

# Oxy-Cholesterols in Food

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Years ago the discussion around cholesterol in food began. Cholesterol was viewed as causing arteriosclerosis and being responsible for the formation of plaques. In the sixties and seventies cardiologists recommended their patients eat low cholesterol foods and more polyunsaturated fatty acids. Linoleic acid became famous. The sales of products rich in this essential fatty acid — especially diet margarines — were staggering.

The knowledge about the fat metabolism in the body has increased enormously. The discussion is not limited any more to saturated fatty acids, linoleic acid and cholesterol, but is far more diversified towards other fatty substances. The unravelling of prostaglandin metabolism and the discovery of the effects of the leuko-trienes in the human body have helped a lot in the understanding of the functions of fatty acids. The scope is no longer directed only towards linoleic acid. The therapeutic value of gamma-linolenic acid in evening primrose oil is now confirmed by many physicians. The same can be said about the effects of EPA in fish oil. Every month new studies are published in which the value of these newly discovered polyunsaturated fatty acids are recognized, especially in the treatment of heart disease.

However, little is said about the *quality* of these highly unstable compounds. Outside the body as well as inside, polyunsaturated fatty acids and also cholesterol are very susceptible to all kinds of chemical reactions. Free radical reactions and oxidation cause degradation of these healthy, physiologic substances, which then turn into toxic compounds. R. Sieber has published in the German journal *Ernahrung* a review article, in which he wonders if the oxy-cholesterols are the primary cause of arteriosclerosis.<sup>1</sup> He mentions an animal experiment with rabbits, in which pure

cholesterol as well as oxy-cholesterols have been given. After 45 days, thickening of the intima of the aorta has been observed in the oxy-cholesterol group. No thickening was observed in the rabbits which got the pure cholesterol. The same experiment has been done with monkeys. The results were the same. Radio-active labeled oxy-cholesterols showed that they were notably connected to the LDL's and VLDL's. There was practically no affinity towards the High Density Lipoproteins.

So the oxy-cholesterols seem to have atherogenic activity. In the same article Sieber mentions research in which has been demonstrated that the oxy-cholesterols are also cytotoxic, mutagenic and even carcinogenic.

Oxy-cholesterols are only found in food of animal origin, or in food in which animal products are used. Table 1 shows a short overview of products in which oxy-cholesterols are found. Products which are extensively exposed to air are most suspected, like powders of egg and milk.

**Table 1.**

Bacon  
Brains  
Butter  
Cheese (grated)  
Chips  
Egg products  
Fast foods (containing butter and eggs)  
Lard  
Milk powder  
Parmesan cheese  
Pork  
Radiated food (gamma-radiation)  
Salami

During the drying process they are exposed to air for a rather long time. Furthermore, because of the granule structure, a large surface is in direct contact with air. Unfortunately these powders are now processed with many foods. Peng and Taylor<sup>2</sup> have found oxy-cholesterols in baby nutrition. Milk itself lacks oxy-cholesterols.

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The circumstances in milk are unfavourable for the formation of oxy-cholesterols. Also beef (muscle meat) and fresh foods which have not been exposed to air are low in oxy-cholesterols.

So the discussion around the arterio-genesis of cholesterol-rich food might be altered towards the atherogenic role of the oxy-cholesterols. Cholesterol itself is a valuable substance and is used in the body for different purposes. It is the precursor of bile acids, the sex hormones and vitamin D. It is a part of the cell membrane. When the diet is low in cholesterol, the body starts producing cholesterol in higher amounts itself. Over the years many studies have been performed to prove that cholesterol is atherogenic. Now, with these new data, cholesterol itself may be harmless but the degraded products of cholesterol are the malefactors.

Egg powder, butter, milk powder and many other dairy products are processed in fast food. This may be one of the main reasons why fast food is so unhealthy. To avoid the oxy-cholesterols, fast food should be avoided. Instead, high quality products, containing the intact cholesterol and other poly unsaturated fatty

acids should be used. "High quality" should be emphasized, especially for oily and animal products. They must be kept away from air, light and heat. Only small amounts should be bought. At temperatures above 50° C oxy-cholesterols are formed. Products which are kept for a long time and contain egg and/or milk powder and butter, such as chocolate, cakes, biscuits and other pastry cook products are dangerous. The food industry should pay attention to the processing and preservation of their products. Packaging with nitrogen to avoid contact with air, and the use of anti-oxidants are measures which would diminish the formation of oxy-cholesterols. And last but not least, governments should set criteria which these products must meet. This would be a major advance in protecting the individual from arteriosclerosis and possibly other degenerative diseases.

### References

1. Sieber R: Oxidiertes Nahrungscholesterin — eine Primarursache der Arteriosklerose? *Ernahrung*, 10, nr.8, 1986, p. 547.
2. Peng SK, Taylor CB: In: Perkins E.G., Visek W.J. *Dietary fats and health*. Am. Oil Chem. Soc., Champaign, 1983, p. 919.