ROLE OF METABOLIC REGULATORS IN THE ASSIMILATION OF CASEIN HYDROLYSATE IN ALLOXAN DIABETES

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UDC 612.018.2.615.
356:-456.1:616.37-008.6

Experiments on rats with alloxan diabetes showed that administration of metabolic regulators (insulin, vitamin C, vitamins of the B group, and nerobolyl) increases the assimilability of casein hydrolysate, as shown by the positive nitrogen balance, maintenance of body weight, and increase in the dry residue of the tissues. The results provide further experimental verification of the need to create hydrolysates with vitamins and hormones in order to make parenteral feeding more effective.

KEY WORDS: alloxan diabetes; casein hydrolysate; parenteral feeding; assimilability of nitrogen.

Disturbances of metabolism, including deficient insulin production, greatly limits the assimilability of parenterally injected nitrogeneous substances [1-4]; the need has thus arisen for a combination of nitrogenous preparations for parenteral feeding with metabolic regulators [5, 6].

In the investigation described below the role of hormones and vitamins in the assimilability of casein hydrolysate was studied in alloxan diabetes.

EXPERIMENTAL METHOD

Insulin deficiency was induced in rats (170-230 g) by two subcutaneous injections of 5% of alloxan solution in a dose of 15 mg/100 g body weight. Animals with diabetes of average severity, as shown by a stable elevation of the blood sugar level to 150-200 mg %, were chosen for the experiments. For 8 days all the rats were kept on a protein-free diet and were given subcutaneous injections of physiological saline (7 ml/100 g body weight) with insulin (0.5 to 1.5 units depending on the level of hyperglycemia) or without insulin, casein hydrolysate (0.3 g conventional protein/100 g body weight) with or without insulin, and also casein hydrolysate, insulin, vitamins (C, 2 mg/100 g, B_1, 0.1 mg/100 g, B_6, 0.1 mg/100 g, B_{12}, 0.4 μg/100 g), and the anabolic steroid nerobolyl (0.05 mg/100 g body weight) daily for 8 days. Besides the hydrolysate, a solution of glucose (200 mg/100 g) was injected as the source of energy. The volume of fluid injected per 100 g body weight was the same in all series of experiments. The assimilability of the casein hydrolysate was judged from changes in the body weight, nitrogen balance, the urea and creatinine concentrations in the blood, and the dry residue of the tissues.

EXPERIMENTAL RESULTS

In rats with alloxan diabetes under conditions of protein deprivation the nitrogen balance became sharply negative, especially on the second day. Injection of insulin improved this index somewhat: It became less negative and remained at about the same level throughout the experiments (Table 1).

Experimental Division, Research Institute of Hematology and Blood Transfusion, L'vov. (Presented by Academician of the Academy of Medical Sciences of the USSR A. M. Chernukh.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 81, No. 5, pp. 560-561, May, 1976. Original article submitted June 11, 1975.

TABLE 1. Changes in Nitrogen Balance in Rats with Alloxan Diabetes during Administration of Insulin (M ± m, n = 10)

Group of animals	Nitrogen balance (in mg/100 g body weight)						
	initial data	1st	2nd	3rd	4-5th	6th	7th
		days					
Alloxan diabetes	−31,5±3,9	−31,1±8,7	−107,5±14,3	−34,0±5,2	—	−42,0±20,9	−56,0±7,6
P		>0,05	<0,05	>0,05		>0,05	>0,05
Alloxan diabetes + insulin	−30,5±5,9	−47,3±19,4	−37,6±10,8	27,7±5,9	−23,2±4,1	−19,0±4,5	−22,7±4,0
P		>0,05	>0,05	>0,05	>0,05	>0,05	>0,05

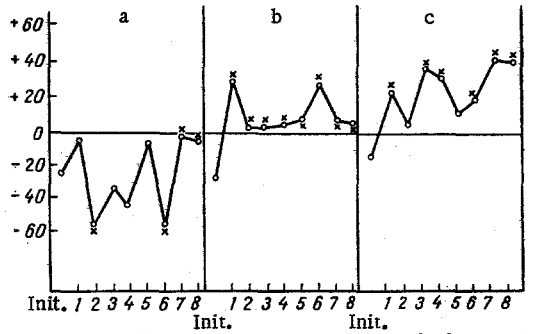

Fig. 1. Effect of hormones and vitamins on nitrogen balance in rats with alloxan diabetes. Abscissa, time of experiment (in days); ordinate, nitrogen balance (in mg/100 g body weight): a) injection of casein hydrolysate; b) injection of casein hydrolysate and insulin; c) injection of casein hydrolysate, insulin, nerobolyl, and vitamins. Indices of nitrogen balance differing by a statistically significant degree ($P < 0.05$) from the initial values are marked by an asterisk.

Injection of casein hydrolysate improved the nitrogen balance in the rats with alloxan diabetes but did not make it positive (Fig. 1). During the first day injection of the hydrolysate increased the nitrogen balance, but thereafter it became sharply negative again, indicating temporary retention of nitrogen in the body without its assimilation. After injection of insulin together with casein hydrolysate the nitrogen balance became positive after 1 day and did not become negative again during the course of the experiment. Insulin combined with vitamins and nerobolyl caused retention of even more of the nitrogen injected with the casein hydrolysate, with a resulting marked increase in the positive nitrogen balance. In this series of experiments (unlike the other) the body weight of the rats did not fall and sometimes it even exceeded the initial weight a little.

The dry residue of the tissues, especially the liver, fell significantly in alloxan diabetes associated with protein deprivation (26.7 ± 0.81, compared with 30.7 ± 0.65% in intact animals). Injection of casein hydrolysate, especially if combined with hormones and vitamins, increased the dry residue both of the liver and of the skeletal muscle. Casein hydrolysate slightly raised the blood urea but increased the creatinine concentration (from 0.88 ± 0.1 to 1.43 ± 0.06 mg%).

In alloxan diabetes the assimilability of parenterally injected casein hydrolysate is thus greatly disturbed. Physiological stimulators (vitamins, insulin, anabolic steroids) increase the assimilability of the injected nitrogen considerably, as shown by the positive nitrogen balance, maintenance of the body weight, and the increase in the dry residue of the tissues.

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