of exercise. Significant decrease in the ventricular tissue after 30 min in both the ages was observed ($p < 0{\cdot}001$). As the duration of the exercise was increased, a progressive increase in serum AAT with a corresponding decrease in the tissue activity was observed. Such decrease in tissue AAT activity has been reported for hepatic tissue[12]. Similar increase in serum AAT in rats subjected to longer durations of exercise has also been reported[8]. The results also indicate a decrease in the tissue AAT activity in the younger rats accompanied by an increase in serum AAT.

Normally, the activity of enzymes in serum is very much lower than that in the tissue[15]. The increase in serum enzymes as a consequence of exercise can be explained on the basis of enhanced permeability of the cells. It is possible that the catecholamines released into the circulation during exercise accounts for the increase in serum AAT[5]. One striking result which we observed was that the rise in serum AAT activity for both the durations of swimming was less in 180-day-old rats as compared to the 60-day-old rats. Such results have been observed in the case of LDH also[10]. The enzymes which are released from the cells under stress are capable of changing the permeability of normal cells and contribute to the additional release of intracellular enzymes into the extracellular compartment[14]. Thus, the present findings indicate an altered activity pattern of AAT in the serum and ventricular tissue of young and old rats after exercise.

ACKNOWLEDGEMENT

One of the authors (A. D. S.) acknowledges the award of a Junior Research Fellowship by the C.S.I.R., Delhi.

1. Acheson *et al.*, *Lancet.*, 1965, **1**, 1306.
2. Bergmeyer, H. U., *Methods of Enzymatic Analysis*, Academic Press, New York, 1965, p. 851.
3. Boyde, T. R. C., and Latner, A. L., *Biochem. J.*, 1962, **82**, 51.
4. Critz, J. B., *Proc. Soc. Exp. Biol Med.*, 1966, 129, 1, 232.
5. Gray, I. *et al.*, *Ibid.*, 1957, **96**, 636.
6. Halonen, P. I. and Konttinen, *Nature*, 1962, p. 193.
7. Kim, M. S. and Han, S. S., *Proc. Soc. Exp. Biol. Med.*, 1969, **130**, 1042.
8. Loll and Hilscher, A., *Arctl. Forsch.*, 1958, **12**, 11/85.
9. Mager, M. *et al.*, *Am. J. Physiol.*, 1968, **215**, 8.
10. Porter, H. *et al.*, *Lab. Invest.*, 1971, **25**, 6, 572.
11. Richterich, R. and Burger, A., *Enzymol. Biol. Clin.*, 1963, **3**, 65.
12. Sangster, J. F. and Beaton, J. R., *Proc. Soc. Exp. Biol. Med.*, 1966, **122**, 544.
13. Van der Veen, K. J. and Willebrands, A. P., *Clin. Chim. Acta*, 1966, **13**, 312.
14. Wells, I. C., *Can. J. Biochem.*, 1969, **117**, 347.
15. Wroblewski, F. *et al.*, *Ann. Intern. Med.*, 1966, 45, 782.