

Concurrent Session 8

Alternatives for elevating the omega 3 LCPUFA status of the population

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Background - Health authorities have recognised the importance of omega 3 long chain polyunsaturated fatty acids (LCPUFAs) in maintaining health. It is generally accepted that we need to increase our dietary intake of these fatty acids, particularly eicosapentaenoic acid (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA) through an increased intake of fish, consumption of fish oil supplements or increasing our intake of omega 3 enriched foods. These recommendations represent significant changes in dietary habits and rely heavily on an already declining global fish supply. Are there alternatives to elevate the omega 3 LCPUFA status of the population? α -linolenic acid (18:3n-3, ALA) is a substrate for the fatty acid synthetic pathway and is converted to EPA and DHA. Increasing ALA intake from vegetable oils improves the EPA status in humans but has only a marginal effect on DHA status. Two fatty acids downstream of ALA, EPA and docosapentaenoic acid (22:5n-3, DPA), are also substrates for the pathway and may be more readily converted to DHA.

Objective - To compare the accumulation of DHA in human hepatoma (HepG2) cells supplemented with ALA, EPA and DPA.

Methods - HepG2 cells were seeded and grown in DMEM plus 10% foetal calf serum. After three days, the medium was replaced with serum free medium supplemented with increasing concentrations of ALA, EPA or DPA bound to bovine serum albumin. After 48h, cells were harvested for fatty acids analysis by gas chromatography.

Outcomes - There was a dose-dependent increase in the level of ALA, EPA and DPA in HepG2 cell phospholipids following supplementation with each of these fatty acids. The accumulation of EPA following supplementation with ALA, EPA and DPA was also dose-dependent. Following supplementation with ALA, EPA or DPA, the level of DHA in cell phospholipids increased 1.7-, 2.4- and 2.8-fold, respectively. The accumulation of DHA was significantly ($P<0.05$) higher in cells supplemented with EPA and DPA compared to those supplemented with ALA.

Conclusions - Foods rich in fatty acids downstream of ALA in the fatty acid synthetic pathway, such as EPA and DPA, may provide an alternative means to elevate the omega 3 LCPUFA status of the population.

A valid and reproducible food frequency questionnaire to estimate long chain omega-3 polyunsaturated fatty acid intakes

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Background - A new food frequency questionnaire (FFQ) has been developed at the University of Wollongong to estimate dietary long chain omega-3 polyunsaturated fatty acid (LC n-3 PUFA) intakes.

Objectives - To validate the new FFQ upon comparison with another well known dietary analysis method and biomarkers of LC n-3 PUFA intake. To determine the reproducibility of the FFQ.

Design - Healthy subjects (n=53) gave a fasting blood sample and completed both the FFQ and a 3-day weighed food record (FR). Average daily LC n-3 PUFA intakes from the FFQ and FR were determined and compared for differences using Wilcoxon signed rank tests. Red blood cell (RBC) and plasma fatty acids were measured by gas chromatography. Spearman correlation co-efficients assessed the relationship between LC n-3 PUFA intakes from the FFQ and both RBC and plasma LCn-3 PUFA (expressed as a % of total fatty acids). In a separate study, 33 subjects completed the FFQ twice, four to six weeks apart. Spearman correlation co-efficients assessed the relationship between intake estimates from the repeat FFQs.

Outcomes - There were no significant differences between intakes from the FFQ and FR and Spearman correlation co-efficients were 0.81, 0.81, 0.70 and 0.70 for total LCn-3PUFA, EPA, DPA and DHA respectively ($P<0.0001$). Significant Spearman correlation co-efficients were obtained between the FFQ intakes and RBC fatty acids for total LC n-3 PUFAs, EPA and DHA (0.50, 0.39 and 0.40 respectively) but not for DPA. Very similar results were obtained for plasma fatty acids. Significant Spearman correlation co-efficients for intakes of EPA, DPA, DHA and total LC n-3 PUFA from the repeat FFQs were 0.88, 0.90, 0.87 and 0.88 respectively.

Conclusion - The new FFQ is valid and reproducible.