EFFECT OF THYROXIN ON LIPOLYTIC ACTIVITY AND GLYCERIDE GLYCEROL CONTENT IN THE LIVER OF ALBINO RATS

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Administration of thyroxin to albino rats for 7 days leads to a decrease in the glyceride glycerol concentration in the liver but has no effect on lipolytic activity in this organ. The glyceride glycerol content in the blood plasma was unchanged.

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We previously discovered [4] that prolonged administration of thyroid to albino rats causes a decrease in glyceride glycerol (GG) concentration in the blood serum. The mechanism of the hypolipemic effect of thyroid hormone has not been completely studied. The suggestion has been made that the effect of thyroxin on the blood lipids is dependent on the action of the hormone on lipid metabolism in the liver [3], although there is little experimental evidence on this problem.

In this investigation we studied the effect of repeated injections of thyroxin on the lipolytic activity and GG content in the liver of rats. Parallel determinations were made of the concentrations of GG and nonesterified fatty acids (NEFA) in the blood plasma.

EXPERIMENTAL METHOD

The experimental technique and method of determining lipolytic activity in the tissues have been described previously. To determine the GG concentration, 1 g of liver homogenate or 0.5 ml plasma was extracted with 25 or 10 ml respectively of a 2 : 1 mixture of chloroform and methyl alcohol, the extract was washed [7], and 1.5 g of preactivated silica gel was added. After filtration, the GG concentration in the extract was determined [11]. An aqueous solution of glycerol was used as the standard [5]. The NEFA concentration in the plasma was determined by Dole's method [6].

EXPERIMENTAL RESULTS

The experimental results are given in Table 1. Statistical analysis showed that repeated injections of thyroxin for 7 days caused only a slight decrease in lipolytic activity in the liver of the rats. This applied to lipolytic activity determined at pH 6.8 and pH 8.5, i.e., under optimal conditions for the action of hormone-sensitive or lipoprotein lipase respectively. The lipolytic activity at pH 8.5 was not reduced after addition (this was done only in individual cases) of characteristic lipoprotein lipase inhibitors, namely protamine sulfate or 0.5 M NaCl, to the incubation mixture.

In the rats receiving thyroxin the GG concentration in the liver was considerably reduced ($P < 0.001$). The weight of the liver per 100 g body weight was increased in the experimental animals compared with the controls ($P < 0.001$). The lipolytic activity of liver homogenate, calculated per mg GG, in the experimental animals was not significantly different from that in the control rats, and the slight increase in its value at pH 8.5 was not significant ($P > 0.05$). The GG concentration in the plasma of the experimental rats was equal to that in the controls, and although the concentration of NEFA was increased, the increase was not significant ($P > 0.05$).

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TABLE 1. Effect of Thyroxin on Some Indices of Lipid Metabolism in Rats (M±m)

Index		Rats receiving thyroxin		Control	
Lipolytic activity in liver (in meq/g/h)	pH 6.8	4.2±0.8	(15)	5.4±1.2	(20)
	pH 8.5	3.6±0.6	(15)	4.6±0.9	(20)
Lipolytic activity in liver (in meq/g/h/mg GG)	pH 6.8	0.83±0.19	(15)	0.89±0.74	(13)
	pH 8.5	0.73±0.16	(15)	0.51±0.17	(13)
GG in liver (in mg/g)		5.20±0.86	(18)	8.9±1.9	(17)
Weight of liver (in g/100 g body weight)		3.80±0.1	(15)	3.20±0.3	(14)
GG in blood plasma (in mg/100 ml)		17.6±2.2	(18)	18.1±2.5	(17)
NEFA in plasma (in μeq)		852±98	(16)	737±86	(14)

As mentioned above [4], injection of thyroid for 28 days produced a considerable decrease in the serum GG concentration in rats. Despite administration of large doses of thyroxin (1 mg/100 g body weight), in the present investigation we found no changes in this index. The difference is probably due to the relatively short duration of our last observations (7 days). However, during this period the GG concentration in the liver of the experimental rats decreased significantly. It may therefore be postulated that the GG concentration falls initially under the influence of thyroid hormone, and only later does it fall in the plasma. The liver is regarded as the main producer of the blood lipoproteins [9], although the mechanism of their formation and liberation from the liver has not yet been studied in detail [8]. It may be assumed that thyroxin brings about the liberation of lipoproteins from the liver into the blood stream and thus causes a gradual decrease in glyceride concentration, first in the liver and later in the blood. As our results show, this is not accompanied by any increase in activity of the lipolytic enzymes in the liver, but on the contrary, the lipolytic activity showed a tendency to decrease. This last observation is compatible with the view that changes in activity of the lipolytic enzymes are adaptive in character [2]. Lipolytic enzymes have been found in the liver by several investigators [1, 10, 12], but as yet we have no precise information regarding the character of these enzymes. The fact that characteristic inhibitors have no effect indicates that the lipolytic activity which we found in liver homogenates at pH 8.5 is not due to the action of lipoprotein lipase.

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