POSITIONAL ISOMERISM, TRIGLYCERIDE FATTY ACID COMPOSITION AND FAT CONTENT OF AUSTRALIAN FISH

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The positional distribution of fatty acids in dietary triglycerides influences their metabolic fate. Studies of Northern Hemisphere fish have shown that n-3 fatty acids are predominantly located in the sn-2 position of the triglyceride. Pancreatic lipases hydrolyse fatty acids in the sn-1 and sn-3 positions, but leave a significant proportion of the sn-2 fatty acids intact. After lipolysis, this pattern of fatty acid distribution may result in the preferential incorporation of n-3 fatty acids into phospholipids in the liver and their subsequent beneficial effects on triglyceride synthesis and prostaglandin, leukotriene and thromboxane production.

The lipid from samples of 23 species of Australian fish was extracted and neutral and phospholipids separated. Aliquots of triglyceride were reacted with Grignard reagent (ethyl magnesium bromide) to produce a mixture of diacylglycerides (sn-1,2/2,3 and sn-1,3) which were then separated by thin layer chromatography. Fatty acids from the original triglyceride and from the sn-1,3 band were transmethylated and determined by capillary gas chromatography. The proportion of each fatty acid in the sn-2 position was determined by calculation.

The mean lipid content of the species analysed (n=23) and the contribution of the fatty acid classes to the triglyceride composition (n=20) are shown below. There was a significant inverse relationship between the proportions of triglyceride n-3 fatty acids and mono-unsaturated fatty acids (r= - 0.77, n=20).

		Contribution of fatty acid class to triglyceride composition			
	Lipid Content (%)	Saturates (%)	n-3 (%)	Monos (%)	n-6 (%)
Mean	2.2	36.0	30.9	27.2	5.5
Range	0.3 - 5.5	27.5 - 45.0	15.3 - 49.8	8.8 - 39.1	2.8 - 13.3

The n-3 fatty acids were predominantly in the sn-2 position (mean of 66.8% in the sn-2 position) while the mono-unsaturates were predominantly in the sn-1,3 positions (66.7% in the sn-1,3 positions). These findings are consistent with our preliminary work on eight species (Roberts and Sinclair 1991).

The proportion of n-3 fatty acids in the triglyceride sn-2 position ranged from 51.3% in the trevally (*Pseudocaranx dentex*) to 79.0% in the yellow fin bream (*Ancanthopagrus australis*). Docosahexaenoic acid (22:6n-3) made a greater contribution to the sn-2 fatty acid composition (mean of 30.8% of all sn-2 fatty acids) than eicosapentaenoic acid (20:5n-3) (9.1%). Oleic acid (18:1n-9) contributed a mean 18.3% of all fatty acids in the sn-1,3 positions. The other classes of fatty acids were more evenly distributed with 52.8% of n-6 fatty acids and 53.4% of saturates present in the sn-1,3 positions.

Defining the positional distribution of fatty acids in fish and other food sources may eventually lead to a better understanding of their therapeutic effects in humans. From these results it is possible to hypothesise that a diet including fish with a high proportion of n-3 fatty acids in the sn-2 position (such as bream) may be more beneficial than one including fish with a lower proportion of sn-2 n-3 fatty acids (such as trevally).

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