

Comparative Cholesterol-Lowering Activity of Citrus and Tomato Pectin (33630)

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Citrus pectin, when included in a cholesterol-containing diet, was reported to be an effective hypocholesterolemic agent in several species (1-3). The purpose of the present study was to evaluate the cholesterol-lowering activity of tomato pectin compared with that of citrus pectin.

Methods and Procedure. Forty-eight male weanling rats were randomly assigned to one of the four different rations shown in Table I. All rats were individually caged and allowed *ad libitum* access to feed and water during the 4-week feeding period. On the twenty-eighth day of the study, all rats were weighed and quickly killed in random sequence with a Harvard model 130 RM decapitator and the liver, kidneys, adrenals, and a blood sample collected from each animal. Serum and hepatic cholesterol were determined by a modification of the technique of Mann (4) and total serum and hepatic lipid measured gravimetrically after the Folch-washed tissue homogenate was evaporated to dryness (5).

Results and Discussion. The performance of the four groups of rats as indicated by body weight gain (Table II) was essentially identical. The pectin-fed animals (Rations 3 and 4) consumed slightly more feed; however, body weight gain expressed in terms of feed eaten did not reveal any ration effects. Liver weights of the rats receiving Ration 1 were significantly lighter ($p < 0.01$) than those of the cholesterol-fed animals regardless of whether or not pectin was included in the ration. There was a trend toward heavier kidney weights in the pectin-fed rats, particularly in the rats fed tomato pectin ($p < 0.01$). Rats receiving citrus pectin in the ration were observed to have adrenals which were significantly smaller than any other group ($p < 0.01$). The ration effects on serum and hepatic lipids are presented in Table III.

TABLE I. Experimental Rations.

Ingredient	Ration no.			
	1	2	3	4
Sucrose	59.0	58.0	53.0	53.0
Vitamin-free casein	24.0	24.0	24.0	24.0
Soybean oil	10.0	10.0	10.0	10.0
Salt mixture (USP XIV) ^a	5.0	5.0	5.0	5.0
Vitamin mix ^b	2.0	2.0	2.0	2.0
Cholesterol (USP)		1.0	1.0	1.0
Citrus pectin ^c				5.0
Tomato pectin ^d			5.0	
	100.0	100.0	100.0	100.0

^a Nutritional Biochemicals Corporation.

^b Vitamin Diet Fortification Mix, Nutritional Biochemicals Corporation.

^c Kindly supplied by Mr. Grant H. Palmer, Pharmaceutical Coordinator, Sunkist Growers, Corona, California.

^d Prepared by Dr. Walter L. Thompson, Senior Fellow, Heinz Fellowship, Mellon Institute, Pittsburgh, Pa.

Serum cholesterol and total lipid levels in the citrus pectin-fed rats were the lowest of any treatment group including the rats receiving the cholesterol-free ration. Feeding tomato pectin resulted in serum cholesterol levels which were approximately the same as the rats fed Ration 1. Cholesterol-fed rats not receiving pectin had serum cholesterol levels which were significantly elevated ($p < 0.05$) above all other treatment groups.

Highly significant differences in hepatic cholesterol levels were noted between each of the four treatment groups. Rats fed Ration 2 had hepatic cholesterol levels which were almost seven times higher than in those animals receiving the cholesterol-free ration. Compared with rats fed Ration 2, hepatic cholesterol levels were effectively reduced in both the citrus (—53%) and tomato (—27%) pectin groups.

TABLE II. Comparative Effects of Citrus and Tomato Pectin on Performance and Organ Weights in Cholesterol-Fed Rats.

Variable	Ration no.				SE
	1	2	3	4	
Initial wt. (g)	83	87	83	86	± 1.0
Final wt. (g)	269	283	276	277	± 8.4
Body wt. gain (g)	186	196	193	191	± 7.8
Total feed eaten (g)	447	455	464	473	NA ^a
Feed eaten/g gain	2.40	2.33	2.40	2.47	NA ^a
Liver wt. (% body wt.)	5.14 ^b	5.90	5.62	5.58	± 0.111
Kidney wt. (% body wt.)	0.77	0.78	0.87 ^b	0.80	± 0.015
Adrenal wt. (% body wt. $\times 10^2$)	1.55	1.49	1.46	1.24 ^b	± 0.063

^a Pooled samples.^b $p < 0.01$.

TABLE III. Comparative Effects of Citrus and Tomato Pectin on Serum and Hepatic Cholesterol Levels in Cholesterol-Fed Rats.

Variable	Ration no.				SE
	1	2	3	4	
Serum total lipid (mg/100 ml)	423	544	467	389	NA ^a
Liver total lipid (g/100 g)	5.1	7.9	6.7	6.5	NA ^a
Serum cholesterol (mg/100 ml)	83	96 ^b	84	80	± 4.2
Liver cholesterol (mg/100 g)	205 ^c	1360 ^c	1003 ^c	639 ^c	± 96.2

^a Pooled samples.^b $p < 0.05$.^c $p < 0.01$.

The results of this study indicate that citrus and tomato pectin significantly lower both serum and hepatic cholesterol levels in the cholesterol-fed rat. Citrus pectin is the more effective of the two pectins in this regard. Ershoff and Wells (6) have reported that the cholesterol-lowering effects of apple and citrus pectins is associated with the methoxyl content. The fact that the methoxyl content of the citrus pectin (9.2%) was somewhat higher than that of the tomato pectin (6.5%) may explain the observed

difference in cholesterol-lowering activity.

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