

Summer Meeting, 4–6 July 2011, 70th Anniversary: From plough through practice to policy

Dose response in $n-3$ PUFA incorporation into human plasma phosphatidylcholine over 12 months

A. L. West¹, L. M. Browning², J. Madden¹, A. P. Mander³, C. G. Walker², S. A. Jebb²
and P. C. Calder¹

¹Institute of Human Nutrition and DOHaD Division, School of Medicine, University of Southampton, IDS Building, Southampton General Hospital, Southampton SO16 6YD, UK, ²Medical Research Council Human Nutrition Research, Fulbourn Road, Cambridge CB1 9NL, UK and ³Biostatistics Unit Medical Research Council Biostatistics Unit, University Forvie Site, Cambridge, UK

There is evidence that increased consumption of the $n-3$ PUFA EPA and DHA, found in seafood and in marine oils, influences cell and tissue function contributing to improved human health⁽¹⁾. Increased intake of EPA and DHA results in their increased incorporation into plasma phospholipids such as phosphatidylcholine (PC)⁽¹⁾. Maximal incorporation happens within a few weeks of beginning a regimen of increased consumption and occurs in a linear dose-response fashion⁽¹⁾. However, studies performed to date investigating the incorporation of EPA and DHA into plasma PC have most often used marine oils consumed on a daily basis. Thus, although much is known about the effect of very frequent intake of EPA and DHA, this situation does not mimic what occurs with less frequent intake of these fatty acids such as when oily fish are consumed just a few times per week. Therefore, the current study set out to describe the effect of increased $n-3$ PUFA intake mimicking the consumption of one, two or four oily fish meals per week on the fatty acid composition of human plasma PC over a 12-month period.

Healthy male and female volunteers (n 204) aged 20–80 years were recruited into a double blind, placebo controlled trial and were randomly assigned to one of five groups each comprising equal gender and age distributions (n 40–42/group). Subjects consumed six 1 g capsules per d for 12 months; capsules contained either placebo oil (an oil mix replicating the fatty acid composition of the average UK adult diet) or fish oil (total dose designed to approximate the EPA and DHA content of one portion of oily fish). Subjects in the placebo group consumed placebo for all days; subjects in the '1 portion of oily fish/week' group consumed fish oil capsules (providing 1.77 g EPA + 1.5 g DHA) on 1 d of each week and placebo capsules on the other 6 d of each week; the '2 portions of oily fish/week' group consumed fish oil capsules on 2 d of each week (6.5 g EPA + DHA) and placebo capsules on the other 5 d of each week; the '4 portions of oily fish/week' group consumed fish oil capsules on fourth day of each week (13.1 g EPA + DHA) and placebo capsules on the other 3 d of each week; the fifth group '2 portions-continuous' consumed two fish oil capsules (providing 0.9 g EPA + DHA) and four placebo capsules/d. Blood was collected in the fasting state on nine occasions (at 0, 1, 2 and 4 week and 2, 3, 6, 9 and 12 month) and plasma was prepared. Plasma PC fatty acid composition was determined by GC. Fatty acids are reported as weight %.

One hundred and sixty-three subjects completed the study (n 30–35 per group). There was a significant treatment effect seen at 12 months in plasma PC EPA ($P < 0.0001$) and DHA ($P < 0.0001$) and EPA + DHA ($P = 0.0001$). There were higher concentrations of EPA and DHA in plasma PC at 12 month in all groups receiving fish oil and the content of EPA, DHA and EPA + DHA in PC at 12 months was dose-dependent. The '4 portions/week' dose resulted in the highest EPA and DHA contents with mean differences from the placebo group of 2.31 and 2.37 %, respectively. The maximum content of EPA (~3.5 % of total fatty acids) was reached within 1–2 weeks of starting the intervention and that of DHA (~5.9 % of total fatty acids) was reached in 2–4 weeks and remained stable at this level for the remainder of the intervention. Importantly, there was no significant difference between the group taking two 'portions of oily fish/week' as an intermittent dose compared with those taking it as an even, daily dose.

Providing EPA + DHA at the level of 13.1 g/week taken intermittently over 4 d/week to mimic consumption of four portions of oily fish significantly increases plasma PC EPA and DHA. These findings demonstrate that the supplementation of EPA and DHA does not need to be continuous (i.e. daily) to produce a significant increase in those fatty acids within plasma PC.

This work is supported by the Food Standards Agency (contracts N05065 and N05066).

1. Calder PC & Yaqoob P (2009) Understanding omega-3 fatty acids. *Postgrad Med* **121**, 148–157.