

Why fish oils work swimmingly against diabetes

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These are fish oil capsules. Credit: UC San Diego

Researchers at the University of California, San Diego School of Medicine have identified the molecular mechanism that makes omega-3 fatty acids so effective in reducing chronic inflammation and insulin resistance.

The discovery could lead to development of a simple dietary remedy for many of the more than 23 million Americans suffering from diabetes and other conditions.

Writing in the advance online edition of the September 3 issue of the journal *Cell*, Jerrold Olefsky, MD, and colleagues identified a key receptor on macrophages abundantly found in obese body fat. Obesity

and diabetes are closely correlated. The scientists say [omega-3 fatty acids](#) activate this macrophage receptor, resulting in broad anti-inflammatory effects and improved systemic insulin sensitivity.

Macrophages are specialized [white blood cells](#) that engulf and digest cellular debris and pathogens. Part of this immune system response involves the macrophages secreting cytokines and other proteins that cause inflammation, a method for destroying cells and objects perceived to be harmful. Obese fat tissue contains lots of these macrophages producing lots of cytokines. The result can be [chronic inflammation](#) and rising insulin resistance in neighboring cells over-exposed to cytokines. [Insulin resistance](#) is the physical condition in which the natural hormone insulin becomes less effective at regulating blood sugar levels in the body, leading to myriad and often severe health problems, most notably [type 2 diabetes](#) mellitus.

Olefsky and colleagues looked at cellular receptors known to respond to fatty acids. They eventually narrowed their focus to a G-protein receptor called GPR120, one of a family of signaling molecules involved in numerous cellular functions. The GPR120 receptor is found only on pro-inflammatory macrophages in mature [fat cells](#). When the receptor is turned off, the macrophage produces inflammatory effects. But exposed to omega-3 fatty acids, specifically docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), the GPR120 receptor is activated and generates a strong anti-inflammatory effect.

"It's just an incredibly potent effect," said Olefsky, a professor of medicine and associate dean of scientific affairs for the UC San Diego School of Medicine. "The omega-3 fatty acids switch on the receptor, killing the inflammatory response."

The scientists conducted their research using cell cultures and mice, some of the latter genetically modified to lack the GPR120 receptor. All

of the mice were fed a high-fat diet with or without omega-3 fatty acid supplementation. The supplementation treatment inhibited inflammation and enhanced [insulin sensitivity](#) in ordinary obese mice, but had no effect in GPR120 knockout mice. A chemical agonist of omega-3 fatty acids produced similar results.

"This is nature at work," said Olefsky. "The receptor evolved to respond to a natural product - omega-3 fatty acids - so that the inflammatory process can be controlled. Our work shows how fish oils safely do this, and suggests a possible way to treating the serious problems of inflammation in obesity and in conditions like diabetes, cancer and cardiovascular disease through simple dietary supplementation."

However, Olefsky said more research is required. For example, it remains unclear how much fish oil constitutes a safe, effective dose. High consumption of fish oil has been linked to increased risk of bleeding and stroke in some people.

Should fish oils prove impractical as a therapeutic agent, Olefsky said the identification of the GPR120 receptor means researchers can work toward developing an alternative drug that mimics the actions of DHA and EPA and provides the same anti-inflammatory effects.

Provided by University of California - San Diego

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