Long Chain omega-3 polyunsaturated Fatty Acids of Plant and Marine Origin: Impacts on Human Health

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Increasing recognition of the importance of the long chain omega-3 polyunsaturated fatty acids (PUFAs), eicosapenatenoic (EPA) and docosahexaenoic acids (DHA), to cardiovascular health, and in the case of DHA to normal neurological development in the fetus and new born, has focused greater attention on the dietary supply of these fatty acids. Daily intakes of EPA/DHA are in the region of 0.1 to 0.5g/d in most European countries and current intake in the UK is reported to be 0.18g/d. Secondary intervention trials have shown intakes of ^0.85g/d of EPA/DHA to reduce mortality from subsequent myocardial infarction and recent recommendations have advised daily intake of 0.45g EPA/DHA per day for healthy adults. During the last trimester of pregnancy the developing fetus assimilates at least 0.4g DHA per week and requirements remain high throughout lactation. Therefore even the most conservative estimates of requirements for EPA/DHA suggest there is a gap between requirement and dietary provision. During periods of high demand, such as pregnancy and lactation, it is clear that for DHA, dietary intake alone would be insufficient to meet demand.

The reason for low intakes of EPA/DHA in most developed countries is due to the low consumption of oily fish, the richest dietary source of these fatty acids. An important question is whether dietary intake of the precursor omega-3 fatty acid, á-linolenic acid (ALNA), can provide sufficient amounts of tissue EPA and DHA by conversion through the omega-3 elongation and desaturation pathway. ALNA is present in significant amounts in plant sources including green leafy vegetables and commonly consumed oils such as rape seed and soyabean oils so that increased intake of this fatty acid would be easier to achieve than via increased fish consumption. However ALNA feeding studies and stable isotope studies using 13C-ALNA, which have addressed the question of bio-conversion of ALNA to EPA and DHA, have concluded that in adult men, conversion to EPA is limited (approximately 8%), and to DHA is extremely low (<0.1%). In women, fractional conversion to DHA appears to be greater (9%) and this may partly be due to a lower rate of utilisation of ALNA for ß-oxidation in women. Upregulation of the conversion of EPA to DHA has been suggested to be due to the actions of oestrogen and may be of particular importance in maintaining adequate provision of

DHA in pregnancy. Although these data are based on studies in a small numbers of individuals, they are supported by a study of 175 subjects which showed that the DHA concentration in the plasma cholesteryl ester fraction was greater in women than in men, and was increased further by use of an oral contraceptive pill. The effect of oestrogen on DHA concentration in pregnant and lactating women awaits confirmation.

The major plant source of omega-3 fatty acids, ALNA, appears to undergo limited conversion to DHA in humans. Adequate intakes of preformed DHA, in fish and other animal products, may be important for optimal nutritional health. Ability to upregulate ALNA conversion to DHA in women may be important for meeting the demands of the fetus and neonate for DHA.