

# why fish oil?

fish oil is an **inexpensive natural anti-inflammatory**. this handout will explain why and how to use it.

## what's inflammation?

inflammation is part of our immune system! read on.

## the immune system has 2 parts:

1. what we usually think of as "the immune system" (white blood cells, T-cells, antibodies, etc.);
2. inflammation (swelling, red-hotness, pain, fever, etc.).

*inflammation is the body's response* to an infection or injury.

swelling, red-hotness, and pain are all caused by chemicals made by the body. these chemicals allow special immune cells to leave the bloodstream, and actively creep into the infected/injured tissues. in the tissues, the immune cells engulf and try to dissolve any germs or foreign bodies (splinter, piece of glass, etc). after doing this, the inflammatory cells die off, leaving pus.

*inflammation also causes heart attacks* and strokes. how?

one way is that cholesterol plaques inside our arteries ("hardening of the arteries") causes an inflammatory response, too - and the inflammatory cells try to engulf and dissolve the cholesterol (just like they'd try to eat up a splinter in your thumb). the other way is that inflammatory chemicals make blood platelets stickier. wherever the blood flow slows down, due to narrowing of the arteries, a clot can form. if a clot (of blood, cholesterol, and remainders of dead inflammatory cells) blocks a heart vessel, it's a heart attack. brain and other blood vessels can get blocked too, causing strokes and other problems.

*chronic inflammation* - when the inflammatory process never stops - causes a variety of illnesses, like rheumatoid arthritis and lupus. most of the studies on fish oil have been directed at reducing risk of heart attacks, but there's no reason to think fish oil wouldn't be helpful for chronic inflammatory diseases too.

*the main inflammatory chemicals* that we know about are called:

- prostaglandins ("PROSS-ta-GLAND-ins")
- and leukotrienes ("LOO-ko-TRY-eens").
- they are made from a fatty acid called arachidonic acid ("a-RACK-a-don-ic acid") found in cell walls.

## steroids block arachidonic acid:

"steroids" are anti-inflammatories that stop the body from making arachidonic acid. examples:

- hydrocortisone cream for eczema
- prednisone pills for rheumatoid arthritis
- budesonide in asthma-control inhalers

...less arachidonic acid = less prostaglandins and leukotrienes = less inflammation.

## NSAIDs block prostaglandins:

NSAIDs are chemicals that block prostaglandin production.

prostaglandins are made from arachidonic acid by enzymes called cyclo-oxygenases (COX). NSAIDs are "COX blockers." the different side effects of these drugs, like the medicinal effects, are due to blocking different prostaglandins by blocking different COX enzymes.

- **typical NSAIDs** block both COX-1 and COX-2; also make the stomach vulnerable to acid, causing ulcers. examples:  

<i>aspirin/ Exedrine</i>	<i>naproxen/ Aleve</i>	<i>ketorolac/ Toradol</i>
<i>ibuprofen/ Advil/ Motrin</i>	<i>indomethacin/ Indocin</i>	<i>diclofenac/ Voltaren</i>
- **Vioxx, Bextra, and Celebrex** block COX-2 only, with fewer stomach side effects, but may cause blood clots.
- **acetaminophen** (Tylenol) blocks COX-3, reducing pain and fever only, but not blocking other forms of inflammation.

the heart-healthy effects of low-dose aspirin are blocked by ibuprofen and indomethacin, but not by other NSAIDs.

## LOX-blockers block leukotrienes:

leukotrienes are made from arachidonic acid by enzymes called lipo-oxygenases (LOX). "LOX blockers" include Singulair, Accolate, and Zyflow, all for allergic asthma. LOX-blocker research has mainly been directed at asthma drug development - so far.

*other inflammatory chemicals* include thromboxanes ("throm-BOX-anes") and prostacyclins ("PROSS-ta-SIKE-linns").

thromboxanes make blood platelets more sticky, and prostacyclins make them less sticky. they need to be in balance, so you have neither too much or too little blood clotting. they are both blocked by NSAIDs.

## there are also a lot of **anti-inflammatory chemicals** the body makes:

...to turn off the inflammation. these are newly discovered, and have names like "resolvins" and "protectins." inflammation is supposed to be a very short-acting response (lasting only hours), and is supposed to be carefully targeted, so the body's own cells don't get too damaged as innocent bystanders. "resolvins" and "protectins" turn off the reaction.

## *this is where fish oil comes in!*

**arachidonic acid is an "omega-6" fatty acid.** it is used by the body to make inflammatory chemicals (prostaglandins, leukotrienes, etc.).

**fish oil provides "omega-3" fatty acids (named EPA and DHA).** these are used by the body to make anti-inflammatory chemicals, called "resolvins" and "protectins." there's also some evidence that low-dose aspirin increases "resolvins" and "protectins."

**another "omega-3" fatty acid is ALA (alpha-linoleic acid)** found in plants like borage, walnuts, and flax\*. however, the body must convert ALA to EPA and DHA first, in order to make anti-inflammatory chemicals. this process is not as simple and efficient as making them from EPA and DHA found in fish oil.

\*note: evening primrose oil contains GLA, **gamma**-linoleic acid. this is an **omega-6** fatty acid that is converted into arachidonic acid in the body. (not to be confused with *alpha*-linoleic acid, an *omega-3*.) but because the conversion process is not very efficient, it can act *against* inflammation by slowing *other* arachidonic acid pathways.

## *frequently asked questions*

### *why do fish have omega-3s?*

omega-3 fatty acids are polyunsaturated, liquid oils. cold-water fish need polyunsaturated fatty acids to keep their cells fluid and flexible at low temperatures. (waxy cholesterol does the opposite, stiffening cells so they keep their shape in warm places, like in our warm-blooded bodies.)

fish eat algae (also known as phytoplankton) and krill (tiny shrimplike creatures) that contain these fatty acids - and then they eat each other. that's where they get their omega-3s.

### *is it better to just eat fish?*

if you are vegetarian, you may not want to do this. if you are busy, or low-income, you may not be able to do this in a healthy way (fried fish sandwiches, or tuna salad with gobs of mayonnaise, are not as heart-healthy as you'd wish).

the American Heart Association recommends eating baked (low-fat, low-salt) fish twice a week, every week. pregnant women and children should eat less; people at risk for heart disease/heart attack (including high cholesterol) should take fish oil on top of eating fish.

### *are vegetable sources better?*

plant-derived oils (flax, borage, evening primrose, etc., containing ALA or GLA) are more complicated for the body to convert to anti-inflammatory molecules (EPA, DHA). taking them does no harm, but they may not have as much effect as fish oil. if anti-inflammatory effects are important to your health (due to illness or risk), then i'd recommend taking plain old fish oil, instead of plant-based oils.

### *which fish are the best?*

most fish oil is produced from menhaden, a small schooling fish. it can also come from sardines, anchovies, tuna, salmon, etc. there are only a few producers in the world. basically all the different brands of fish oil come from these few sources, and they are all basically the same. don't pay extra for exaggerated claims on a label!

- they all come from cold, deep waters, so a label saying "cold, deep waters" makes no difference.
- all the world's oceans have some degree of pollution, so saying it comes from "pure ocean waters" is a lie.
- medically, it doesn't matter what fish is "richest" in oil, since the oil capsules are a refined product anyway.
- "molecular distillation" is the way most oils are purified industrially, and i find no evidence that it makes fish oil any better or worse. don't pay extra for this claim on a label.
- there's no such thing as "pharmaceutical grade" fish oil, because fish oil is not classified by the USP (United States Pharmacopeia) as a pharmaceutical ingredient. it is classified as a dietary supplement. find out what brands have been USP verified as safe and authentic dietary supplements at [www.usp.org](http://www.usp.org). note: just because it's not USP verified does not necessarily mean it is fraudulent or unsafe.
- we don't have enough research on krill or algae oil to say if it is any different, medically, from fish oil.

### *how about fish liver oil?*

fish liver oil (cod liver, shark liver) is a byproduct of fish meal manufacturing. both contain omega-3 fatty acids, but also contain very high levels of vitamin A. vitamin A is a structural part of the eyes (chemical name: retinol - like retina).

vitamin A can build up in the body, and too much is dangerous. for example, if used for acne treatment while pregnant, it can cause severe birth defects. too much vitamin A also blocks the effects of vitamin D and weakens the bones. i recommend avoiding fish liver oils to avoid getting too much vitamin A.

fish livers, like all livers, also concentrate pollutants, like dioxin and PCBs. when fish oil comes from the entire body of the fish, this concentration is reduced.

traditionally, cod liver oil was prepared by fermenting codfish livers and seaweed in brine for a long period of time, then scooping off the oil. again, there's no medical evidence that this method produces oil that is substantially different from other types.

there have been periodic claims over the years that shark liver oil contains chemicals that prevent cancer (alkylglycerols, squalene, etc.), but no solid evidence at this time.

## *what about pollution?*

in spring 2010, a lawsuit was filed in California against the major fish-oil manufacturers, claiming their products contain PCBs (which cause cancer). the outcome is pending.

PCBs, dioxin, mercury, and other industrial contaminants (as well as e.coli, salmonella, and other foodborne contaminants) can be found in all sorts of foods and supplements. i find no evidence that fish oil is any more contaminated than the rest of what we eat and use.

## *what about endangered species?*

menhaden have been overfished in multiple areas, but are not on the endangered species list. overfishing is a problem worldwide for lots of kinds of fish, and the demand for omega-3 oils is a new pressure on ocean communities. to find out more about local overfishing situations, see the National Marine Fisheries Service website at [www.nmfs.gov](http://www.nmfs.gov).

## *what kind to buy?*

i advocate buying the least expensive, simplest product you can find. fish oil doesn't help you if you can't afford to take the right amount (approximately 1000 mg twice a day). the Environmental Defense Fund says that these brands are safest:

<u>A&amp;P</u> : Health Pride brand	<u>Nature Made/Pharmavite</u> : Fish Oil	Omega brand	ArcticPure EPA, ArcticPure DHA
<u>Albertsons</u> : Nature's Valley, Sav-On	<u>Nature's Bounty</u> : Cod Liver Oil, DHA, EPA, Fish Oil, Omega-3 brand	<u>Rexall Sundown</u> : EPA/DHA, Fish Oil, Essential Oils/EFA brand	<u>Spectrum Organics</u> : Norwegian Fish Oil, Cod Liver Oil
<u>Bi-Mart</u> : Bi-Mart brand	<u>NOW Foods</u> : Cod Liver Oil (liquid), Omega-3 (liquid) brand	<u>Safeway</u> : Safeway Select brand	<u>Target</u> : Cod Liver Oil, EPA, Fish Oil, Omega-3 brand
<u>Costco</u> : Kirkland brand	<u>Price Chopper</u> : Cod Liver Oil, Fish Oil	<u>Sam's Club</u> : Member's Mark brand	<u>The Vitamin Shoppe</u> : Omega-3 Fish Oil brand
<u>CVS</u> : CVS Pharmacy brand	<u>Puritan's Pride</u> : Cod Liver Oil, DHA, EPA, Fish Oil, Halibut Liver Oil	Complex brand	<u>Wal-Mart</u> : Spring Valley brand
<u>Eckerd</u> : Eckerd brand	Heart Assure, Joint Maintenance,	<u>Shopko/Topco</u> : Top Care brand	<u>Walgreens</u> : Fish Oil brand
<u>GNC</u> : Cod Liver Oil, DHA 250, Omega Complex brand	Omega-3, Shark Liver Oil, Triple	<u>Shoprite</u> : Cod Liver Oil, Fish Oil	
<u>Kroger/Ralphs</u> : Kroger brand		<u>Source Naturals</u> : ArcticPure EFA,	
<u>Meijer</u> : Meijer brand			

## *correct omega-6 to omega-3 ratio?*

the usual american diet contains a lot of pre-prepared foods which are **high in omega-6** fatty acids, from corn, peanut, and cottonseed oil, and **low in omega-3**. best evidence shows that this imbalance is unhealthy.

it doesn't matter what your personal ratio is, because if you eat closer to a "mediterranean diet" (lots of vegetables; low red meat; garlic and herbs instead of salt; olive oil; nuts\*) and take fish oil, your health will be better, regardless of the "ratio."

\*tree nuts (unsalted walnuts, pecans, almonds), not peanuts.

## *more reading:*

what is inflammation: <http://en.wikipedia.org/wiki/Inflammation>

chronic inflammation and cancer: <http://www.scientificamerican.com/article.cfm?id=chronic-inflammation-cancer>

arachidonic acid: <http://en.wikipedia.org/wiki/Eicosanoid>

omega-3 vs -6, and alpha- vs. gamma- linoleic acids: <http://supplementscience.org/pufas.html>

resolvins and protectins: <http://lipidlibrary.aocs.org/Lipids/eicresol/file.pdf>

environmental impact of the fish oil industry: <http://www.ethicurean.com/2009/03/23/menhaden/>

about cod liver oil: [http://en.wikipedia.org/wiki/Cod\\_liver\\_oil](http://en.wikipedia.org/wiki/Cod_liver_oil)

about shark liver oil: [http://www.cancer.org/docroot/eto/content/eto\\_5\\_3x\\_shark\\_liver\\_oil.asp](http://www.cancer.org/docroot/eto/content/eto_5_3x_shark_liver_oil.asp)

about dioxins in fish liver: <http://www.efsa.europa.eu/en/press/news/datex100331.htm>

what is the USP: [http://www.usp.org/USPVerified/dietarySupplements/faq.html?USP\\_Print#Q2](http://www.usp.org/USPVerified/dietarySupplements/faq.html?USP_Print#Q2)

Environmental Defense Fund list of safe fish oils: <http://www.edf.org/page.cfm?tagID=16536>

should i eat the fish i catch? a guide: <http://www.epa.gov/waterscience/fish/files/fisheng.pdf>

American Heart Association's fish-eating guidelines: <http://www.americanheart.org/presenter.jhtml?identifier=3071550>

aspirin vs ibuprofen: <http://content.nejm.org/cgi/content/full/345/25/1809>