

CASEIN, SOYA PROTEIN, SERUM-CHOLESTEROL

SIR,—Epidemiological studies suggest a relation between intake of animal protein and cardiovascular disease,¹ and several groups have shown that in rabbits semisynthetic diets containing animal proteins such as casein cause hypercholesterolaemia and atherosclerosis, while soya protein has no such effect.² Strictly controlled experiments in man, however, have been rare because it is difficult to change the protein sources in the human diet without simultaneously altering other constituents.^{3,4} We have investigated the effects of casein and soya protein in 69 healthy volunteers (18–28 years of age) under strict dietary control.

Three groups, matched for serum-cholesterol and sex, were fed for 6 weeks on diets containing 13% of energy as protein and 38% as fat, with polyunsaturated to saturated ratio of 0.6 and an average daily cholesterol intake of 380 mg. Caseinate (protein content 95 g/100 g dry weight) and soya isolate (92 g protein per 100 g dry weight) were incorporated into analogues for milk, yoghurt, spreads, meat, bread, biscuits, soups, and sauces, all specially developed and produced for this project. With these products 66–68% of the protein in the diet could be replaced by either soya protein, casein, or a 1:2 mixture of soya and casein (cassoy). The non-replaceable protein was derived from bread, potatoes, and vegetables. All groups received the cassoy diet for a control period of 10 days. During the next 4 weeks one group continued on the cassoy diet, as a check against baseline drift, one took the casein diet, and the third received the soya diet. The volunteers took their hot meals in this department and were given daily individual packages containing the other meals, beverages, and snacks. Participants recorded their actual food intakes, excluding plate waste and so on on questionnaires; they used portable scales. Analysis of these questionnaires and chemical analysis of double portions of the diets revealed identical intakes of total energy, saturated fat, polyunsaturated fat, cholesterol, plant sterols, dietary fibre, pectin, oligosaccharides, total carbohydrates, alcohol, total protein, and, depending on the group, an average daily intake of 55 g casein or of 54 g soya protein.

Throughout the experiment duplicate portions of the diets were collected. These were homogenised afterwards and fed to 12 New-Zealand White rabbits. The casein diet caused a clear-cut, rapid hypercholesterolaemia in the rabbits (table). However, in the volunteers there was not the slightest difference in the effects of the different diets on serum-cholesterol levels (table).

These data suggest that, for healthy young people, there is no difference in short-term experiments between casein and soya protein in effect on serum-cholesterol. Large decreases in serum-cholesterol on soya diets have been reported.⁵ However,

soya preparations may differ in their content of fibre and other substances which may affect serum-cholesterol. These components rather than the protein moiety may have been partly responsible for the observed effects. Carroll et al.⁶ reported that in twelve healthy young women, in whom all other nutrients were kept constant, soya protein caused a small but significant depression of 9 mg/dl (0.23 mmol/l) compared with milk/meat protein. It is unlikely that we would have missed an effect of this size in our groups through chance fluctuations. We cannot explain the difference between our results and those of Carroll et al. except perhaps differences in design, such as the use of casein instead of milk/meat protein. All the same, our results do stress the risk of extrapolating to man from animal data on the effect of protein on serum-cholesterol.

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PRETREATMENT SERUM-CHOLESTEROL AND RESPONSE TO ASCORBIC ACID

SIR,—Treatment of hypercholesterolaemia needs to be life-long. With long-term administration of halogenated hypolipidemic drugs serious side-effects will probably prevail over the therapeutic benefit, as happened with clofibrate¹—hence the search for naturally occurring lipid-lowering agents. In laboratory animals ascorbic acid (vitamin C) stimulates the rate-limiting reaction in the conversion of cholesterol to bile acids, microsomal 7 α -hydroxylation of cholesterol.^{2–4} However, studies of the hypocholesterolaemic effect of ascorbic acid in man are contradictory. I should like to point to one of the causes of this. In a series of studies varying in duration and in ascorbate dosage, I and my colleagues found that the hypocholesterolaemic effect of vitamin C depends on the initial serum-cholesterol level: the lower the serum-cholesterol is to start with, the lower is the decrease brought about by vitamin C (see figure). Extrapolation suggests that below about 190 mg/dl ascorbic-acid treatment will not affect serum-cholesterol concentrations. A similar result was obtained with a combined dietary and clofibrate treatment.⁵ Reports^{6–8} on the inefficacy of ascorbic acid in lowering serum-cholesterol values in healthy people with initial values under 200 mg/dl thus become irrelevant. In hypercholesterolaemic subjects with a low vitamin-C intake, the cholesterol-lowering effect of ascorbic acid is clear-cut.^{9–11} High-density-lipoprotein cholesterol levels rise with increasing plasma-ascorbate levels in elderly men.¹² A daily ascorbic acid intake of around 0.5 g represents a simple, inexpensive, and a safe method of managing secondary hypercholesterolaemia resulting from an imbalance between cholesterol input (increased absorption of exogenous or enhanced synthesis of

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EFFECT OF CASEIN AND SOYA PROTEIN DIETS ON AVERAGE SERUM-CHOLESTEROL (mmol/l)* IN MAN AND IN RABBITS

	Man			Rabbit	
	Casein	Cassoy	Soya	Casein	Soya
Initial	3.93	3.96	3.95	0.78	0.82
Final†	3.85	3.88	3.87	3.09	1.43
Change (mean)	−0.08	−0.08	−0.07‡	+2.30	+0.61§
±SD	±0.37	±0.33	±0.26	±1.70	±0.52
No.	25	20	24	6	6

*1 mmol/l=39 mg/dl.

†Test period in man 4 weeks, and in rabbits 2½ weeks.

‡Not significantly different from casein or cassoy group.

§Significantly different from casein group ($p < 0.05$, $t = 2.33$).