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Effect of Thyroid Hormone on Lipogenesis of Rat White and Brown Adipocytes

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Thyroid hormone is a key regulator in lipid metabolism. It has been generally accepted that the interaction of thyroid hormone with its receptors stimulates hepatic lipogenesis by increasing expression of genes encoding lipogenic enzymes, including acetyl-CoA carboxylase (ACC) and fatty acid synthase (FAS). S14 mRNA, which encodes a protein thought to be involved in lipid metabolism, appears to respond in parallel. Unlike liver, which lipogenesis is stimulated by thyroid hormone, thyroid hormone status does not alter the rate of lipogenesis in white adipose tissue. Moreover, in brown adipose tissue, fatty acid synthesis is enhanced in hypothyroidism as compared to eu- or hyperthyroidism. These tissue specific responses to thyroid hormone have been postulated to be due partially to the indirect effects of thyroid hormone on these adipose tissues *in vivo*. To identify the effects of thyroid hormone in adipose tissues and to define the regulatory mechanism, we developed adipocytes systems where the indirect effects of thyroid hormone are abolished. Lipogenesis and the amount ACC, FAS and S14 mRNAs were measured using tritiated water incorporation and northern blot analysis respectively. The effects were relatively small as compared to that of liver, thyroid hormone stimulated lipogenesis 1.5- to 2.5-fold in both type of adipocyte. These results show that thyroid hormone effect on lipogenesis is different *in vivo* and *in vitro*. Insulin enhanced lipogenesis markedly in both types of adipocytes. These responses in the rate of lipogenesis occurred at the level of gene expression, as shown by alterations in the levels of ACC, FAS, and S14 mRNAs. The fold changes seen in these mRNAs were quite sufficient to account for the alterations in lipogenesis. Thus, it appears that the regulation of lipogenesis by thyroid hormone and insulin occurs via changes of the expression of lipogenic genes at pretranslationsl level in adipocytes. The synergistic effect of thyroid hormone and high glucose on lipogenesis seen in liver was not manifested in adipocytes. It seems that these adipocyte systems are useful model to study the effects of hormones on lipogenic gene expression as well as lipogenesis. It remains to be determined whether the modest effects of thyroid hormone represent a limitation of the *in vitro* system or a tissue specific differences between adipose tissue and liver.