Influence of Dietary Fish Oil on the Fatty Acid Composition of Colonic Epithelial Cells

Nelly Chankova1, John McLaughlin1, Karen Massey 2, Anna Nicolaou2,3, Philip Padfield1

1 Epithelial Sciences, School of Translational Medicine, University of Manchester, Manchester UK; 2 School of Pharmacy and 3 Centre for Skin Sciences, School of Life Sciences, University of Bradford, Bradford, UK.

The fatty acid (FA) content of the diet can influence the function of cells through altering the FA profile of the cells’ membrane phospholipids. Recent epidemiological studies have shown that a diet high in n-3 polyunsaturated fatty acids (PUFAs) has a beneficial effect on colonic health by reducing the risk if inflammatory bowel disease (IBD). In this study we have examined whether the anti-IBD activity of n-3 PUFAs might reflect dietary induced changes in the FA composition of colonic epithelial cells (CECs).

C57BL/6 mice were fed a maintenance chow in which 10% of the caloric value of the diet was made up of soya oil (control) or a modified maintenance chow that was supplemented with fish oil (FO) as source of n-3PUFA, to raise the fat caloric contribution to 35%. Mice were euthanized on days 0, 5, 10, 15, 20, and 25 post supplementation. Blood and colonic tissue were harvested. Colonic tissue was then disassociated with dispase to isolate CECs. Lipids were extracted from blood and isolated CECs. The fatty acids were analysed by gas chromatography.

The fish oil supplement affected the concentration of n-3 and n-6 PUFA in blood and isolated CECs. Specifically, in blood n-3 PUFA increased by 56.5% (p<0.05, day 15) whilst n-6 PUFA were decreased by 38% (p<0.05, day 15) compared to untreated controls. Similarly, in CECs, n-3 PUFAs were increased by 58% (p<0.05, day 15) whilst n-6 PUFA decreased by 72% (p<0.05, day 15). The n-3/n-6 PUFA ratio increased by almost 4 fold in blood and 8.5 fold in CECs by day 15 and remained at this level up to day 25. In CECs these changes were also accompanied by an increase of 31% (p<0.05, day 10) in saturated FAs and a decrease of 68% (p<0.05, day 10) in unsaturated FAs.

Overall, the n-3 PUFA enriched diet increased the relative concentration of n-3 PUFA whilst reduced the concentration of n-6 PUFA and total saturated FA in CECs. This study is the first to demonstrate that diet can significantly alter the FA composition of CECs and raises the possibility that the observed benefits of n-3 PUFAs on colonic health may, in part reflect dietary induced changes in the FA content of CEC cell membranes.