Dietary docosahexaenoic and eicosapentaenoic acid: emerging mediators of inflammation.

Chapkin RS, Kim W, Lupton JR, McMurray DN.

Department of Nutrition and Food Science, Faculty of Nutrition, Kleberg Biotechnology Center, MS 2253, Texas A&M University, College Station, TX 77843-2253, USA. r-chapkin@tamu.edu

Abstract

The inflammatory response is designed to help fight and clear infection, remove harmful chemicals, and repair damaged tissue and organ systems. Although this process, in general, is protective, the failure to resolve the inflammation and return the target tissue to homeostasis can result in disease, including the promotion of cancer. A plethora of published literature supports the contention that dietary n-3 polyunsaturated fatty acids (PUFA), and eicosapentaenoic (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) in particular, are important modulators of a host's inflammatory/immune responses. The following review describes a mechanistic model that may explain, in part, the pleiotropic anti-inflammatory and immunosuppressive properties of EPA and DHA. In this review, we focus on salient studies that address three overarching mechanisms of n-3 PUFA action: (i) modulation of nuclear receptor activation, i.e., nuclear factor-kappaB (NF-kappaB) suppression; (ii) suppression of arachidonic acid-cyclooxygenase-derived eicosanoids, primarily prostaglandin E(2)-dependent signaling; and (iii) alteration of the plasma membrane micro-organization (lipid rafts), particularly as it relates to the function of Toll-like receptors (TLRs), and T-lymphocyte signaling molecule recruitment to the immunological synapse (IS). We propose that lipid rafts may be targets for the development of n-3 PUFA-containing dietary bioactive agents to down-modulate inflammatory and immune responses and for the treatment of autoimmune and chronic inflammatory diseases.