THE EFFECT OF ANIMAL AND VEGETABLE PROTEIN DIETS ON CHOLESTEROL METABOLISM IN THE RAT

J.S. COHN*, P.J. NESTEL* and W.G. KIMPTON**

The plasma cholesterol level of hypercholesterolaemic patients can be lowered by replacing the animal protein in the diet with protein of vegetable origin (Sirtori et al. 1979). The mechanism for this is unclear although, in rabbits fed soy protein, cholesterol catabolism is raised (Huff and Carroll 1980). The present study was undertaken to examine changes in cholesterol metabolism in rats fed different dietary proteins.

Male Sprague Dawley rats (60-80 g) were fed semipurified diets containing either casein or soy protein. The diets contained 21% protein, 41% carbohydrate, 21% fibre, 8% saturated fat as coconut oil, and 1.2% cholesterol. After 4 weeks on the diet, the casein-fed animals had a significantly higher mean plasma cholesterol level (258 ± 31 mg/100 mL) than the soy-fed animals (115 ± 5 mg/100 mL; $P < 0.005$). Intestinal cholesterol absorption was measured by two methods. In the first, the secretion of cholesterol and triglyceride into thoracic duct lymph was measured after an oral fat load. Six one-hourly lymph samples were collected, starting 3 h after the fat load. In the second procedure, a dual isotope method was employed, in which the absorbed fraction of an oral dose of ^{3}H-cholesterol was calculated by relating plasma ^{3}H to ^{14}C-cholesterol, given intravenously. The results are shown below.

	Method 1			Method 2
	Lymph flow* (mL/h)	Lymph cholesterol* output (µg/h)	Lymph TG/Chol* ratio	% Cholesterol† absorbed
Casein-fed (n=13)	1.14 ± 0.60	803.4 ± 111.0	59.9 ± 11.7	46.5 ± 10.1 (n=8)
Soy-fed (n=9)	1.34 ± 0.67	702.4 ± 161.2	71.5 ± 9.4	48.9 ± 4.9 (n=7)

*Measured 8 h after oral fat load. (Mean ± SEM). †Measured 4 d after injection of labels. % absorbed = $^{3}H/^{14}C$ x 100. (Mean ± SEM).

By both methods, the soy- and casein-fed groups of rats absorbed similar amounts of cholesterol. The disappearance of the intravenously injected ^{14}C-cholesterol was monitored frequently over 4 weeks. The specific radioactivity-time curves for plasma cholesterol could be analysed in terms of a 2-pool model. The calculated cholesterol flux (cholesterol absorbed and endogenously synthesised) for the casein-fed group (21.84 ± 1.09 mg/d) was not significantly different from that for the soy-fed group (22.96 ± 1.80 mg/d). Endogenous cholesterol synthesis must therefore also have been similar. Pool sizes, calculated by isotopic dilution, were larger and the irreversible removal rates significantly slower with casein. The accumulation of cholesterol in the plasma and tissue pools of the casein-fed animals must therefore be due to impairment of cholesterol clearance, possibly due to deficient lipoprotein catabolism.

SIRTORI, C.R., GATTI, E., MANTERO, O., CONTI, F., AGRADI, E., TREMOLI, E., SIRTORI, M., FRATTERIGO, L., TAVAZZI, L. and KRITCHEVSKY, D. (1979). Am. J. clin. Nutr. 32: 1645.

HUFF, M.W. and CARROLL, K.K. (1980). J. Lipid Res. 21: 546.

*Baker Medical Research Institute, Prahran, Victoria 3181. ** Department of Pathology and Immunology, Monash Medical School, Prahran, Victoria 3181