

EFFECT OF FATIGUE ON NUCLEIC ACID METABOLISM IN THE REGENERATING LIVER OF PARTIALLY HEPATECTOMIZED RATS

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There is much information in the literature on the subject of the action of various forms of physical exertion on carbohydrate and lipid metabolism [1, 3, 5, 6, 7, 8], but very little concerned with the effect of this factor on protein metabolism [2, 4]. We were unable to find any report in the literature of investigations of the effect of fatigue on nucleoprotein and nucleic acid metabolism.

To test the effect of physical exertion, an investigation was made of the changes in the rate of renewal and concentration of nuclei acids in the regenerating liver of partially hepatectomized rats.

EXPERIMENTAL METHOD

Experiments were carried out on 28 male albino rats weighing about 200 g. The animals were fatigued by immersing them in a bath, of capacity 20 liters, containing water at a temperature of 28-32°, in which they had to swim for 9-10 h on the day before the operation (until the onset of marked fatigue), and for 2.5 h next day before the operation. The fatigued animals kept themselves up in the water with difficulty, their respiration rate was high, they ceased to grasp objects held out towards them, and they became apathetic and timid.

Partial hepatectomy consisted of the removal of two-thirds of the liver (the left lateral and middle lobes). The animals withstood the operation comparatively well and they regained their previous level of activity within a few hours. The control animals were hepatectomized rats not subjected to fatigue.

Twenty-four hours after the operation, when the intensity of nucleic acid synthesis in the regenerating liver reached its maximum, the animals were decapitated, the liver was extracted and weighed, and the content and rate of renewal of nucleic acids investigated in terms of phosphorus.

The nuclei acids were fractionated by the method of Schmidt and Thannhauser as modified by Davidson, and the inorganic phosphorus was extracted by Weil and Malerby's method. The phosphorus concentration was estimated

Concentration and Rate of Renewal of Nucleic Acids in Regenerating Liver of Rats Exposed and Not Exposed to Fatigue, 24 Hours after Partial Hepatectomy

Acid	Index determined	Without fatigue (8 animals)	With fatigue (20 animals)	Difference	t
RNA	Concentration*	0.613 ± 0.028	0.600 ± 0.012	0.013 ± 0.031	0.4
	Relative specific activity	0.25 ± 0.024	0.18 ± 0.013	0.07 ± 0.029	2.4
DNA	Concentration	0.094 ± 0.0035	0.092 ± 0.004	0.002 ± 0.0053	0.4
	Relative specific activity	0.23 ± 0.027	0.12 ± 0.014	0.11 ± 0.031	3.5

* Amount of phosphorus in mg/g fresh tissue.

colorimetrically by the method of Cohen and Kutner, using the type FEK photoelectric colorimeter. The rate of renewal of the nucleic acids was investigated by means of radioactive phosphorus (P^{32}). The animals received a subcutaneous injection of a solution of $Na_2HP^{32}O_4$ in a dose of 20,000 impulses/g body weight 4 h before sacrifice.

The specific activity (activity of P^{32} /mg phosphorus) and the relative specific activity (ratio between specific activity of the test fraction and the specific activity of the inorganic phosphorus) were determined in each fraction, and these were used to indicate the rate of renewal of each particular fraction. Activity was counted on a type B-2 apparatus, using a cylindrical type AS-2 counting tube mounted in a lead housing.

EXPERIMENTAL RESULTS

The results of the investigation are given in the table as comparable mean values of the content and rate of renewal of nucleic acids in the regenerating liver of the rats subjected and not subjected to fatigue. To determine the significance of the differences (t), the ratio between the difference between the results and the standard error was used.

It is clear from the table that fatigue had practically no effect on the content of nucleic acids in the investigated organ, whereas the intensity of renewal of the nucleic acids fell significantly.

SUMMARY

A considerable fatigue attained by prolonged swimming caused a marked reduction of the intensity of nucleic acid renewal in the regenerating rat liver 24 hours after partial hepatectomy (RNA by 28%, DNA by 48%) without affecting the content of these acids in the organ investigated.

A model is suggested for studying the efficacy of low doses of ionizing radiation, i.e., reduction of nucleic acid synthesis in the regenerating liver of partially hepatectomized rats, resulting from prolonged fatigue.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of this issue.
