Comparative effects of EPA and DHA ethyl esters and fish oil on hepatic fatty acid metabolism in the rat

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Physiological activity of fish oil, and ethylesters of eicosapentaenoic (EPA) and docosahexaenoic acids (DHA) in affecting hepatic fatty acid metabolism was compared in the rats. Rats were fed experimental diets containing either 9.4% palm or fish oil, and those containing 4% EPA ethyl ester or 4% DHA ethyl ester or a diet containing both 1% EPA and 3% DHA ethyl esters for 15 days. Dietary fat content of diets containing EPA and DHA ethyl esters were adjust to be 9.4% by adding palm oil. Fish oil diet serves 1% EPA and 3% DHA in the form of triacylglycerol. Fish oil diet compared to a control diet containing 9.4% palm oil significantly increased mitochondrial fatty acid oxidation rate. However, the diets containing EPA and DHA in the form of ethyl ester failed to do so. Compared to control diet, all the diets containing EPA and DHA in the form of either ethyl esters or triacyglycerol significantly increased peroxisomal fatty acid oxidation rate. The extent of increase was, however, greater with fish oil diet (3.1-fold) than with diets containing EPA and DHA as ethyl esters (1.5- to 1.7-fold). All the diet containing EPA and DHA compared to a control diet also increases activity of various fatty acid oxidation enzymes except for 3-hydroxyacyl-CoA dehydrogenase. Again, the extents of increase were much more grater when these n-3 fatty acids were given in the form of triacygricerol rather than of ethyl esters. All the diets containing EPA and DHA also increased the gene expression of hepatic fatty acid oxidation enzymes. However, the extents of the increase were again much greater with a diet containing fish oil than with those containing EPA and (or) DHA ethyl esters. The diets containing EPA and DHA ethyl esters and fish oil, compared to a control diet, greatly decreased activity and mRNA levels of lipogenic enzymes. The extents of the decrease were comparable in the animals fed fish oil and those fed EPA and DHA in the form of ethylesters, however. Fish oil diet and diets containing EPA and DHA ethyl ester greatly increased the content of EPA, DHA and docosapentaenoic acid (DPA) in hepatic total lipid. Sum of the values of theses n-3 fatty acids was significantly higher (13-18%) in the animals fed fish oil than in three groups of rats fed EPA and DHA ethyl esters. The value in triacyglycerol fraction was also significantly higher (60-90%) in fish oil group than in the groups of rats fed EPA and DHA ethyl esters. But no such differences were seen in phospholipid fraction. It is apparent that EPA and DHA in the form ethyl ester do not mimic the physiological activity of fish oil in affecting fatty acid metabolism. EPA and DHA supplied in diet in the form triacyglycerol compared to those supplied as ethyl esters appeared to be more competent in affecting hepatic fatty acid. The differences may exist between n-3 fatty acid supplied in the form of ethyl esters and triacyglycerol in intestinal absorption and (or) subsequent metabolic fate in liver and hence may cause divergent effects in hepatic fatty acid metabolism.