

Effect of dietary n-6 and n-3 fatty acids on phospholipid fatty acid composition of rat stomach, jejunum and colon

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Changes in dietary fatty acid composition alter phospholipid fatty acid composition in a variety of tissues, including liver, brain, skeletal muscle and blood. Previous studies have shown dietary fat modifications can occur rapidly (within days) and in turn alter a wide range of cellular activities through alteration of the physical properties of membranes and/or via alterations in eicosanoid as well as cytokine metabolism. Relatively little attention has been paid to the effects of dietary fat manipulation on the gastrointestinal tract (GIT). We report on the influence of feeding diets rich in n-6 and n-3 fatty acids on various parts of the GIT.

Three groups of eight weanling male Sprague-Dawley rats were fed one of three isocaloric, 20% fat diets. The fat type in the control diet contained primarily beef tallow supplemented with sufficient n-6 to prevent essential fatty acid deficiency. The n-6 diet was sunflower oil only and the n-3 diet was a mixture of beef tallow and sunflower oil with 5% fish oil. After a six weeks' feeding period, the animals were sacrificed and samples of stomach, jejunum and colon were excised and stored at -20°C. After homogenisation, the lipids were extracted and the phospholipid fractions methylated and analysed by gas chromatography.

Tissue	Fatty Acid	Control	n-6 Diet	n-3 Diet
			(w/w) % fatty acid	
Stomach	20:4n-6	1.9 ± 0.3 ^a	1.3 ± 0.1 ^{ab}	1.0 ± 0.1 ^b
	20:5n-3	-	0.1 ± 0.1 ^a	0.4 ± 0.1 ^b
	22:6n-3	0.3 ± 0.1 ^a	0.3 ± 0.2 ^a	1.5 ± 0.2 ^b
Jejunum	20:4n-6	8.9 ± 0.7 ^a	13.9 ± 0.9 ^b	7.8 ± 0.4 ^a
	20:5n-3	-	-	4.4 ± 0.3
	22:6n-3	1.4 ± 0.2 ^a	0.5 ± 0.1 ^b	3.5 ± 0.3 ^c
Colon	20:4n-6	10.8 ± 1.1 ^a	9.8 ± 0.8 ^{ab}	7.7 ± 0.3 ^b
	20:5n-3	-	-	3.6 ± 0.2
	22:6n-3	0.9 ± 0.2 ^a	0.4 ± 0.2 ^a	3.5 ± 0.2 ^b

Values without common superscript are statistically different (Scheffe F-test at 95%)

Results indicated that linoleic acid (18:2n-6) content of intestinal segments increased following consumption of the n-6 diet, while the n-3 diet fed animals exhibited intermediate values. Arachidonic acid (20:4n-6) content was higher in the jejunum but not in the colon or stomach phospholipids in animals fed the n-6 diet. The n-3 diet reduced the 20:4n-6 content in the stomach and colon but not in the jejunum phospholipids. This diet also resulted in enrichment of all the gastrointestinal segments with 20:5n-3 (EPA) and 22:6n-3 (DHA). In conclusion, these results suggest that dietary fat manipulation can alter the fatty acid composition of phospholipids in gastrointestinal tract segments which may in turn alter the functioning of the stomach, jejunum and colon.

1. ML Garg, M Keelan, ABR Thomson, MT Clandinin. Desaturation of linoleic acid in the small bowel is increased by short-term fasting and by dietary content on linoleic acid. *Biochim Biophys Acta* 1992;1126:17-25.
2. ML Garg, M Keelan, ABR Thomson, MT Clandinin. Intestinal microsomes: polyunsaturated fatty acid metabolism and regulation of enterocyte transport properties. *Can J Physiol Pharmacol* 1990;68:636-41.