Dietary Protein and Serum Cholesterol in Rats. (22596)

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Undernutrition has been shown to enhance atherosclerosis and hypercholesterolemia in cholesterol-fed chickens(1) and rabbits(2). The role played by protein intake in this phenomenon is not quite clear. Diets high in casein(3) or defatted beef(4) have been reported to be atherogenic for rabbits, although vegetable protein appeared to have no such effect(5). Recently, cholesterol-fed rabbits were maintained on low calorie, high protein diets, and while atherosclerosis was not reduced in these animals, some lowering of the levels of serum cholesterol was observed(6). The purpose of the present investigation was to study the effect of varying amounts of dietary protein on the serum cholesterol of rats being fed this sterol.

Method. Two experiments were carried out; in the first, casein was the protein fed to groups of rats, in the second, Drackett protein* was used (Table I). The diets in the casein series (A to E) contained 10, 10, 20, 40 and 60% protein as noted. No choline chloride was present in diet A, while 0.5% of the compound was added to the remainder of the casein diets. In the Drackett protein series (K to M) the percentages of the protein were 10, 40 and 60, supplemented in each case by 2% choline chloride. Table I gives the percentages of diet components. Protein was increased at the expense of sucrose, and cholic acid(7) was added in order to heighten cholesterolemia. All diets contained 25% lard, 5% H.M.W. salt mix(8), 2% cholesterol, 1% cholic acid and the following vitamin mixture (mg/kg): thiamin 10, riboflavin 10, pyridoxine 10, niacin 10, Ca pantothenate 30, inositol 100, p-aminobenzoic acid 10, folic acid 1, biotin 0.1, mixed tocopherols 40, menadione 1; plus Vit. A 7200 u/kg and Vit. D 1200 u/kg. Diets A-E also contained 4% alphacel. Rats were males of the Charles River strain. Those in Exp. 1 weighed 180 g initially; in Exp. 2, 200 g. After 3 weeks (Exp. 1) or 4 weeks (Exp. 2) on the various diets, all animals were exsanguinated. The livers were pooled by groups and dissolved in 20% KOH for subsequent analysis, and the sera were assayed individually for total cholesterol, using the method of Trinder(9).

* Purified soybean protein prepared by the Drackett Products Co., Cincinnati, O.

Results. Results are given in the Table. The average serum cholesterol value in Group B was 5 times higher than in Group A; while the percentage of liver cholesterol was almost half.

The effects of the incorporation of different percentages of casein in diets are apparent from an examination of data on Groups B through E. When casein comprised 10% of the diet, the average serum cholesterol value was 1132; at 20% it was 658; and at 40%, 460. The average weight of the rats also increased with greater protein intake, as would be expected. However, 60% casein did not produce a further lowering of serum cholesterol and weight gain as compared with 40% casein.

In Exp. 2, where Drackett protein was fed, similar results were obtained in animals receiving increasing amounts of dietary protein. The average serum cholesterol level dropped in Groups K, L and M, the weight of rats rose, and liver weight increased as percentages of protein were raised. In contrast to the observation made in Exp. 1, 60% protein continued to influence these values beyond those at 40%. Whether the higher percentage of choline in the Drackett diets may be related to this difference is uncertain.

The differences between the serum cholesterol level of groups A and B, A and D, C and B and L and M are highly significant ($p < 0.001$) and those between groups C and D and L and K are significant ($p < 0.05$ and $p < 0.03$, respectively).

Summary. Increasing the protein content

TABLE I. Autopsy Data* on Rats Fed Various Levels of Dietary Protein.

Group	Diet components (%) Protein	CCL†	Sucrose	Wt gain (g)	Serum chol. (mg %)	Liver wt (g)	Liver lipid distribution % NS‡	% chol.
Exp. 1								
A	10 C§	—	53.0	– 4	228 (121- 299)	11.8	19.4	9.3
B	10 C	0.5	52.5	–14	1132 (885-1500)	10.5	12.3	5.0
C	20 C	0.5	42.5	96	658 (423- 945)	16.7	13.3	5.7
D	40 C	0.5	22.5	113	460 (274- 983)	16.4	16.9	5.3
E	60 C	0.5	2.5	72	483 (351- 728)	15.2	10.8	5.0
Exp. 2								
K	10 D‖	2	55	–10	637 (341- 978)	12.6	—	—
L	40 D	2	25	174	382 (198- 520)	16.4	—	—
M	60 D	2	5	164	188 (141- 258)	17.2	—	—

* Averages for groups of 6 rats each. † CCL—Choline chloride. ‡ NS—Nonsaponifiable. § Casein. ‖ D—Drackett protein.

of the diets of groups of rats on a normally hypercholesterolemic regimen (cholesterol plus cholic acid) caused a progressive drop in serum cholesterol values. This observation held true when either casein or Drackett protein was used. All diets except one contained added choline chloride. Animals on the choline-free diet had lower serum cholesterol levels and higher liver cholesterol levels than a comparable choline-fed group.

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Serum Glycoproteins in Thyroidectomized Rats. (22597)

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Robbins, Petermann and Rall(1) found that the thyroxine-binding protein of human serum has a solubility, sedimentation constant and electrophoretic mobility in alkaline solution resembling an α-2-glycoprotein. Gersh (2) pointed out that thyroid cells present submicroscopic particles containing glycoproteins and that thyroid colloid has at least 2 proteins with carbohydrate-reacting groups. One of these proteins seems to be identical with thyroglobulin.

However, we were unable to find any reference in the literature dealing with serum glycoproteins in thyroidectomized animals. This paper reports the results of our experiments on the effect of thyroidectomy in serum glycoproteins.

Materials and methods. Male Wistar rats weighing between 50 and 80 g were thyroidectomized under ethyl urethane anesthesia. These animals and a group of normal Wistar rats of the same age, sex and weight were given the normal laboratory diet. After 45 days all animals were bled by heart puncture under ether anesthesia. Blood was left to clot and serum separated. Serum glycoproteins