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Omega-3 polyunsaturated fatty acids in physical performance optimization

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Summary of the review article:

- Fish oil is high in omega-3 polyunsaturated fatty acids (PUFAs). Omega-3 supplements are popular for athletes and non-athletes alike for their ability to improve endothelial (blood vessel) function, reduce inflammation, and increase provision of energy from fat.
- Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), the major omega-3 fatty acids in fish oil, inhibit cyclooxygenase-2 and 5-lipoxygenase biochemical pathways for the production of arachidonic acid (AA). The replacement of AA with EPA in the cellular membranes of inflammatory cells leads to a reduction in the inflammatory response to exercise.
- Omega-3 fatty acids are incorporated into the membranes of all cells. When incorporated in the membranes of red blood cells, they increase the deformability of the red blood cells. This allows them to move swiftly through capillary beds and efficiently deliver oxygen and remove carbon dioxide.
- Omega-3 fatty acids are prone to lipid oxidation. However, it is thought that the harms will only outweigh the benefits at large concentrations (yet to be demonstrated but larger than about 4 g/day).
- Fish oil supplementation leads to attenuated oxidative stress in response to strenuous exercise. This is positive in that it reduces exercise-induced inflammation, decreases delayed-onset muscle soreness, increases the rate of recovery, and reduces the risk for infection due to immunodeficiency.
- The attenuation of exercise-induced inflammation has been seen with doses of about 0.5-4 g omega-3s per day for at least 3 weeks. However, some of these supplements included other ingredients such as isoflavones or vitamin E (confounding factors) and not all studies have seen this response.
- Fish oil induces fat breakdown while sparing glucose/glycogen.
- Fish oil has improved exercise performance in some but not all studies. In most of the studies, fish oil increased cardiovascular health even if performance was not enhanced to a statistically significant degree.
- Fish oil supplementation has been associated with improving cognitive abilities including reaction time, decision making, and stabilizing mood.
- Fish oil can reduce heart rate during rest and exercise implying a more efficient heart. This effect is perhaps because of direct effects on electrophysiological function of the heart.
- Fish oil likely improves the blood flow through skeletal muscle specifically, thereby having a direct effect on exercise performance.
- Animal studies have correlated the types of fatty acids that constitute muscle cells and locomotion (ex. a hare running, a hummingbird flapping, or a salmon swimming). Specifically, omega-6 polyunsaturated fatty acids were associated with improved running speed. Also, fish oil improved physiology during exercise in rats and thoroughbred horses. Interestingly, before a nonstop migratory flight from Eastern Canada to South America, sandpipers have been observed to binge on small crustaceans (specifically, *Corophium volutator*) which contain high amounts of omega-3 fatty acids. Additionally, omega-3 fatty acids have been shown to improve endurance in Atlantic salmon, rats, and the red-eyed vireo, another migrating bird.
- Not all fish oil supplements are equal. Lower-grade fish oil supplements can be contaminated with heavy metals, dioxins, polychlorinated biphenols (PCBs), or other toxins. Pharmaceutical grade fish oils are purified and should contain negligible

quantities of these toxins.

- Too much fish oil can lead to a reduced ability to clot blood and therefore increasing bleeding. However, a dose that would be “too much” has not yet been determined.
- Some people may experience negative gastrointestinal side effects from fish oil. These may be circumvented by consuming the supplements with meals.

Key practice applications: Approximately 1-2 g of fish oil per day, with a ratio of 2:1 EPA:DHA, can improve cardiovascular function and exercise performance. Most studies have shown that this regimen reduces exercise-induced muscle soreness and many have shown a lowering of blood pressure and improved blood flow during exercise. However, there are many studies that have not reported benefits with fish oil supplementation and more research is necessary to determine who will benefit, under what physiological conditions, which types of fish oil are best, optimal doses and duration of supplementation for specific outcomes, and timing of supplementation.

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