Concurrent Session 11: Fish and Omega-3 Fatty Acids

Effect of DPA (22:5n-3) on expression of genes involved in fat synthesis and fat oxidation

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Background – Fish oil is a rich source of n-3 long chain polyunsaturated fatty acids including eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and also docosapentaenoic acid (DPA). Both EPA and DHA have been demonstrated to have significant biological activity, including the potent regulation of key genes involved in lipid synthesis and fatty acid oxidation. However, the biological activity of DPA is currently not known.
Objective – To elucidate the impact of DPA, compared to EPA and DHA, on lipid synthesis and fatty acid oxidation genes using FAO rat liver cells as the *in vitro* model.
Design – FAO cells were treated with 25, 50 and 100 μM of EPA, DPA and DHA for 24 and 48 hours. Oleic acid (50 and 100μM) was used as a fatty acid control. Each treatment was performed in triplicate and real time-PCR was used to measure gene expression levels.
Outcomes – All the three fatty acids including DPA, at all concentrations tested for 24 hours, led to a significant decrease by ~ 0.3 to 0.95 fold ($P<0.01$, n=3) in the expression levels of the genes involved in lipid synthesis. including; SREBP-1c, FASn, ChREBP and ACC relative to the vehicle-treated cells. L-FABP (gene involved in fat oxidation) increased significantly by ~ 11 to 14 fold ($P<0.01$, n=3) at 25μM after 48 hours of treatment with all the three n-3 fatty acids including DPA.
Conclusions – DPA regulated the expression levels of key genes involved in fatty acid metabolism and hence, may have similar biological activity to both EPA and DHA. Functional endpoint assays such as the determination of fat oxidation and triglyceride levels are currently underway to add to our findings.
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Anti-inflammatory and cardio-protective effects of omega-3 polyunsaturated fatty acids and plant sterols in hyperlipidemic individuals

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Background – Cardiovascular risk factors are prominent aetiologies in hyperlipidemia. Omega-3 polyunsaturated fatty acids (n-3PUFA) have hypotriglyceridemic and anti-inflammatory properties and plant sterols are hypocholesterolemic, although their effect on the inflammatory cascade is uncertain.
Objective – To investigate the effect of combined n-3PUFA and plant sterol supplementation on cardiovascular risk factors and markers of inflammation, in adults with combined hyperlipidemia.
Design – A 3 wk, placebo-controlled, 2 x 2 factorial design, in 4 parallel groups. Sixty hyperlipidemic individuals (male *n*=27 and female *n*=33) were randomised to receive either sunola oil or 1.4 g n-3PUFA capsules alone or in combination with 25 g sterol-enriched spread daily (2 g sterols).
Outcomes – Supplementation with sunola oil or plant sterols alone had no effect on inflammatory markers, whereas n-3PUFA alone reduced hs-CRP by 27±11% (*P*=0.02) and TNF-α by 7±1.7% (*P*=0.002). The combination of n-3PUFA and plant sterols reduced hs-CRP (39%, *P*=0.005), TNF-α (10%, *P*=0.006), IL-6 (11%, *P*=0.009), LTB_4 (30%, *P*=0.01) and increased adiponectin (30%, *P*=0.05) concentration. Overall cardiovascular risk was reduced by 5% (*P*=0.8), 15% (*P*=0.5), 15% (*P*=0.5) and 23% (*P*=0.005) in the sunola oil, n-3PUFA, plant sterol and combination groups.
Conclusion – Concomitant supplementation with n-3PUFA and plant sterols provides greater cardio-protection due to synergistic hypolipidemic and anti-inflammatory effects. This combined therapy might be a useful strategy to existing regimens, for the prevention of cardiovascular disease in high risk individuals.