Concurrent Session 16

The influence of n-6 fatty acids and low-dose fish oil on n-3 fatty acid incorporation into heart cell membranes of the rat

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Background - Dietary fish oil (FO) reduces the risk of primary cardiac arrest, due to the incorporation of DHA into heart phospholipids. The n-6 PUFA-rich human western diet restricts conversion of α-linolenic acid (18:3n-3) to long chain n-3 PUFA but direct effects on their myocardial incorporation are not known.
Objective - To establish the dose-response effects of very low dietary FO intake on myocardial membrane content of long-chain n-3 PUFA and the influence of dietary n-6 PUFA on this incorporation.
Design - Rats were fed 5, 1.25, 0.63, 0.31, 0.16 or 0% FO with either olive oil as a background or 5% linoleic acid (18:2n-6)-rich sunflower seed oil plus oleic acid (18:1) rich olive oil to bring to 10% dietary fat, for four weeks followed by analysis of the phospholipid fatty acid content of myocardial membranes.
Outcomes - Fish oil produced dose-related increases in membrane n-3 PUFA incorporation primarily as DHA (22:6n-3), which was significant at all doses (table). N-6 PUFA decreased with increasing FO dose, wholly due to decreased 20:4n-6 (18:2n-6 increased, reflecting reduced conversion). High dietary n-6 PUFA increased both 18:2n-6 and 20:4n-6 and reduced 18:1 but had no significant effect on DHA and only a small effect on EPA incorporation ($P<0.001$).

	Diet	0% FO	0.16% FO	0.31% FO	0.63% FO	1.25% FO	5% FO
Ventricle DHA (%)[1]	Low n-6	[a]7.69 ± 0.55	[b]12.75 ± 0.57	[c]14.91 ± 0.38	[d]17.90 ± 0.44	[e]19.29 ± 0.41	[f]24.54 ± 1.01
	High n-6	[a]6.69 ± 0.21	[b]13.00 ± 0.82	[c]14.29 ± 0.52	[d]17.16 ± 1.09	[e]19.36 ± 0.95	[f]22.25 ± 0.35

[1]mean ± SEM n=4 per group. Common superscripts indicate not significantly different $P>0.05$).

Conclusions - There was a dose-response relationship between dietary fish oil and the composition of heart cell membranes that was sensitive to the absolute amounts of long-chain n-3 PUFA in the diet but not to the dietary ratio of n-6:n-3 PUFA, even at low fish oil intakes.

Fish, fish oils and long chain omega 3 fatty acids – cardiac benefit and risk: review by the Nutrition and Metabolism Committee of the National Heart Foundation of Australia

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Background - Fish is a rich source of protein and omega-3 fatty acids (n-3). New findings have been reported regarding the benefits of long chain n-3 on coronary heart disease (CHD) risk. Recent concerns have also been raised about the potential toxicity of fish from heavy metals, pesticide contamination and microbial infection along with the possibility of ciguatera poisoning.
Objective - To undertake a comprehensive review of the cardiac effects of omega 3 consumption and the associated benefits and potential risks associated with fish and fish oil intake.
Design - A comprehensive MEDLINE and internet search of clinical and epidemiological research was undertaken on the cardiac and general health benefits associated with the intake of fish, fish oils and n-3 fatty acids—in particular alpha-linolenic (ALA), docosahexaenoic (DHA), docosapentaenoic (DPA) and eicosapentaenoic acid (EPA). Similarly, a review was conducted of research concerning the toxicity of methylmercury, dioxin contamination and risk of ciguatera poisoning in fish, along with relative potential benefits and risks associated with consumption of possibly contaminated fish species. Furthermore, the guidelines of Australian, United States, European Union, Japanese, British and WHO statutory bodies and health agencies were synthetically examined and assessed in relation to acceptable mercury and dioxin levels for human consumption.
Outcomes - Consistent with the above evaluations, new National Heart Foundation of Australia intake guidelines are proposed for the intake of fish, fish oil and n-3 fatty acids for the general population and for populations at risk of mercury poisoning (e.g. pregnant women).
Conclusion - There is a need for a national nutrition survey to assess intake of nutrients, food items and measurement of biomarkers in blood – such as n-3. Marine n-3 fortification of foods is likely to play an increasing role in facilitating an adequate intake of marine n-3 in the general population and as an alternative means of therapeutic intake of marine n-3 for patients with CHD or elevated triglycerides.