Journal of the American College of Nutrition ›
Volume 21, 2002 - Issue 6

Reviews

Omega-3 Fatty Acids in Inflammation and Autoimmune Diseases

Artemis P. Simopoulos, MD, FACN

Pages 495-505 | Received 21 May 2002, Accepted 15 Aug 2002, Published online: 27 Jun 2013

Cite this article https://doi.org/10.1080/07315724.2002.10719248

Abstract

Among the fatty acids, it is the omega-3 polyunsaturated fatty acids (PUFA) which possess the most potent immunomodulatory activities, and among the omega-3 PUFA, those from fish oil—eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)—are more biologically potent than α-linolenic acid (ALA). Some of the effects of omega-3 PUFA are brought about by modulation of the amount and types of eicosanoids made, and other effects are elicited by eicosanoid-independent mechanisms, including actions upon intracellular signaling pathways, transcription factor activity and gene expression. Animal experiments and clinical intervention studies indicate that omega-3 fatty acids have anti-inflammatory properties and, therefore, might be useful in the management of inflammatory and autoimmune diseases. Coronary heart disease, major depression, aging and cancer are characterized by an increased level of interleukin 1 (IL-1), a

proinflammatory cytokine. Similarly, arthritis, Crohn's disease, ulcerative colitis and lupus erythematosis are autoimmune diseases characterized by a high level of IL-1 and the proinflammatory leukotriene LTB_4 produced by omega-6 fatty acids. There have been a number of clinical trials assessing the benefits of dietary supplementation with fish oils in several inflammatory and autoimmune diseases in humans, including rheumatoid arthritis, Crohn's disease, ulcerative colitis, psoriasis, lupus erythematosus, multiple sclerosis and migraine headaches. Many of the placebo-controlled trials of fish oil in chronic inflammatory diseases reveal significant benefit, including decreased disease activity and a lowered use of anti-inflammatory drugs.

inflammation | cardiovascular disease and major depression autoimmune diseases | IL-1 | IL-6 | TNF | background diet | omega-6/omega-3 ratio

---

Key teaching points:

• In Western diets, omega-6 fatty acids are the predominant polyunsaturated fats. The omega-6 and omega-3 fatty acids are metabolically distinct and have opposing physiologic functions.

• Eicosapentaenoic acid (EPA) is released to compete with arachidonic acid (AA) for enzymatic metabolism inducing the production of less inflammatory and chemotactic derivatives.

• Animal and human studies support the hypothesis that omega-3 PUFA suppress cell mediated immune responses.

• In experimental animals and humans, serum PUFA levels predict the response of proinflammatory cytokines to psychologic stress. Imbalance in the omega-6/omega-3 PUFA ratio in major depression may be related to the increased production of proinflammatory cytokines and eicosanoids in that illness.

• The increased omega-6/omega-3 ratio in Western diets most likely contributes to an increased incidence of cardiovascular disease and inflammatory disorders.

• Patients with autoimmune diseases, such as rheumatoid arthritis, inflammatory bowel disease and asthma, usually respond to eicosapentaenoic acid (EPA) and

docosahexaenoic acid (DHA) supplementation by decreasing the elevated levels of cytokines.

Key teaching points:

• In Western diets, omega-6 fatty acids are the predominant polyunsaturated fats. The omega-6 and omega-3 fatty acids are metabolically distinct and have opposing physiologic functions.

• Eicosapentaenoic acid (EPA) is released to compete with arachidonic acid (AA) for enzymatic metabolism inducing the production of less inflammatory and chemotactic derivatives.

• Animal and human studies support the hypothesis that omega-3 PUFA suppress cell mediated immune responses.

• In experimental animals and humans, serum PUFA levels predict the response of proinflammatory cytokines to psychologic stress. Imbalance in the omega-6/omega-3 PUFA ratio in major depression may be related to the increased production of proinflammatory cytokines and eicosanoids in that illness.

• The increased omega-6/omega-3 ratio in Western diets most likely contributes to an increased incidence of cardiovascular disease and inflammatory disorders.

• Patients with autoimmune diseases, such as rheumatoid arthritis, inflammatory bowel disease and asthma, usually respond to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) supplementation by decreasing the elevated levels of cytokines.
