Effect on Experimental Avian Atherosclerosis of Dietary Oils and Gallogen. (22782)

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(Introduced by Camillo Artom)

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The diethanolamine salt of the mono-(+)-camphoric acid ester of α, 4-dimethylbenzyl alcohol (Gallogen) has been reported(1) to impede serum and tissue cholesterol elevations in the cholesterol-fed cockerel. Recently, clinical(2-7) and experimental(8-12) aspects of the relationship between the degree of unsaturation of dietary fats and their effects on serum cholesterol have begun to be explored. The experiment reported here was designed to show what effect the feeding of fats of various degrees of unsaturation, singly and with Gallogen, would have on atherogenesis in the cholesterol-fed cockerel.

Method. The experimental arrangements and procedure were as previously described (1). Twenty-one-day-old cockerels were placed on a diet of Purina Growing Mash and 1% Cholesterol and divided into 6 groups, which received additional materials as follows: Group I, 8% Peanut Oil;* Group II, 8% Coconut Oil;† Group III, 8% Sardine Oil;‡ Group IV, 8% Peanut Oil, 0.1% Gallogen; Group V, 8% Coconut Oil, 0.1% Gallogen; Group VI, Sardine Oil, 0.1% Gallogen. An edible antioxidant, butylated hydroxyanisole (Eastman), 0.01%, was added to the sardine oil and, as a control, to the coconut oil. The diets were mixed every 2 weeks, except for the sardine oil, which was refrigerated and mixed weekly.

Results. Food consumption was equal for all the groups. During the experimental period (Feb.-June) there were 2 deaths. One occurred in Group IV during the seventh week and was of unknown cause; the other was in Group I during the eleventh week and was due to anemia complicated by endocarditis.

TABLE I. Mean Serum Cholesterol Levels in mg per 100 ml.

	Group*					
Wk	I	II	III	IV	V	VI
0	151	151	155	161	149	147
1	497	660	532	511	618	317
2	879	1025	769	725	889	524
3	939	850	910	798	1014	598
4	1113	1002	996	891	784	556
5	1039	934	974	877	814	534
7	1177	1057	886	1058	834	489
9	1081	1061	864	927	919	476
11	1252	1106	469	938	1143	245
12	1475	1154	633	1076	1259	366
13	1331	1001	838	1029	1264	485
14	1304	1118	1123	1014	1046	447
15	1617	1273	1219	1097	1092	568
16	1642	1339	1372	1143	1054	623

* Groups I and II had 8 birds, the remaining groups had 9 each.

The averages of weekly (or fortnightly) individual serum total cholesterol determinations are given in Table I. Unfortunately, 5 days before the blood samples were obtained at the end of week 11, the supply of sardine oil was exhausted. The two groups on sardine oil were fed regular mash until their experimental diet could be resumed at the end of week 11. It can be seen that the serum cholesterol levels of both groups receiving sardine oil declined sharply during this time, but rose again when the experimental ration was resumed. This interruption, although relatively brief, causes the succeeding serum cholesterol figures for Groups III and VI to be somewhat equivocal. The Gallogen-sardine oil group did not rise much above the level attained by week 9, but the sardine oil-alone group continued to rise sharply until the experiment was ended.

Although there were no striking differences among the average serum levels of Groups I, II, and III, the group receiving sardine oil was almost consistently the lowest of the 3, by a small margin.

* Obtained from Welch, Holme, and Clark Co., New York City, Iodine no. 95-100.

† Obtained from Welch, Holme, & Clark Co., New York City, Iodine no. 9-11 m.p. 24°C.

‡ Obtained from Pacific Vegetable Oil Corp., Gardner color 11, Iodine no. 190-200.

TABLE II. Post-Treatment Aortic and Hepatic Cholesterol Concentrations, and Body Weights.

Group	Aortic cholesterol (mg/g dry wt)*	Hepatic cholesterol (mg/g dry wt)*	Avg body wt (g)
I	19.7 ± 4.8†	81.9 ± 8.4	1833
II	20.0 ± 7.6	74.1 ± 17.8	1561
III	20.9 ± 5.8	76.5 ± 17.0	1703
IV	14.6 ± 3.6	78.2 ± 16.5	1727
V	23.9 ± 8.3	74.7 ± 25.9	1637
VI	10.7 ± 3.6	49.7 ± 12.1	1686
Normal (12 wk, from ref. 1)	7.6 ± 1.2	20.5 ± 3.0	—

* The dry wt/wet wt ratio for aorta and liver is 0.25 and 0.42, respectively.

† ± Stand. dev. $\sigma = \sqrt{\frac{\Sigma d^2}{N}}$.

The addition of Gallogen to the rations containing the various oils resulted in a decrease in the serum cholesterol in each case. This decrease was small and inconsistent in the case of the coconut oil (saturated), larger in the case of peanut oil (moderately unsaturated), and quite distinct for sardine oil (highly unsaturated), with the reservations mentioned above.

The body weights at necropsy and the results of the tissue analyses are detailed in Table II. It is apparent that the aortic cholesterol levels were essentially the same for the 3 fat-alone groups, but were again inversely proportional to the unsaturation of the fats when these were co-fed with Gallogen. Hepatic cholesterol was affected markedly only in the group fed both sardine oil and Gallogen. Body weight was highest in Groups I and IV, receiving peanut oil, and lowest in Groups II and V, receiving coconut oil.

It is noteworthy that a separately caged group, not described in this paper but receiving a control atherogenic diet plus a drug having no apparent effect, paralleled closely the serum values of Group I (and their weekly variations) throughout the experimental period, and had aortic and hepatic cholesterol values averaging 19.1 and 84.4 mg/g, respectively. This serves to illustrate the degree of precision attained in this experiment.

Summary. 1. Dietary fats of varying degrees of saturation were no different from each other with respect to their effect on aortic or hepatic cholesterol levels of cholesterol-fed cockerels and only slightly with respect to serum levels. 2. When 0.1% Gallogen was added to the diet, serum and aortic levels were in proportion to the degree of saturation of the fat fed.

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