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# NITROGEN-SPARING ACTION OF LIPID EMULSIONS FOR PARENTERAL FEEDING OF ALBINO RATS WITH THYROTOXICOSIS

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The nitrogen-sparing action of lipid emulsions (intralipid and lipidin) during parenteral administration of casein hydrolysate was studied in 65 albino rats with thyrotoxicosis. If casein hydrolysate was given together with lipid emulsions and physiological regulators of metabolism the negative nitrogen balance was found to be quickly changed to positive, the free amino acid nitrogen level in the blood and tissues (skeletal muscle, heart, liver) fell, and the body weight of the animals increased.

KEY WORDS: *Parenteral feeding; lipid emulsions; nitrogenous substances; nitrogen-sparing action; thyrotoxicosis.*

Rational parenteral feeding must include not only nitrogenous substances but also sources of energy. Otherwise the nitrogenous preparations administered would be partially utilized to meet the energy requirements of the organism and this would naturally reduce the effectiveness of the parenteral feeding [5-7].

In this investigation the nitrogen-sparing action of two lipid emulsion preparations, intralipid (Sweden) and lipidin (L'vov Institute of Hematology and Blood Transfusion; B. V.

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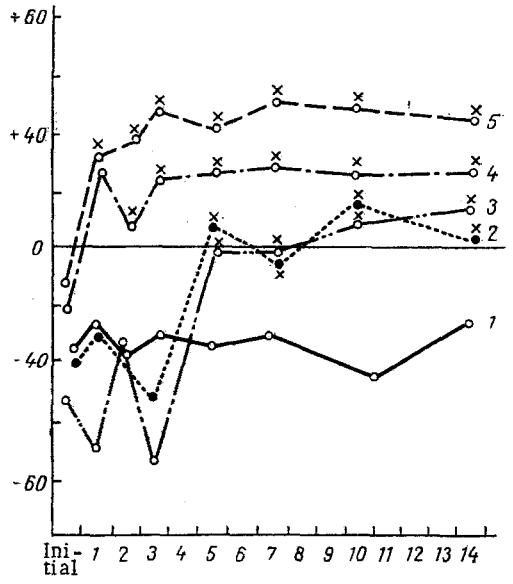


Fig. 1

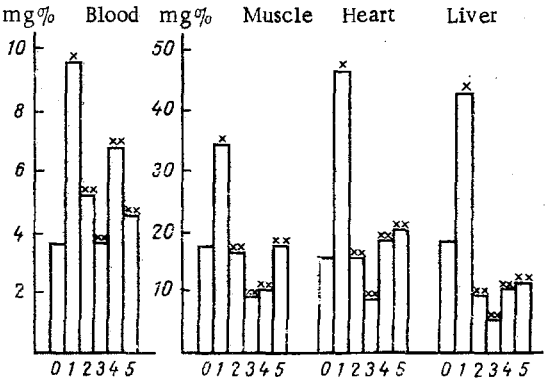


Fig. 2

Fig. 1. Dynamics of nitrogen balance in rats with thyrotoxicosis: 1) physiological saline; 2) casein hydrolysate; 3) casein hydrolysate and physiological regulators of metabolism; 4) the same and Intralipid; 5) the same and Lipidin. Values differing from the initial results by a statistically significant degree ($P < 0.05$) shown by crosses. Ordinate, nitrogen balance (in mg N/100 g body weight); abscissa, period of parenteral feeding (in days).

Fig. 2. Changes in amino nitrogen concentration in blood and tissues of rats with thyrotoxicosis: 0) intact; 1) physiological saline; 2) casein hydrolysate; 3) casein hydrolysate and physiological regulators of metabolism; 4) the same and Intralipid; 5) the same and Lipidin. One cross $P < 0.05$ compared with intact; two crosses $P < 0.05$ compared with group 1.

Kachorovskii [2]), was studied in the investigation described below in rats with experimental thyrotoxicosis, i.e., when all types of metabolism, especially energy and protein metabolism, are severely disturbed [3].

## EXPERIMENTAL METHOD

Experiments were carried out on 65 sexually mature albino rats weighing 200-290 g. Thyrotoxicosis was produced by daily subcutaneous injection of thyroxine in a dose of 15 µg/100 g body weight for 30 days. The severity of thyrotoxicosis was judged from the decrease in body weight of the animals (by 20.0 ± 1.6%; $P < 0.05$) and the increase in oxygen consumption (by 49.9 ± 8.5%; $P < 0.05$). The total number of animals was divided into five groups (10 to 12 rats in each group) and for the last 14 days of the experiments the animals received a protein-free synthetic diet [1].

The animals of group 1 were given 0.9% NaCl solution in a dose corresponding to the volume of fluid injected during parenteral feeding, group 2 received casein hydrolysate, group 3 casein hydrolysate and physiological regulators of metabolism (nerobolil 0.05 mg, insulin 0.5 unit with 200 mg glucose, vitamin C 2 mg, vitamin $B_1$ and $B_6$ 0.1 mg each, $B_{12}$ 0.4 µg — all doses per 100 g body weight), groups 4 and 5 casein hydrolysate, physiological regulators of metabolism, and Intralipid or Lipidin, respectively. Casein hydrolysate (in a dose of 0.3 g conventional protein/100 g body weight) and lipid emulsions (1.5 ml/100 g body weight) were injected subcutaneously.

The nitrogen-sparing action of the lipid emulsions was estimated from the dynamics of the nitrogen balance and the urinary excretion of amino nitrogen during the experiments. Changes in the body weight of the animals also were taken into account. The animals were decapitated 24 h after the last injection of the preparations and the concentration of amino nitrogen determined in the blood and tissues (skeletal muscle, heart, and liver). Total nitrogen was determined by the micro-Kjeldahl method, amino nitrogen in the urine, blood, and tissues by the ninhydrin method [9], and the oxygen consumption by the method described by Rylova [4].

## EXPERIMENTAL RESULTS

In the animals of group 1 a marked negative nitrogen balance was observed throughout the period of observation (Fig. 1). Injection of casein hydrolysate alone (and also together with metabolic regulators) in thyrotoxicosis restored the nitrogen balance to normal only after the fifth day of its administration. If lipid emulsions were given at the same time, the negative nitrogen balance was converted to positive after the first day.

Assimilation of the administered nitrogenous product, even with the physiological regulators of metabolism, on the fifth day in the animals with thyrotoxicosis was 70% (after Mitchell [8]), whereas administration of the lipid emulsions increased this index to 100%.

The urinary excretion of amino nitrogen in rats with thryotoxicosis during administration of casein hydrolysate either with or without metabolic regulators was increased, and on the third day it amounted to 8.1 ± 3.8 and 8.1 ± 2.3 mg/day respectively, compared with initial levels of 1.9 ± 0.3 and 2.5 ± 0.4 mg/day ($P < 0.05$). By the fifth day the excretion of amino nitrogen in the urine fell to 3.2 ± 1.0 and 2.9 ± 0.7 mg/day. On the tenth day it rose again to the level of the third day and at the end of the experiment was the same as initially. The maximal excretion of amino nitrogen was 16% of the injected dose. Administration of the lipid emulsions reduced the excretion of amino nitrogen throughout the experiment. The maximal excretion was only 6.8% of the injected dose.

The amino nitrogen concentration in the blood and tissues (Fig. 2) in thyrotoxicosis increased sharply as a result of protein starvation. It must be emphasized that thyroxine poisoning is characterized by an increase in the free amino acid concentration in the tissues and by predominance of the catabolic direction of metabolism [3, 10].

Administration of casein hydrolysate, especially together with metabolic regulators, substantially lowered the amino nitrogen level in the blood and tissues of the animals, evidence of the utilization of the administered nitrogen for synthesis. Injection of casein hydrolysate together with physiological metabolic regulators and lipid emulsions also increased the body weight of the animals by 10-20%.

Parenteral feeding with nitrogenous substances only in thyrotoxicosis, or even with the addition of physiological regulators of metabolism, does not enable a positive nitrogen balance to be attained during the first few days. Administration of lipid emulsions in conjunction with parenteral feeding, however, leads to a rapid change of the nitrogen balance into positive and an increase in the body weight. The nitrogen-sparing action of lipid emulsions enables the dose of the nitrogenous substances injected to be reduced, a very important matter in clinical practice.

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