Optimize Your Omega-3 Status
Personalized Blood Test Reveals a Novel Cardiac Risk Factor

By Julius Goepp, MD

Suppose you could assess with precision your personal risk for sudden cardiac death—then reduce it substantially in a matter of weeks.

You would be able to take immediate steps to lower your risk of sudden heart attack, without the need for drugs. You would even be able to determine whether the steps you’ve taken to induce favorable physiological alterations in your body have been effective and adjust them accordingly.

Thanks to a team of pioneering scientists, this improbable medical scenario is now a reality.

Just as hemoglobin A1c provides a snapshot of long-term glucose intake to assess diabetes risk, a revolutionary omega-3 index now provides a clear picture of the percentage of EPA/DHA omega-3 fatty acids in your blood to estimate your risk of a major cardiac event, including sudden cardiac death, heart attack, and fatal ischemic heart disease.

In this article, you will learn about Omega Score™, a novel analytic technology that assesses multiple markers of cardiovascular disease risk. You will discover how a revolutionary, low-cost at-home blood test may furnish you with a tailored assessment of how much omega-3 is in your whole blood, serum, and red blood cells. You also will find out how to adjust your omega-3 supplementation for optimal cardiovascular protection.

OPTIMAL CARDIAC DEFENSE

No cardioprotective dietary interventions have received more clinical validation than EPA and DHA.1-5 These widely recognized essential omega-3 fatty acids (derived from marine sources, primarily algae and fish) have been shown to safely suppress pro-inflammatory cellular signaling molecules and enzymes implicated in virtually all facets of cardiovascular disease and mortality, including:

- **Interleukin 1-beta** (IL-1b): Docosahexaenoic acid (DHA) targets IL-1b, a pro-inflammatory cytokine known to upregulate expression of adhesion factors in endothelial cells, which in turn contributes to atherosclerosis.7 (In cytokine blood panel readings, the optimal reference range for IL-1b is <2.9 pg/mL.)
- **Cyclooxygenase-2** (COX): Eicosapentaenoic acid (EPA) and DHA quench gene expression of cyclooxygenase, an enzyme involved in the production of various prostaglandins that contribute to chronic inflammation and cardiovascular disease.1,9
- **Leukotriene B4** (LTB4): A cytokine synthesized from the pro-inflammatory omega-6 arachidonic acid and 5-lipoxygenase. DHA displaces arachidonic acid from cells, inhibiting LTB4-induced vascular adhesion and inflammation of arterial and cardiac tissues.10
- **Tumor necrosis factor-alpha** (TNF-a): A cytokine known to contribute to system-wide inflammation. It stimulates production of vasoconstricting (vessel-narrowing) endothelin-1, a protein that can induce high blood pressure and long-term cardiovascular damage.11 EPA and DHA blunt the body’s inflammatory response to TNF-a.12 (The healthy reference range for TNF-a is <8.1 pg/mL.)
- **Thromboxane** (TxB2): A potent hypertensive lipid synthesized from omega-6 fatty acids. In addition to boosting blood pressure, TxB2 plays a central role in potentially lethal blood clot formation.1,13 Its activity is suppressed in the presence of EPA/DHA.
Through these and other multi-targeted mechanisms of action, EPA and DHA provide virtually unrivalled heart health defense. They can prevent and even reverse cardiovascular disease by increasing levels of artery-cleansing HDL in the blood.14 They reduce harmful triglyceride and very-low density lipoprotein (VLDL) cholesterol levels. They have also been shown to slow disease progression and reduce mortality in aging humans already afflicted with cardiovascular disease, and to prevent sudden cardiac death in people previously without symptoms.1,2,15-17

While sufficient dietary intake of these essential fatty acids is crucial, researchers have further established that it is the ratio of omega-3 to less desirable omega-6 fatty acids—not their total concentration in the red blood cell membrane—that correlates with cardiovascular disease risk. The higher the amount of omega-3 relative to omega-6 in an aging individual’s total fatty acid composition, the greater the benefit, and vice versa.18

But not everyone metabolizes essential fatty acids in a reliable fashion. A host of factors may affect the actual levels of these important nutrients in whole blood and red blood cell membranes, resulting in widespread variation in those levels. In other words, simply eating a healthy diet, or even supplementing with health-promoting nutrients, often may not confer the benefits you are hoping for if your body isn’t processing the nutrients efficiently. Some people may require more, while others might get by with less supplementation.

This may be one reason why, despite the widely publicized benefits of EPA and DHA, nearly 100,000 Americans died from omega-3 deficiency in 2009.19,20 In fact, a study published in 2009 ranked omega-3 dietary deficiency among the top ten preventable causes of death.19 Many times that number will likely suffer debilitating heart attacks, strokes, and neurological or cognitive damage as a result of sub-optimal omega-3 status.21-24

**DETERMINING INDIVIDUALIZED CARDIOVASCULAR DISEASE RISK: THE OMEGA SCORE™**

Increasing EPA and DHA intake may increase omega-3 in cell membranes and circulating lipids, while simultaneously lowering the concentration of less beneficial omega-6 fats.1,25 However, there has been no simple way for aging individuals to determine with precision whether they have actually attained an optimal omega-3 to omega-6 ratio in their own bodies. Until now.

**WHAT YOU NEED TO KNOW: OMEGA-3 AND CARDIAC RISK**

- Omega-3 fatty acids combat cardiovascular disease through a host of interrelated mechanisms, including the suppression of pro-inflammatory cytokines, elevation of beneficial HDL, and reduction of triglycerides and VLDL.
- The ratio of omega-3 to omega-6 fatty acids in blood and cell membranes strongly influences cardiovascular disease risk factors.
- Until recently there was no good way of determining how much omega-3 your body was metabolizing and absorbing into the blood.
- A new at-home test called the Omega Score™ allows for convenient determination of your own individual omega status and your risk of developing or dying from cardiovascular disease.
- This breakthrough technology enables you to establish several key indices of cardiovascular risk, including risk of sudden cardiac death, risk for developing heart disease, risk of fatal ischemic heart disease, and risk of sudden heart attack.
- The Omega Score™ can be repeated as required to help you track your progress as you use supplements and lifestyle changes to minimize your risks.

The Omega Score™ was developed by Bruce Holub, PhD, and a private research group. It combines cutting-edge analytic technology with clinically validated measures that correlate established risk factors for cardiovascular disease to the lipid composition of human blood. The results are obtained from a simple finger stick blood sample you do at home, then simply send in your sample to the lab.

Omega Score™ results provide a complete profile of an individual whole-blood fatty acid composition. This is known as the omega-3 index. Using these results, specific scores and ratios are calculated automatically. They are then correlated with known risk factors for various kinds of cardiovascular disease, based on the most recent scientific research. As you may know, recent research suggests that omega-3 levels may be among the best predictors of future coronary heart disease, providing stronger correlations to the risk of sudden cardiac death than traditional indicators.

With this information in hand, you can estimate your own cardiovascular risk profile and monitor changes in your risk status as you adjust your omega-3 intake along with other lifestyle changes.
Dr. Holub’s breakthrough technology began with the simple insight that measurements of omega-3s in the blood correlate with cardiovascular risk in a number of striking ways. He knew from the scientific literature that it is the relative contribution of each fatty acid (as a percent of total fats) that is vital in cardiovascular disease risk calculation, as opposed to the absolute concentration of any one fatty acid. Holub realized he could use this information to construct customized risk profiles that would be specific to each individual—without the need for time-consuming and expensive blood draws and lab analysis.

For example, Holub knew that the risk of coronary heart disease was 34% lower in men who had DHA percentages significantly greater than the population mean, and 31% lower for those whose total omega-3 percentages were significantly greater than the mean. Older adults whose total EPA plus DHA percentages were significantly higher than the population mean had a 70% reduction in risk of fatal heart attacks. Studies in the scientific literature had validated the idea that measurement of serum fatty acid composition could be used in assessing both intake of omega-3s and overall cardiac risk.

In late 2009, Dr. Holub and colleagues published their own study, demonstrating that they could accurately assess cardiovascular disease risk based on the ratios of various omega-6 and omega-3 fatty acids in a very large sample of subjects. The strong correlation between these ratios and cardiovascular risk provided them with another valuable tool for assessing an individual’s cardiovascular status.

Dr. Holub and his colleagues realized that their own work as well as that of other researchers now provided sufficient information to develop a comprehensive cardiovascular risk assessment tool.

The following test parameters are included in the Omega Score™ blood test.

**RISK OF SUDDEN CARDIAC DEATH**

Your risk of sudden cardiac death can be estimated from the Omega-3 Whole Blood Score, which measures omega-3 fatty acid content as a percentage of your total whole-blood fatty acid composition. This marker is based in part on the groundbreaking work of a team of Harvard researchers. They found that people with total omega-3 levels above 6.1% in their blood had a compelling 90% reduction in risk of sudden cardiac death compared with those whose omega-3s were 4.3% or less of their total fatty acids. People with omega-3 levels between 4.3 and 5.2% attained some benefit, with a 48% reduction in risk, while those whose scores were between 5.2 and 6.1% had an 81% risk reduction.

Users of the Omega Score™ will see their own Omega Whole Blood Scores plotted on a graph that places them in the appropriate risk category for sudden cardiac death: Very High, High, Moderate, or Low, corresponding to the risk reductions identified by the Harvard researchers.

**OMEGA-3 STATUS: AT-RISK POPULATIONS**

The capacity to metabolize and absorb EPA and DHA varies from one individual to the next. The right amount of omega-3 for one person might be entirely insufficient for another, rendering it difficult to determine whether you are obtaining the full cardioprotective benefit. Testing allows aging individuals to establish baseline cardiovascular disease risk levels, and then optimize their omega-3 status with additional intake. Re-testing after four weeks is recommended to monitor your progress.

Some groups of people are at high risk for omega-3 deficiency—and cardiovascular disease. Vegetarians, especially vegans, typically have difficulty obtaining optimal EPA and DHA levels, since these omega-3s are absent from plant-derived foods. Flax seeds and oil contain the omega-3 alpha-linolenic acid (ALA), which is converted only very slowly in the body to EPA and DHA. For these reasons, people who eat little or no cold water fish may especially wish to determine their omega-3 status.

Surprisingly, individuals who consume high quantities of fish may also suffer from sub-optimal omega-3 status. Our increasingly industrialized food chain now produces a substantial portion of its harvest from mega fish-farms, where the unnatural diet of soy and grain meal the fish are given greatly diminishes the omega-3 content of their flesh. Fish obtain and concentrate omega-3 fatty acids by consuming natural sources of these fats. The original source of EPA and DHA is from marine algae and phytoplankton. Small fish consume the algae and phytoplankton, then larger fish consume them, then even larger fish consume them and thus the EPA and DHA become concentrated at higher levels of the food chain. Farmed fish are completely dependent on their feed—if it does not contain EPA and DHA, the fish will not contain it in the levels found in wild fish.

Disturbingly, it seems more and more farm raised fish are coming up short in quantities of important EPA and DHA fatty acids.
RISK FOR DEVELOPING HEART DISEASE

Your overall risk for developing heart disease can be estimated from the Omega-3 Serum Equivalence Score. Based on work by researchers at the Department of Veteran Affairs Medical Center in San Francisco, this score provides a simple two-way assessment of an individual’s overall risk for heart disease. They used the total omega-3 content of serum (blood without the cellular components) to determine a risk cut-off for the development of heart disease, and found that a value of greater than 7.2% omega-3s resulted in a risk reduction of 32% compared with those whose value was 5.0% or lower.

Users of the Omega Score™ will see their own Omega Serum Equivalence Score plotted on a graph that places them in the appropriate risk category for development of heart disease: Risk (5.0 or lower), or Low Risk (7.2 or higher), corresponding to the values determined by the VA researchers.

RISK OF FATAL ISCHEMIC HEART DISEASE

Your risk of dying from ischemic heart disease (heart attack) can be estimated from the EPA+DHA Serum Equivalence Score, which represents the total percent of fatty acids comprised of EPA and DHA in serum. This score is based on research from the Cardiovascular Health Research Unit at the University of Washington in Seattle. They found a 70% reduction in the risk of death from ischemic heart disease (heart attack) for people with total EPA and DHA values of 4.6% or greater, when compared with those whose total values were less than 3.5%.

Users of the Omega Score™ test will see their own EPA + DHA Serum Equivalence Score plotted on a graph that places them in the appropriate risk category for fatal ischemic heart disease: Risk (less than 3.5) or Low Risk (greater than 4.6), corresponding to the values determined by the Washington research group.

RISK OF SUDDEN HEART ATTACK

Your risk for having a sudden myocardial infarction (MI, or heart attack) can be estimated from the Omega-3 Index Red Blood Cell Equivalence Score. Based on research from the Lipid and Diabetes Research Center, Mid America Heart Institute at the University of Missouri Kansas City School of Medicine, this test takes into account the fact that red blood cell fatty acid composition reflects intake of EPA + DHA over time (analogous to the way that hemoglobin A1c reflects long-term blood sugar levels). These researchers found that people whose total EPA + DHA in red blood cells (the Omega-3 Index) was greater than or equal to 8% had the greatest degree of protection against sudden cardiac death, whereas an index of less than or equal to 4% was associated with the least.

Users of the Omega Score™ will see their own Omega Index plotted on a graph that places them in the appropriate risk category for sudden myocardial infarction: Very High Risk (less than 4), High (4-6), Moderate (6-8), and Low Risk (greater than 8), corresponding to values determined by the Kansas City researchers.

According to a 2008 sampling survey of farmed fish, tilapia (the fastest growing and most widely farmed fish) and catfish have much lower concentrations of omega-3s, very high ratios of omega-6 to omega-3, and high saturated and mono-unaturated fat to omega-3 ratios. The study’s authors noted that “marked changes in the fishing industry during the past decade have produced widely eaten fish that have fatty acid characteristics that are generally accepted to be inflammatory by the health care community.”