EFFECT OF HYPOXIA ON SOLUBLE PROTEIN CONTENT IN THE BRAIN AND LIVER OF RATS AT DIFFERENT BODY TEMPERATURES

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The character of the effect of acute hypoxia on the content of soluble proteins in the cerebral hemispheres and liver of rats in the presence or absence of marked hypothermia was studied. The soluble protein content in the brain fell only very slightly and their content in the liver remained unchanged in rats with marked hypothermia, but it fell sharply in both the brain and liver of rats in the absence of hypothermia.

KEY WORDS: hypoxia; rat brain and liver proteins; hypothermia.

The fraction of soluble proteins extractable from the tissues with 0.14 M NaCl solution is a very heterogeneous mixture containing both simple proteins and their complexes. Soluble proteins have a relatively high renewal rate. Previous investigations [3] showed that during acute hypoxia there is a marked inhibition of incorporation of carbon-labeled acetate and glycine into soluble brain and liver proteins of rats and that the degree of this inhibition depends to a definite degree on the depth of hypothermia accompanying the hypoxia. The present writers have shown [1,2] that acute hypoxia, whether or not it is accompanied by lowering of the body temperature, has no significant effect on the content of total phospholipids or their individual fractions (with the exception of polyphosphoinositides) in the brain and liver tissues of animals, despite well-marked changes in the intensity of their metabolism.

TABLE 1. Content of Soluble Proteins (in mg/g wet weight of tissue) in Cerebral Hemispheres and Liver of Normal and Hypoxic Rats ($M \pm m$)

Group of animals	Statistical parameter	Brain	Liver
Control	n [1] $M \pm m$	154 27,3±0,5	137 87,7±1,9
1) Hypoxia; body temperature lowered on the average by 1.35°C	n $M \pm m$ % of control P	36 14,8±0,7 54,1 <0,001	37 68,2±4,4 77,7 <0,001
2) Hypoxia; body temperature lowered on the average by 4.75°C	n $M \pm m$ % of control P	52 23,1±0,8 84,6 <0,001	52 90,4±2,2 103,0 >0,1

*n – number of animals.

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The object of this investigation was to study the character of the effect of acute hypoxia on the content of soluble proteins in the cerebral hemispheres and liver of rats exposed to hypoxia, accompanied or not by marked hypothermia.

EXPERIMENTAL METHOD

Male Wistar rats were kept in a pressure chamber in which the pressure was lowered in the course of 20 min to 240 mm Hg, and they remained under these conditions for 2 h. Before and after the experiments the animals' rectal temperature was measured. The experimental animals were divided into two groups: 1) animals whose body temperature fell only slightly (by less than 3°C compared with initially) during their stay of 2 h in the pressure chamber, and 2) animals with marked hypothermia – whose body temperature fell by 3°C or more. Soluble brain proteins were extracted from the tissues of the cerebral hemispheres and liver of the control and experimental rats in the cold for a period of 4 h with 0.14 M NaCl solution and subsequently precipitated with TCA. The protein residue was freed from lipids and dissolved in 0.5 N NaOH. The content of soluble proteins was determined by the method of Ryth and Gill [4] and expressed in mg/g wet weight of tissue.

EXPERIMENTAL RESULTS

It will be clear from Table 1 that hypoxia led to a definite decrease in the content of soluble proteins in the animals without marked hypothermia (group 1), and that the decrease was much greater in the brain than in the liver. In the rats with marked hypothermia (group 2) the content of soluble proteins in the cerebral hemispheres showed a smaller decrease (by 15%; $P < 0.001$), and in the liver it was indistinguishable from the control. The difference between the soluble protein content in groups 1 and 2 was statistically significant for both tissues studied.

The decrease in the soluble protein content in the brain and liver of the rats exposed to acute hypoxia, but whose body temperature remained at close to the initial level (group 1), can evidently be explained by the predominance of protein breakdown over protein synthesis, which is definitely inhibited under these hypoxic conditions [3]. The very small decrease in the content of soluble proteins in the brain and the absence of changes in the liver of the animals of group 2 may indicate that hypothermia in an animal exposed to hypoxia inhibits the breakdown of soluble proteins by a greater degree than their synthesis.

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