

The Impact of Omega-3 Polyunsaturated Fatty Acids on Lipid Metabolism, Composition and Oxidizability of Low-density Lipoproteins and on Endothelial Adhesion Molecules

Sarah Egert^{1,3}, Veronika Somoza², Helmut F. Erbersdobler¹, Ursel Wahrburg³

¹ Christian-Albrechts-University of Kiel, Kiel, Germany, ² German Research Centre of Food Chemistry, Garching, Germany, ³University of Applied Sciences, Muenster, Germany

The individual effects of the dietary omega-3(n-3) polyunsaturated fatty acids alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) on lipid metabolism, composition and oxidizability of low-density lipoproteins (LDL), and on several endothelial adhesion molecules have been investigated in a strictly controlled dietary study in 48 healthy volunteers. Subjects received a 2-week wash-in diet rich in monounsaturated fatty acids (21% of energy) followed by experimental diets enriched with about 1% of energy of ALA, EPA, or DHA for 3 weeks. All diets consisted of conventional mixed foods. The n-3 fatty acids were provided with special rapeseed oils and margarines. Venous blood samples were obtained at the beginning of the study, at the end of the 2-week wash-in period, and after the 3-week experimental period.

Main results: All three experimental diets significantly decreased lag time until start of oxidation of isolated LDL particles suggesting enhanced susceptibility to oxidation. This reduction was significantly more pronounced in the EPA-diet group and DHA-diet group as compared to the ALA-group. The DHA-diet significantly increased the maximum amount of conjugated dienes, which is consistent with increased LDL oxidizability on this diet. The experimental diets led to a significant enrichment of LDL with the administered fatty acids ALA, EPA, or DHA. However, the increase of ALA, EPA and DHA differed between the three diets: On the ALA-diet, there was a 2-fold increase in the ALA content. On the EPA-diet, the amount of EPA increased 9-fold, and the DHA-diet increased the DHA content 3-fold. On the ALA-diet there also was an increase in EPA content. The EPA-diet led to an additional enrichment with ALA and with DHA, while the DHA-diet further increased the amount of ALA and EPA. The serum concentrations of the soluble cell adhesion molecules (sE-selectin, sICAM-1, sVCAM-1) were not significantly affected by the experimental diets.

In conclusion, the results of the study clearly show that there are metabolic differences between the individual n-3 PUFA.