GUEST EDITORIAL

Incorporation of *n*-3 polyunsaturated fatty acids into processed foods

The paper by Lovegrove *et al.* (1997) in the present issue of this journal clearly shows that it is technologically possible to fortify common foods (bread, biscuits, cakes, ice-cream, orange juice, milk shake, spreads, pasta, mayonnaise and vinaigrette) with long-chain *n*-3 polyunsaturated fatty acids (PUFA) such that they are indistinguishable from control non-fortified foods, and to lead to a doubling of platelet phospholipid *n*-3 PUFA in just 21 d. This opens up the possibility that an increased intake of *n*-3 PUFA may be achieved without an increased intake of oily fish. To have this additional string to our public health nutrition bow is quite a boost. As the paper points out, there is a large gap between the prevailing consumption of oily fish and the intake of *n*-3 PUFA recommended by many expert committees (British Nutrition Foundation, 1992; FAO/WHO, 1993; Scientific Committee for Food, 1993). This is not a problem peculiar to the UK, as is evident from Table 1 which looks at the best-possible scenario for *n*-3 PUFA intake in ten EU states. It is a best-possible scenario because in this analysis it is assumed that all seafood consumed is oily fish and that the *n*-3 PUFA content is for the species richest in *n*-3 PUFA. The Iberian peninsula countries come closest to the figure of 2·0 g *n*-3 PUFA/d which was the target figure in the paper under discussion. For most countries, however, bearing in mind that this is a best-possible scenario, there is a long way to go towards improving *n*-3 PUFA intake. One way to improve these figures is to increase the percentage of consumers who eat oily fish on a reasonably regular basis. Although that remains a definite strategy for increasing *n*-3 PUFA intake, in some countries data exist to suggest that this strategy will not resolve the problem. For example, a survey of 1400 Irish adults found that two-thirds ‘do not

Table 1. *Best-case estimates* of fish intake,* n-*3 PUFA intake (g/d) and percentage contribution of* n-*3 PUFA to energy intake in selected countries*

	Fish intake (g/d)	*n*-3 PUFA intake (g/d)	Energy intake (MJ/d)	*n*-3 PUFA intake (% energy)
Belgium	17	0·34	10·4	0·12
Denmark	26	0·52	11·3	0·17
France	41	0·82	NA	NA
Germany	16	0·32	8·8	0·13
Ireland	19	0·38	9·7	0·14
Italy	24	0·48	11·4	0·16
Netherlands	10	0·20	10·1	0·07
Portugal	92	1·84	10·7	0·64
Spain	72	1·44	12·7	0·42
UK	27	0·54	8·7	0·23
Mean	34	0·68	10·4	0·23

NA, Not available.
* Based on mean values for the total population in nationally representative food consumption studies. Prepared for Director General V of the European Union Commission by Nutriscan Ltd. of Trinity College Dublin (contract no. 92CV01297 B 34300).

intend to increase their fish consumption over the next 3 years' (Kearney, 1994). An alternative strategy might be to increase consumption of foods rich in the C18 *n*-3 PUFA, α-linolenic acid. However, the rate of conversion of this fatty acid to the long-chain *n*-3 PUFA is low (Indu & Ghafoorunissa, 1992). Nonetheless, oils rich in both the shorter- and longer-chain *n*-3 PUFA may play a complementary role in enriching foods with *n*-3 PUFA. Indeed, future developments in biotechnology may see some vegetable oils emerge with reasonable levels of long-chain *n*-3 PUFA which will overcome the environmental impact of ever-increasing sea fisheries catches or the ever-expanding, and environmentally-difficult, fish-farm industry.

One of the consequences of having branded foods available that are rich in *n*-3 PUFA is that their promotion by the private sector may be more successful than that attainable through the generic promotion of fish. We have seen how the margarine industry, by providing *n*-6-rich PUFA spreads, has done more to create an awareness of the desire for an optimal balance of dietary fatty acids than most governmental budgets could ever achieve. Equally, the breakfast cereal industry has fostered a knowledge of fibre and soluble fibre to a much greater extent than public health nutrition programmes. Where proprietary commercial interests and public health nutrition interests coincide, the consumer wins.

In the study of Lovegrove *et al.* (1997) the target *n*-3 PUFA intake was 1·8 g/d, and in their paper the authors discuss many other studies of the effects of *n*-3 PUFA at different doses. Several factors influence the degree of incorporation of *n*-3 PUFA into platelet phospholipids: the baseline *n*-3 PUFA level in phospholipids, the dose of *n*-3 PUFA, and the duration of exposure. Most studies involve, for purely opportunistic reasons, larger doses for shorter periods. The present study with 1·8 g *n*-3 PUFA/d led to a doubling of the level of *n*-3 PUFA in platelet phospholipids without any effect on plasma triacylglycerol (TAG) levels. However, another study (Roche & Gibney, 1996) observed a significant blunting of a high-carbohydrate-diet-induced elevation of plasma TAG with 1·0 g *n*-3 PUFA/d for 12 weeks. It may well be that the dose–response curve for *n*-3 PUFA will differ from one metabolic effect to another. For example, Wallace *et al.* (1995) found that 0·72 g *n*-3 PUFA/d for 4 weeks significantly altered leucocyte function and cytokine production in healthy women. Perhaps the effect of *n*-3 PUFA on plasma TAG lies at the upper end of the dose–effect curve and therefore only becomes evident after a reasonable period of *n*-3 PUFA intake.

The paper by Lovegrove *et al.* (1997) shows that it is now technologically possible to enrich common foods with *n*-3 PUFA without any effect on quality or consumer acceptability. The more we understand about the dose–response effects of *n*-3 PUFA at lower levels of intake and the effects of time thereon, the more confident we can become of the value of enriching specific foods with *n*-3 PUFA to a meaningful degree. Increasing consumer options to improve *n*-3 PUFA intake can only be a good thing.

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