

ACTIVITY OF SOME BLOOD ENZYMES IN RATS DURING HYPOTHERMIA

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The activity of the following enzymes was studied in various states of hypothermia: serum (SCE) and erythrocyte (ECE) cholinesterases, lactate dehydrogenase (LD), fructose-1-monophosphate aldolase (F-1-PA), fructose-1,6-diphosphate aldolase (F-1,6-PA), glucose phosphate isomerase (GPI), and aspartate aminotransferase (AsAT). In rats with hypothermia activity of pseudocholinesterase (SCE) fell whereas AsAT activity in the blood rose sharply; activity of F-1-PA fell, but not significantly, whereas the activity of F-1,6-PA, GPI, and LD increased. The changes in activity of the blood enzymes depend to a certain degree on the depth and duration of the hypothermia.

KEY WORDS: hypothermia; blood enzymes.

Despite the wide use of hypothermia in various pathological states [8, 9, 17], few papers have been published on its effect on the activity of the blood serum enzymes [3-5, 11-14, 16].

The activity of a number of serum enzymes was determined simultaneously in animals under various depths of hypothermia.

EXPERIMENTAL METHOD

Experiments were carried out on 38 rats divided into four groups: group 1 (8 rats) - control (immobilization without cooling), groups 2, 3, and 4 (each containing 10 rats) - experimental (immobilization with cooling). Cooling was carried out by application of cellophane bags containing ice to the animals for 3 h daily for 2 consecutive days, for 1 h daily for 5 consecutive days, and for 30 min daily for 6 consecutive days, respectively.

During cooling for 3 h, the rectal temperature of the rats on the first day averaged 15.5°C by the end of the experiment, and 16°C on the second day (4 rats died in the course of the experiment); after cooling for 1 h the mean rectal temperature on the consecutive days fell to 21.1, 21, 19.7, 18.7, and 18.4°C (3 rats died), and after cooling for 30 min daily the temperature fell to 21, 20.5, 18.8, 16.9, 18.2, and 18.3°C, respectively. The rectal temperature of the rats which died fell below 15°C. The temperature of the surviving rats 2 h after the cooling period returned to its initial level or, in some cases, exceeded it by 0.2-0.8°C. After the end of the experiments, the rats were decapitated and their blood collected to determine the activity of the enzymes: serum (SCE) and erythrocyte (ECE) cholinesterases [6], lactate dehydrogenase (LD) [19], fructose-1-monophosphate aldolase (F-1-PA) [2], fructose-1,6-diphosphate aldolase (F-1,6-PA) [1, 15], glucose phosphate isomerase (GPI) [2], and aspartate aminotransferase (AsAT) [10]. The results of the determinations were subjected to statistical analysis [7].

EXPERIMENTAL RESULTS

The results of determination of the enzyme activity in the rats' blood are given in Table 1.

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TABLE 1. Changes in Blood Enzyme Activity of Rats after Various Periods of Hypothermia ($M \pm m$)

Group of animals	No. of animals	Cholinesterases (mg acetylcholine/30 min)		Lactate dehydrogenase (i.u.)
		serum	erythrocyte	
Cooling for 3 h on 2 days P	6	0,120 \pm 0,020 0,03	0,205 \pm 0,022 0,38	1034 \pm 79,8 0,002
Cooling for 1 h on 5 days P	7	0,112 \pm 0,028 0,04	0,239 \pm 0,030 —	933 \pm 84,3 0,02
Cooling for 30 min on 6 days P	10	0,132 \pm 0,010 0,014	0,186 \pm 0,020 0,15	947 \pm 79,9 0,011
Control		0,178 \pm 0,013	0,243 \pm 0,032	653 \pm 70

Group of animals	No. of animals	Aldolases (conventional units)		Glucose phosphate isomerase (conventional units)	Aspartate aminotransferase (units/ml)
		fructose-1-monophosphate	fructose-1,6-diphosphate		
Cooling for 3 h on 2 days P	6	3,5 \pm 0,52 0,06	12,9 \pm 0,93 0,15	61,1 \pm 2,12 0,09	150 \pm 10,2 <0,001
Cooling for 1 h on 5 days P	7	3,82 \pm 0,58 0,11	16,2 \pm 1,91 0,03	44,0 \pm 1,13 <0,001	151,0 \pm 9,58 <0,001
Cooling for 30 min on 6 days P	10	4,2 \pm 0,53 0,18	17,5 \pm 0,92 <0,001	59,7 \pm 0,88 0,3	—
Control		6,1 \pm 1,18	10,0 \pm 1,66	57,0 \pm 0,81	13,3 \pm 0,75

The SCE activity was reduced in hypothermia, whereas ECE activity in all the experimental groups remained virtually at the control level. A sharp increase was observed in AsAT activity. Activity of the glycolytic enzymes changes in various ways in hypothermia: LD activity was increased in all the experimental groups, F-1-PA activity was very slightly reduced, whereas F-1,6-PA activity was increased only in the course of repeated cooling periods. GPI activity was lowered in the blood of the rats of group 3.

Under different conditions of hypothermia the enzyme activity thus changed variously. For example, SCE activity was reduced more after longer periods of cooling than after shorter periods; the increase in LD activity also was greatest in the rats of group 2.

It can accordingly be concluded that in general hypothermia, when the rectal temperature of rats falls to 18°C or below, important changes take place in their blood enzyme activity.

The next stage of the investigation will be to study the mechanisms responsible for these changes.

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