The Mechanism for Changes in Blood Cholesterol in Deranged Thyroid States

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THE PLASMA cholesterol level rises in the hypothyroid state and falls in the hyperthyroid state,[1-7] although without a close or immediate relation with the basal metabolic rate.[8] Feeding excess cholesterol to animals will increase the hypercholesteremia of the hypothyroid state.[7,9] However, low-sterol diets are without effect[4] and changes in intestinal absorption of cholesterol do not account for the blood cholesterol changes in either hypo- or hyperthyroid states.[5,10,11] No redistribution of cholesterol between the blood and fixed tissues occurs which might explain the change in blood levels.[12,13]

The rate of synthesis of lipids and phospholipids is apparently increased in hyperthyroidism.[14-19] This is true also of cholesterol synthesis.[12,17,22] Conversely, there is a lower synthesis rate in hypothyroidism.[12,17,21,22]

These changes in rate of synthesis are of course opposite in direction to the blood cholesterol concentration changes. In order for the blood levels to vary as they in fact do vary, the excretory or destructive processes concerned with cholesterol must dominate in the hyperthyroid state and be subordinate to synthesis in the hypothyroid.

Where a radioactive label is incorporated from body water into cholesterol and the rate of loss of labeled cholesterol observed, it is noted that cholesterol is lost more rapidly in hyperthyroid rats than in normal rats, while loss of cholesterol is diminished in hypothyroid animals.[12] Here is a rate process in the same direction as the blood change.

TABLE I

Rate of Disappearance of Injected Cholesterol in Hypo- and Hyperthyroid Rats*

Type of rat	Number of rats	Plasma cholesterol increments (mg/100 ml)†				
		Immediately after injection	1 hr after injection	3 hr after injection	6 hr after injection	12 hr after injection
Control	5	114 ± 5.4	113‡	69.6 ± 3.4	33 ± 3.5	9 ± 3.5
Hyperthyroid	7	137 ± 7	103 ± 6.5	58.4 ± 8	6 ± 4.1	−18 ± 7.4
Hypothyroid	6	127.6 ± 8.4	118 ± 3.4	90 ± 6.3	51.5 ± 9	10.8 ± 4.4

The figures following the ± sign refer to the standard error of the mean.

* Hypercholesteremia was induced by intravenous injection of hypercholesteremic rat plasma.

† These increments represent the plasma cholesterol (mg/100 cc) in *excess* of the pre-injection values.

‡ Number of rats too small to permit calculation of the standard error.

The rate of disappearance of injected physiologic cholesterol is in keeping with this view (Table I).[12,20]

The rate of excretion of sterols is greater in hyperthyroid animals than normals and is less in hypothyroid animals,[12] even though all the animals eat a sterol-free diet. Thus a disparity between rates of synthesis and destruction or excretion underlies the inverse thyroid activity/blood cholesterol relationship.

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