Fish Oil, Omega 3 Fatty Acids, EPA and DHA

And the Whole Stinking Story!

By: Terry Lemerond

Scientific publications praising the merits of omega-3's have reached an astronomical figure. Most people today no longer know where to turn amid this wealth of information. In this article I will share with you some key facts which can provide you with a better understanding of the omega-3 fatty acids. Fish oils, due to their nature, are the most highly, overly refined and processed so-called "natural foods". This article will not focus on the benefits of omega-3 fatty acids for that information can be found in a variety of publications. This article will address the question of, what is really natural about omega-3 fatty acids from fish oil and how to improve the bioavailability and where to find an all-natural whole food omega-3 fatty acid.

EPA and DHA are mainly present in seafood (fish oil) and to a lesser degree in meat. However, meat is higher in omega-6 versus omega-3. The presence of omega-3 fatty acids in animals is a direct result of their plant diet. In fact, in the case of fish, it is the one-celled marine organisms like algae or plankton which synthesize EPA and DHA. Their consumption by crustaceans and fish permits an accumulation of omega-3 fatty acid in the tissue of predatory animals. As a general rule, the fattier a fish is (5% or more lipids) the higher its level of omega-3 fatty acids. Among them, salmon, herring, eel, mackerel, sardine and trout are good sources of omega-3 fatty acids. Certain crustaceans are also rich in omega-3's including krill but they are also high in cholesterol and the cholesterol is only removed by the use of hexane. As an example, a 100 gram serving of Atlantic salmon provides about 1.2 grams of omega-3 fatty acids but several factors influence omega-3 content; geographic origin, species, diet and age. Interestingly, farmed Atlantic salmon is generally fattier than wild salmon and thus richer in EPA and DHA (+15% on average). Added to this is a difference in maturity between these two types of salmon. The slow growth of wild salmon increases the risks of absorption and storage of heavy metals in their tissues, unlike farm salmon which grow more quickly. In spite of the disparities in sources of omega-3's, it's important to consume one serving of fish, preferably fatty fish, at least once weekly in order to cover in part the EPA and DHA requirements. For those who may not have the means or the desire to eat fish several times a week, can find a more reasonable solution by selecting **Vectomega**, **a natural whole food omega-3 fatty acid supplement in the preferred form and ratio of EPA and DHA**.

Fish oils and omega-3 supplements and their commercial products are as processed and refined as vegetable oils that you would typically find in your grocery store produced by mass merchants.

<u>There is a Natural Whole Food Omega-3 Fatty Acid (Vectomega) Produced without Chemicals or Heat</u>.

Extraction Methods for Obtaining Omega-3 Supplements
The principal differences between omega-3 food supplements depend primarily on the species of the fish of which the product is composed, the type of tissue used as raw material, whether or not the oil is refined and the final form of the product (oil capsules or dry tablets).

Pressing
The majority of oils come from small cold water pelagics (sardine, anchovie) which are more or less rich in EPA and DHA whose co-products and waste generated by the fishing industry constitute important and inexpensive stocks. The parts used are generally the residue of processing operations, filleting residue, skins, viscera and cartilage. The pressing technique is based on the use of high temperatures (85-95 degrees centigrade) which denatures the proteins of the fish by coagulating from this thermal treatment which lasts up to 30 minutes. The raw material is then inserted into presses of various shapes in order to separate the protein aqueous phase, containing oil, from the solid material into decanters. The water left from the draining and pressing is then treated with live steam so that the oil phase can be further separated into another decanter. The fish oil thus collected may undergo a bleaching phase by addition of amorphous silica and then deodorized by injection of 200 degrees centigrade steam under a partial vacuum. A final stage of refining through activated charcoal allows most of the heavy metals and dioxins to be eliminated. This process also has a direct consequence of destroying the phospholipids, the transporting system of the EPA and DHA which are required to penetrate the cellular membrane.

Fractionation and Concentration of Omega-3 Fatty Acids
Once the fish oil has been extracted, certain additional processes are carried out to purify and enrich the EPA and the DHA in order to obtain a higher percentage of molecules of interest (up to 95% omega-3's when the natural rate is actually 20%) to the manufacturer. These processes unfortunately require the use of organic solvents and chemical compounds to manipulate and modify the omega-3 fatty acids EPA and DHA.

Cryoconcentration
This process permits omega-3 fatty acid enrichment by crystallization at low temperature. Lowering the temperature to less than -50 degrees centigrade in the presence of acetone for 24 hours leads to the formation of fatty acid crystals with high melting point and at their concentration in the reaction medium. The EPA and DHA content of a fish oil can be increased by up to a factor of 2.5 using this method.

In the case of a **urea complexation**, after a saponification stage in the presence of sodium and in a solution of alcohol, the fish oil is freed of its unsaponifiable fraction containing interesting substances such as sterols and fat soluble vitamins. Fatty acids are then dissolved in an alcohol/urea mixture and cooled to a temperature which allows the desired degree of concentration to be reached. This concentration process permits preliminary eradication of a large number of the substances and enrichment of the oil content by a factor of 3 without any special difficulties. Still this fractionation involves

the use of these solvents and generates a very high quality of reactional residues which must then be retreated and not without harm.

Molecular distillation can also be used to partially separate fatty acid mixtures. These must first undergo esterification using ethanol to form fatty acid ethyl esters which can be separated according to differences in their boiling points and molecular weights. This distillation generally occurs at high temperatures (about 250 degrees centigrade). Under these conditions the ethyl esters of EPA and DHA are less well protected against oxidation and the process does not respect the natural contents of the omega-3's.

Finally, the use of **chromatographic techniques** based on separation of fatty acids according to the length of their carbon chains or their degree of unsaturation permits high purification of omega-3's at levels surpassing 90%. The principal is to pass a mixture containing the ethyl or methyl esters of EPA or DHA to be purified through a column. The compounds then progress more or less quickly through the column depending on their size and their spherical footprint, and then all that needs to be done is collect the esters of omega-3's that have been separated from the other components of the mixture in this process. The liquid used to carry the esters is generally a methanol/water mixture or solvent/water mixture.

The process of extraction of omega-3's using organic solvents permit obtaining relatively high yields but pose certain constraints as to the elimination of solvent residues still present in the concentrated fractions. Liquid chromatography leads to the obtaining of fractions with high concentrations of EPA and DHA but the solvent-product separation is still delicate and costly. Thus it is difficult to find a "natural and clean" and effective extraction technique which also respects the natural contents of the oil.

Enzymatic Hydrolysis of Vectomega – a Natural Whole Food Omega-3 Fatty Acid Containing Phospholipids, DHA and EPA and Marine Peptides

Vectomega uses a process of extraction and purification of omega-3 fatty acids using a safe and natural processing method which in part mimic the functioning of the organism; the digestive enzymes. In fact, specific enzymes are used to digest the salmon flesh and thus release the lipids naturally including omega-3 fatty acids. Part of the neutral oil and nearly all of the phospholipids containing EPA and DHA are fixed in a partially hydrolyzed protein matrix which then undergoes simple centrifugation in order to concentrate the molecules of interest into a pallet. This is then kept frozen until freeze dried which limits the oxidation and degradation of the omega-3 fatty acids.

The process to produce **Vectomega** uses neither an oil press nor high temperatures nor esterfication nor solvents and guarantees the natural contents of the product while respecting the salmon's natural position and ratio of omega-3 fatty acids on the triglyceride chain bound to phospholipids. In summary, the only process used to extract **Vectomega** (whole food omega-3 fatty acid) is an enzyme process and a cold water flush which takes less than 1 ½ hours. In addition, this process makes it possible to have a product rich in natural omega-3 fatty acids in dry form which makes the product more

stable with little oxidation and far more digestible, and avoids the adverse effects of fish oil such as belching, nausea, unpleasant fishy taste or odor. Finally, unlike other formulations, **Vectomega** is a natural mixture as it is found only in nature combining omega-3 fatty acids vectorized using the phospholipidic process to a protein hydrolysate which according to studies on similar peptide complexes may have many healthy beneficial effects for the organism.

Omega-3 Requirements

Surprisingly and although many studies have demonstrated the benefits of omega-3's, there is no consensus on the recommended daily dose by groups of experts around the world. Certain scientific experts claim that omega-3 deficiencies are very difficult to prove in most individuals and that consequently weekly consumption of one fatty fish meal and the use of olive oil daily is ample to cover needs. Others emphasize that the intakes currently recommended are insufficient to guarantee optimal cardiovascular and mental health and that they should be at least doubled to have beneficial effects.

Organization	**Recommended dietary intake (g/day)**
WHO	ALA:0.8-1.1-EPA+DHA:0.3-.05
Group of experts	ALA:2.2-EPA+DHA:0.65
FDA (USA), Canada	ALA:1.1-EPA+DHA:0.5
AFSSA (France)	ALA:2-DHA:0.12

Table: Recommended daily intake of omega-3 PUFA

Bioavailability of Omega-3's

In addition to these RDI's, several factors influence the manner in which omega-3's are absorbed and metabolized.

The first of these is the omega-6/omega-3 ratio in each person's diet. An excess of omega-6 prevents the individuals optimal use of omega-3's through enzymatic competition. In fact, the metabolism of omega-3's and omega-6's calls on the same enzymes and less significantly are several common co-factors (vitamin B, C, E, zinc and magnesium). The more omega-6 in your diet, the more the individual's use of omega-3's is inhibited.

This imbalance thus favors a physiological condition predisposed to cardiovascular disease and inflammatory processes. The problem is accentuated in cases of metabolic diseases involving lipids as well as sugars. Diabetes as well as excess alcohol, tobacco or stress can thus influence the body's ability to transform ALA into EPA and EPA into DHA.

Studies on Western dietary habits show that the current omega-6/omega-3 ratio is about 10-15:1 while it should ideally be about 5 or even 4 omega-6 for 1 omega-3 (a 4:1 ratio in favor of omega-6). Thus omega-6 intake should be limited and omega-3 intake increased without however greatly increasing the total quantity of lipids absorbed daily.

Depending on the extraction processes, we have seen that the omega-3's are vectorized in the form of omega-3 ethyl esters, triglycerides or phospholipids. This vectorization is very important for the absorption and bioavailability of EPA and DHA.

In fact, comparative studies on the intestinal absorption of different forms of fish oil have shown that the ethyl esters were three times less absorbed than triglycerides. In terms of bioavailable EPA and DHA, this represents an absorption deficiency respectively, 40% and 48% compared to molecules vectorized by triglycerides. This low bioavailability may be explained by the greater resistance of ethyl esters to enzymatic digestion by pancreatic lipase. At the beginning of this article I mentioned the sensitivity of DHA and EPA to the oxidation phenomenon. In the presence of oxygen or light, DHA and EPA content of fish oil rapidly and significantly diminish. In this case, it is the vectorized omega-3's in the form of phospholipids which best resist oxidation followed by ethyl esters and finally triglycerides which offer little protection.

In view of these scientific results, it must be noted that the quality of a product rests in large part on how natural the contents are and on the form of vectorization of DHA and EPA.

Some consumers and medical experts however are tempted to believe that a product's omega-3 content and potency is the last word on its effectiveness. In order to compare this theory to the practical metabolization of omega-3's, Laboratoires LeStum, researchers and developers of Vectomega, have conducted a new in vivo study consisting of comparing the bioavailability of Vectomega to standard fish oil. With the observation that many supplements contain quantities of EPA and DHA much greater than that of Vectomega, the study set out to clarify certain points.

- What is the capacity of DHA enrichment of cell membranes with these supplements?

- What is the efficacy of restoring an optimal level of omega-3's in subjects with severe deficiencies?

- Do the vectorization and natural contents of DHA play a role in the bioavailability of a supplement?

To do this, the quantity of DHA present in various cell compartments was determined in normal subjects (controls) and subjects with severe omega-3 (deficients) who were then given supplements for 30 days using respectively 80 mg of DHA/day for reference fish oil and 27 mg of DHA/day of Vectomega in order to mimic the differences in observable content between the products marketed.

The results below indicate the proportion of DHA compared to total fatty acids found in the membranes at day 0 and day 30 for the control group, and the deficient group with DHA supplements (same results at day 30 for both groups).

Several lessons can be drawn from this new in vivo study: in the individuals not deficient in omega-3's (controls), the two supplements permit enriching the erythrocyte membranes by similar proportions and, to a lesser degree, the cerebral membranes. A DHA intake almost three times lower with Vectomega presents the same efficiency of enrichment as the reference fish oil.

In subjects presenting with serious omega-3 deficiencies, Vectomega permits not only a return to normal levels but also a DHA enrichment of membranes in spite of a lower intake than the reference oil.

Vectomega thus effectively corrects moderate to severe deficiencies in omega-3 fatty acids by favoring good cell integration of DHA. The quantities required to correct omega-3 deficiencies in the brain are three times lower with Vectomega than with reference fish oil suggesting a better bioavailability of DHA vectorized by phospholipids compared to triglycerides. These results tend to prove that quantity is not the essential criteria for a product rich in omega-3's and that the natural content of the product as well as its mode of vectorization should be accorded greater importance.

- Summary -

It's not how much you take, but how much you absorb!

Vectomega is a natural whole food omega-3 fatty acid containing five phospholipids DHA/EPA and marine peptides in one complex molecule. This whole food omega-3 fatty acid complex is extracted from salmon through an enzymatic extraction process and a cold water flush, and then freeze dried into a fine powder which makes it available in a dry tablet. This extraction method only requires 1 ½ hours of processing which is a far more natural and gentle process than the typical methods used to extract fish oil using very high temperatures, pressing, refining, deodorizing and chemically altering and manipulating the DHA and EPA. There is no longer a true scientifically based rationale for the levels of DHA and EPA that are now sold as food supplements. This complex, because of the above method, creates a very stable molecule with greater resistance to oxidation without causing regurgitation, burping or a fishy odor or after taste. Using the Caco method of analysis for absorption, Vectomega is absorbed 10-50 times greater than typical fish oil. All fish oil today is highly refined and processed, severely damaged by heat destroying the phospholipids and coagulating the proteins. The commercial fish oil sold does not even closely represent the omega-3 fatty acids proportion and ratio as they occur naturally in fish. You could say standard fish oil is pharmaceutical grade because it certainly does not represent a natural whole food complex. Most manufacturers are so fired up to introduce a fish oil product. They either don't take the time or the concern to investigate the method of processing. If they had they would understand why standard fish oil is a stinky story! Vectomega is the answer for those who are truly interested in a food form omega-3 fatty acid that is more highly and effectively absorbed and clinically studied to support heart and brain function.