A PROPOSED MECHANISM FOR THE SERUM CHOLESTEROL REGULATING EFFECT OF DIETARY FATS AND OILS*

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1. Preliminary results reported 2 years ago[1] showed that, under certain conditions, rats behaved similarly to humans regarding the serum cholesterol regulating effect of dietary coconut fat and sunflower seed oil. These studies have now been substantiated by numerous experiments and extended to other fats and oils. Thus in one experiment butter, tallow, peanut oil and pilchard oil, when fed as 20% of the diet, produced serum cholesterol levels in decending order of magnitude with butter as the highest and fish oil the lowest. These differences were sustained for 3 weeks with all oils. The butter and fish oil groups were kept on their diet for a further 7 months, without significant change in serum cholesterol concentration.

2. The chemically separated non-saponifiable fraction of sunflower seed oil, which had been reported earlier to have cholesterol-lowering properties, was further investigated. Different fractions obtained by the physical fractionation (liquid propane segregation process) of the whole oil were tested. It was found, that the heaviest fraction was the most, and the lightest the least potent. These fractions showed quantitative and qualitative differences in the composition of the unsaponifiable matter. The cholesterol-lowering action was unrelated to the fatty acid content and composition, since this was much the same in all of these fractions.

3. The various components of the unsaponifiable portion were next tested in amounts far in excess of those naturally occurring in sunflower seed oil. Fed as pure compounds dissolved in the coconut fat of the standard diet, β sitosterol had little effect, while squalene had a slight cholesterol-lowering effect. Combinations of these with β carotene and α tocopherol (vitamin E) produced a significant effect.

The conclusion was drawn that although substances which are present in the unsaponifiable fraction have been shown to have a certain serum cholesterol lowering effect, this could not be shown to be responsible for the action of the oil as a whole. Thus it appears possible that the effects of different oils can only be explained in terms of some property of the oil as a whole.

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4. The effect on the serum cholesterol of rats of feeding cholesterol was next investigated. It was found that large doses of cholesterol fed with a virtually fat-free diet did not raise the serum-cholesterol levels. If it was fed dissolved in oil the serum cholesterol level became elevated. Dietary cholesterol apparently exerts little effect on the serum cholesterol levels in the absence of dietary fat.

5. The solubility of cholesterol in a variety of fats and oils at 37°C as determined *in vitro* was next compared with the serum cholesterol level produced when these oils were fed to rats. There was a good correlation. Thus the high serum cholesterol produced by coconut fat, for example, was reflected in a comparatively high solubility in this fat. The reverse was found in fish oil which had the lowest solvent capacity.

6. The hypothesis was advanced that the proporties of different fats to raise or lower the serum cholesterol levels may be due to their different capacities to dissolve cholesterol, both dietary or endogenous. The different cholesterol-raising properties of fats originally free from cholesterol, viz. coconut oil, may thus find an explanation through their ability to cause the intestinal re-absorption of biliary cholesterol.

7. On the above hypothesis there should be a certain amount of cholesterol, when fed with a given quantity of fat, above which no further rise in serum cholesterol is observed. This amount of cholesterol would correspond to the quantity necessary to saturate the fat with cholesterol. This appeared to be the case. In a direct experiment, increasing percentages of cholesterol in sunflower seed oil were fed to rats. Above 4 – 6% no further rise in serum cholesterol was observed.

8. Evidence was presented in support of the view that under certain conditions man can absorb dietary cholesterol, and the application of the solubility hypothesis to man was discussed.

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REFERENCE

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