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Effect of dietary fats and triiodothyronine administration on the lipid components of serum and tissues in the rat

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With 2 figures and 1 table

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Experimental atherosclerosis could be produced in dogs and other animals by surgical excision of thyroid gland (9), or by the use of thyroid suppressive agents such as thiouracil (17) or radioactive iodine (10) together with increased intake of various fats, especially cholesterol. The combination of cholesterol feeding and thiouracil for production of experimental atherosclerosis in rats has been tried by many authors (2, 3).

Prolonged lipaemia by administration of high lipid diets, together with thyroidectomy in dogs was found to augment capillary permeability and increase serum lipids (cholesterol and total lipids) giving myxoedematous manifestations (6).

Data on the effectiveness of thyroactive compounds in preventing atherogenesis or causing regression of established lesions in experimental animals have been summarized by *Kritchevsky* 1964 (11). Although thyroactive compounds exert an anti-atherogenic effect in cholesterol-fed rabbits, their effect on established lesions is negligible or only slightly inhibitory.

In this study, serum and tissues lipid components in response to high contents of different dietary fats (containing different percentages of enoic acids) alone and combined with triiodothyronine (T_3) in rats were carried out.

Material and methods

The present study was carried out on 36 male and 36 female Wistar rats, 160 g initial body weight, classified into twelve groups. Six groups (3 of male and 3 of female rats) were fed with the experimental diets listed below; the other six groups were fed the same diets added to it 20 µg triiodothyronine per kg of the diet. The daily quantity of the diet for each rat was 10 g. The experimental treatment lasted 60 days. Throughout the experimental period the animals were daily inspected and the body weight recorded. At the end of 8 weeks the animals were then killed by decapitation.

Diet constitution (%)	
Sucrose	56.9
Lactose	4.0
Peanut oil, maize oil, or lard	20.0
Casein (purified)	20.0
Choline chloride	0.1
Salt mixture	4.0
Cellulose	5.0
With the addition per kg of the diet of:	
Water-soluble vitamin mixture	305 mg
Alpha-tocopherol acetate	325 mg
Vitamin A acetate	12,000 IU
Vitamin D ₂ acetate	1,300 IU
Vitamin B ₁₂	30 µg

Lipids from serum, liver, omental, perirenal, brown fat (from the intrascapular region in rat), epididymal fat and aortas were extracted by chloroform, methanol 2 : 1 (8). Pools of 6 rats were run together, estimates were repeated three times and the mean and SE were calculated. Aortas were dissected out from its beginnings up to the bifurcation of iliac arteries (1). Total lipids were determined gravimetrically, by evaporating a known volume of extract under current of nitrogen and keeping in a dessicator till constant weight. Lipids were fractionated by thin layer chromatography (5). Quantitative estimation of each fraction was done by charring method (14).

Results and discussion

From the results in table 1, it is noticed that the percentage of weight gain in male rats was decreased when T₃ was added to the high fat diets. However, this decrease was found statistically insignificant in all the 3 fats used. On the other hand T₃ caused a decrease in the percentage of weight gain in female rats kept on diets containing peanut oil ($P < 0.025$), and maize oil ($P < 0.02$), while insignificant difference was found in case of lard.

Numerous studies on the use of thyroid hormones as hypocholesterolemic agents were done (12, 13, 7, 16, 4). The results presented in this study show that triiodothyronine administration to rats added to diets with high lipid content, caused no change in total lipid content of adipose tissues studied, liver and aortas in both male and female rats (figs. 1, 2). These

Table 1. Percentage weight gain of male and female rats kept on high fat diet and T₃ plus high fat diets.

	Male rats			Female rats		
	Peanut oil	Maize oil	Lard	Peanut oil	Maize oil	Lard
High fat diet (SE ±)	43.63 4.68	42.32 2.99	42.28 5.05	27.94 2.95	25.67 2.26	25.25 2.36
High fat diet (SE ±) + T ₃	37.95 5.35	35.39 8.00	35.32 5.01	18.65 1.66	14.56 3.28	17.71 3.10

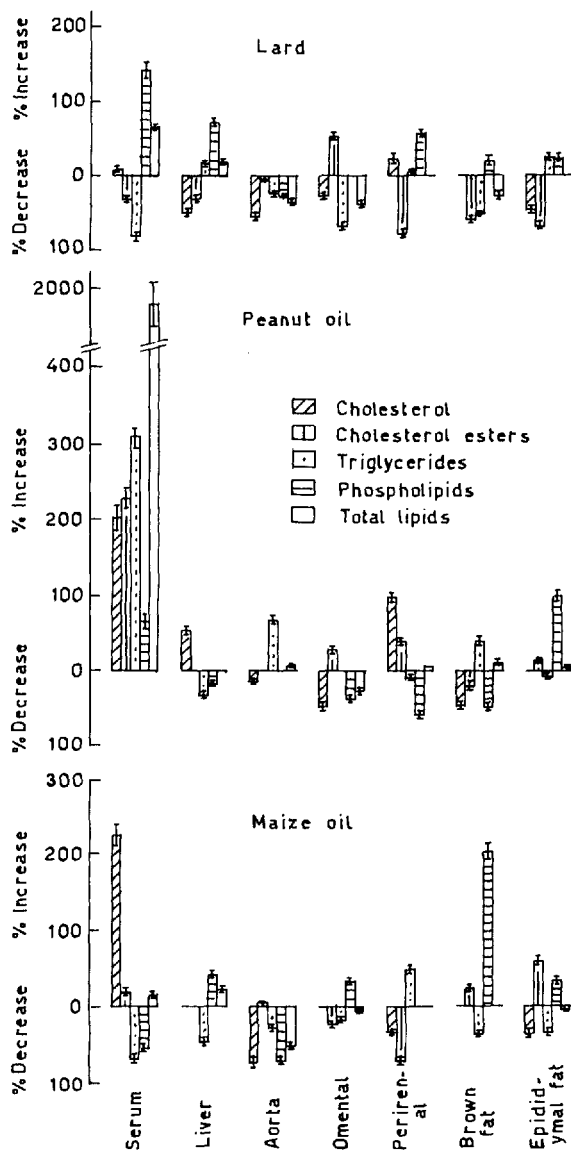


Fig. 1: Percent change in serum and tissues lipid components in response to hypercaloric diets & Triiodothyronine in male rats.

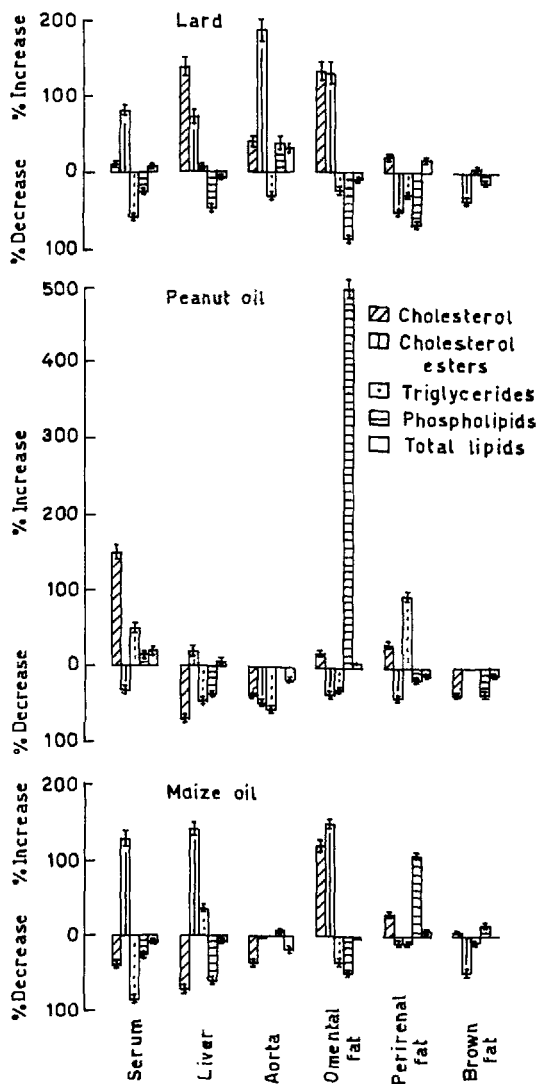


Fig. 2 : Percent change in serum and tissues lipid components in response to hypercaloric diets & Triiodothyronine in female rats.

findings agree with what was found by *Kritchevsky* and *Tepper* (13), they reported that D-thyroxine and L-thyroxine when admixed with diets during the postcholesterol feeding period, a reduction in the severity of atheroma was observed in rabbits.

Diets containing peanut oil together with triiodothyronine caused a slight increase in serum total lipid in female rats, but approximately 20-fold increase in male rats. Studies of *Myasnikova* et al. (15) suggests that thyroid hormones affect lipid metabolism and atherogenesis through an intermediate action on the liver. In this experiment male rats kept on peanut oil (28.4% saturated fatty acids) plus T_3 , there was no change in liver total lipid content compared to those not receiving T_3 . This observation is hard to explain on the basis of these results.

Aorta total lipids and all lipid fractions studied in male rats were decreased in response to T_3 , except a rise in triglycerides content in those kept on peanut oil, was observed. These data agree with what was found by *Yosho* et al. (18) that addition of triiodothyro-fatty acids to atherogenic diets containing cholesterol and hydrogenated fatty acids decreased the elevation of blood total cholesterol and showed a somewhat, though not conclusive, prophylactic effect on the degree of atheromatous lesions of the aorta in rabbits. On the other hand, addition of T_3 to diets containing saturated fatty acids (lard) to female rats caused significant rise in cholesterol esters, phospholipid, and free cholesterol aortic contents. No such increase was observed in diets containing unsaturated fats (maize oil). These findings agree with those stated by *Kritchevsky* (12) that D-thyroxine, D- and L-triiodothyronine caused a very slight inhibitory effect on atheromata progression in cholesterol-fed rabbits, and that keeping animals with pre-established atheroma on a diet containing unsaturated fat the progression of the lesion was significantly retarded.

Summary

Twelve groups of rats were included in this study. Six groups (3 males and 3 females) received high fat diets containing 20% of either peanut oil, maize oil or lard. The other six groups received the same diets plus triiodothyronine.

Triiodothyronine T_3 added to diets containing peanut oil caused slight increase in total serum lipids in female rats, while in male rats serum total lipids were increased about 20-fold.

T_3 administration caused almost no change in aortic total and all lipid fractions in male rats kept on diets containing any of the fats used. Female rats kept on lard plus T_3 showed a rise in cholesterol free and esterified and phospholipid contents of aorta lipids.

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