Concurrent Session 10: Omega 3s

Long chain polyunsaturated fatty acids and bone health: epidemiological and human data

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Osteoporosis represents a major challenge to health care services. Polyunsaturated fatty acids (PUFAs) may be required for renal calcium metabolism and for the regulation of the normal balance between bone and ectopic calcification. Experimental animal and human studies have indicated that PUFAs enhance calcium absorption, reduce urinary calcium excretion, and increase bone calcium content and density. Long chain PUFA (LCPUFA) may therefore play a role in bone maintenance as well as prevention of bone loss. Epidemiological studies indicate that frequent consumption of fish is positively associated with changes in bone mineral density (BMD). These observations have been made in a female population in Norway as well as in Japan where higher n-3 status is linked to higher BMD. A recent investigation of the association between the ratio of dietary n-6 to n-3 fatty acids and BMD indicated a significant inverse relationship between the ratio of dietary linoleic acid to α-linolenic acid and BMD at the hip of men and women. This study further showed that an increasing ratio of total dietary n-6 to n-3 fatty acids was significantly associated with lower BMD in women. Some interaction with hormone replacement therapy was also shown. In contrast a longitudinal observational study reported negative associations between total PUFA intake and bone mass when dietary calcium was also low. There have been minimal studies on bone accretion and the effects of the LCPUFA in children. A study in 1996 indicated that total dietary PUFA were associated with increases in bone density in girls aged eight – 16 years but not in boys of the same age. In the NO study (2007), 95 healthy adolescent white males were recruited and factors important for development of BMD and body composition were assessed after five years. Serum docosahexaenoic acid (DHA) and total n-3 were positively correlated with BMD of the total body whilst changes in BMD of the spine between the ages of 16 and 22 were positively correlated with arachidonic acid, DHA and total n-3. Experimental studies in humans are controversial. In elderly women a mixture of evening primrose and fish oils together with calcium enhanced femoral bone mass by 1.3% compared to a decline in the placebo group of 2.1% over 18 months. However, no benefit or harm to bone mass was observed in premenopausal women after supplementation with a similar mixture plus 1000mg of calcium for one year. These findings suggest that long term intervention studies are needed to clarify the role of LCPUFA in maintenance of bone.

Lipid-lowering potential of combined phytosterols and long chain omega-3 polyunsaturated fatty acids (LCn-3PUFA) in hyperlipidemia

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Background – Hyperlipidemia is a major risk factor in the development of cardiovascular disease (CVD). Fish oils rich in LCn-3PUFA can reduce circulating triacylglycerides (TG) and raise high density lipoprotein (HDL) cholesterol. Phytosterols, incorporated into fat spreads have been shown to reduce total cholesterol (TC) and low density lipoprotein (LDL) cholesterol in normocholesterolemic and hyperlipidemic subjects.

Objective – To investigate the synergistic effects of phytosterols and LCn-3PUFA on plasma lipid profile in hyperlipidemic subjects.

Design – Double-blind randomised controlled trial in four parallel groups. Thirty-one (male n=17; female n=14) participants with established hyperlipidemia ([mean±SEM] TC 6.56±0.15mmol/L; TG 1.69±0.11mmol/L) were randomised to receive either LCn-3PUFA (1.5g/day EPA+DHA) or placebo (sunola oil) supplements alone, or in combination with a phytosterol-enriched spread (25g/day margarine) providing 2g/day of phytosterols, for three consecutive weeks. Outcome measures included plasma total-, LDL-, HDL-cholesterol and TG concentration and projected risk analysis of CVD was calculated.

Outcomes – The combination of phytosterols and LCn-3PUFA significantly reduced TG concentrations by 30.25±7.42% (P=0.005) after three weeks. Changes in other lipoproteins included a reduction in TC and LDL-cholesterol (9.50±1.24%; 11.23±5.97% respectively) and an increase in HDL-cholesterol (10.18±4.29%), although not significant. Highest CVD risk reduction was noted in the combined group (14.01±5.24%) followed by phytosterol (11.67±7.26) and LCn-3PUFA (9.26±7.99) supplementation alone.

Conclusions – The combination of phytosterols and LCn-3PUFA may be a more effective dietary strategy in the management of hyperlipidemia and associated CVD risk, than either of these alone.