

Fatty Acid Profile FAQ

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This material provides guidance for discussions with doctors, researchers, etc. It is probably too difficult for a normal consumer to make decisions alone. The subjects are highly complex and difficult information was omitted.

What to look for in a FAP

A fatty acid profile should measure the two types of essential fat abnormalities: a **relative abnormality or deficiency** (caused by the presence or absence of other substances) and an **absolute abnormality or deficiency** (caused by a huge deficiency in some essential fat). The profile should compare concentrations of fats or lipids with percents of essential fats. For example, a diagram would show the concentration of total cholesterol + total triglycerides on the Y axis, and the % of PUFAs on the X axis. Another diagram displays the Derivatives of the $\omega 6$ EFAs on the Y axis and linoleic acid (the parent $\omega 6$) on the X axis. Similar relationships can be showed using tables or two-dimensional diagrams. These diagrams are critical to make a proper diagnosis (see other reports on how to interpret FAPs). The test should measure the amount of different types of EFs you have, their biochemical activity or metabolism, and how well your body uses the EFs (indicators of EF status and metabolism). The test should include 20:3 $\omega 9$, 16:1 $\omega 7$ and other biochemical markers. The FAP should determine whether the body can utilize the EFs for proper functioning or if it has a problem using these EFs.

Your doctor should ask you to eat (drink) a special mixture of oils before the test. This mixture will depend on your health condition. If you are not told to follow a specific diet and eat (or avoid) specific oils, you probably received incomplete instructions. The test should measure how much of different types of essential fats you have, measure their biochemical activity or metabolism, and measure how well your body uses the essential fats (indicators of EF status and metabolism). The test should include 20:3 $\omega 9$, 16:1 $\omega 7$ and other biochemical markers described by Dr. Siguel and other researchers.

The fatty acid profile should determine whether the body can use the essential fats it has for its essential functions (being healthy) or whether the body has a problem using the essential fats. There are many reasons why the body may not be able to use the essential fats it has. One reason may be that the person has eaten too many oils (instead of natural foods).

In many oils, the essential fats are not accessible as essential fats, and the substances are thus not properly utilized by the body. This has nothing to do with issues such as cold pressed vs. hexane extracted oil, dark plastic bottle vs glass bottle, etc. These issues have to do with the *intrinsic structure* of the seed and fat molecule. The fats in oils (extracted from oil seeds) are triglycerides with 3 fatty acids in each molecule. There is excellent evidence that the body makes better use of essential fats located in a particular position of the triglyceride molecule (called the # 2 or middle position).

Beware of test results that report many more than 35 fatty acids and/or place too much emphasis on fluctuations of small substances. You may find some reports that provide a long list of fatty acids, many in amounts < 1%. These "small" FAs (present in small amounts) exhibit huge fluctuations due to measurement errors. Beware of reports that place too much emphasis on "normal" or "abnormal" values for these small FAs. One must compare the values of many different FAs to determine whether the results make sense. For example, it is unlikely for $\omega 7$ s to be elevated and $\omega 9$ s not to be elevated, and vice versa. When abnormal patterns occur, one must look for a meaningful explanation.

Before trusting a source, check their credentials by searching Medline for papers they have written (look for papers on methods or test interpretation), looking at www.ama.org for their

medical license, or visiting their universities' website for their curriculum. Ideally, someone interpreting a complicated blood test, such as a fatty acid profile, should have a PhD in chemistry (or a related field). A person's education and degree suggests a person has skills in a specific area. Would you let a fantastic pilot or race car driver do brain surgery? How would you feel if your 747 was piloted by a PhD in English who learned to pilot by reading commercials for Microsoft flight simulator? Do you take your car to the vet and your dog to the gas station? Check credentials before using a health professional.

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What is a fatty acid profile?

When we measure many variables (parameters, indicators) at the same time, we call them a "profile." There are many types of profiles. One can have a profile of a wanted criminal (based on what the police knows) or a profile of a type of car (car characteristics). In blood testing, we refer to *profiles* that measure different chemicals. **A fatty acid profile is a blood or tissue or food test that measures many fatty acids at the same time.**

There are many kinds of blood test "profiles." We have a CBC (complete blood count), which is a profile of key aspects of the blood cells. A CBC counts how many red cells, white cells, and platelets are in the blood. It also measures the size and shape of red cells. These characteristics together provide a profile of blood cells. A lipid profile (or *cardiac profile*) usually measures TC, TG, HDL, and calculates LDL. There are other profiles which measure aspects of the liver, kidney, etc.

There are no specific rules about what constitutes a profile. Different labs may include different things under the same name of a profile. What is included often depends on what doctors consider important and what can be measured with existing technology. As new technology evolves, the profile changes.

Many lipid profiles once included a classification of lipoproteins by a technique known as electrophoresis. However, the results were rarely used, and many labs no longer report them (to save money).

Fatty acids are very difficult to measure. They require extraction from tissues, various chemical reactions, and separation in an instrument called a Gas Chromatograph. This process usually takes more than 10 hours per sample. Many fatty acids can be measured at the same time. [Read the tutorials at www.essentialfats.com to learn about fatty acid profile methods.] A fatty acid profile measures many fatty acids. There are various types of fatty acid profiles used for different purposes. Some are very old (more than 10 years); others are very new. Read Dr. Siguel's book for a description of many types of blood tests.

Fatty acid profiles were once used to identify bacteria. Each bacteria has a unique composition of fatty acids. Scientists prepared tables of the composition of the bacteria. Then doctors would take blood from infected patients and compare its fatty acid composition to the tables to determine what bacteria was in the blood. Most bacteria fatty acids are short and require a special technique to extract and protect them. With the advent of DNA and modern technology to identify bacteria, fatty acid analysis to identify bacteria is less frequently used.

There are a few disorders, such as ALD, where children have a genetic defect that interferes with their ability to burn surplus fatty acids. These children accumulate very long chain fatty acids such as 25:0 and 26:0 (25 and 26 carbons in length, no double bonds). These fatty acids require special technology to measure accurately, because they are usually present in the blood only in very tiny amounts, and can easily be confused with similar chemicals derived from cholesterol and other substances in blood. Dr. Siguel's book contains descriptions of other rare conditions. The fatty acid profile most commonly used in connection with health and disease measures saturated, monounsaturated, polyunsaturated, and *trans* fatty acids from chain length 12 to 26. Many other types of fatty acids, such as branched, isomers of the unsaturated types and CLA are not usually measured, except in rare conditions or for research purposes. Other FAs are so similar to other FAs that they are extremely difficult to separate and measure. Due to the cost and unreliability, we prefer not to measure them. Currently, the best technology to measure these fatty acids separates them using a column which is ~ 100m long, and takes about 3 hours. (Issues on the methods of optimally separating fatty acids are explained in the tutorials at www.efafood.com.)

How fatty acids are measured

We decide whether to measure fatty acids in plasma, RBCs, or some other tissue type (such as adipose tissue, white cells, etc) ("*tissue sample*"). Usually, we draw blood and separate the plasma from the red cells (RBCs). The tissue sample is mixed and cooked with various chemicals to prepare Fatty Acid Methyl Esters (FAME). The FAME are easier to analyze than the fatty acids.

For example, we mix ~ 0.100 ml of plasma with several chemicals and cook the mixture for ~ 1 hour at a constant temperature while stirring continuously. We end up with several layers. We remove one of the layers and mix and shake with other chemicals until we end up with a mixture of pure FAMES in a solvent such as isooctane. We evaporate the mixture until we end up with ~ 0.500 ml (1 tsp = 5ml!). This process extracts the fats from the blood, breaks the fats into fatty acids and other things, eliminates the protein and other parts of the blood not needed, and forms the FAME.

The FAME are injected into a GLC and ~ 400 substances are separated over a period of 3 hours (per sample).

There are more than 60 different types of fatty acids in human tissues, and over 300 substances that are measured at the same time we measure fatty acids. Many of these substances are unknown. Some are byproducts of oxidation of cholesterol and fatty acids, in part caused by the body and in part caused by the process of measuring fatty acids. Others are fatty acids produced by bacteria in the body, or in plants or animals we eat. Some are produced by processing food (cooking, hydrogenation, etc.).

What tissue to use: plasma, red cells, adipose...

Each part of the body (tissue sample) has a different fatty acid composition. The tissue sample we use depends on the purpose of the analysis. Adipose tissue stores LA and ALA (parents) but practically no children fatty acids.

If we want to know about the body's reserve of EFAs (ALA and LA), adipose tissue is the best sample. Taking the sample is tricky. It feels like an injection. We inject a small amount of sterile water and remove it again, along with tiny amounts of fat. The procedure is rapid and simple, but sometimes we get cells or blood which confound the results. It is possible to get a larger amount of fat, like a small biopsy, but the procedure hurts more.

The composition of adipose tissue varies in different parts of the body (leg, breast, abdomen, etc.). Due to this variation we commonly use the buttock, which provides a fairly accurate representation of EFA stores. This test is most useful for research purposes, to determine long term body changes in response to diet. However, we cannot evaluate how the body uses PUFAs. Some patients have abnormal genes that are best reflected in abnormal composition of the fat in some parts of the body. Analyzing these patients requires special biopsies. Unfortunately, such biopsies are rarely available. For example, we rarely study the FA composition of the brain (would you let anyone cut a small piece of your brain?). Because blood is easily available, we use blood as an indicator of body status.

The fatty acids in RBCs are primarily in the RBC membranes, in the form of phospholipids. By analyzing RBCs, we measure phospholipids. The results are fairly independent of total cholesterol and total triglycerides. However, the results can change in response to diet. Although RBCs have an average 120 day life expectancy, the RBC composition does not reflect the average of 120 days of eating-- recent meals influence the composition far more than older meals.

It is difficult to determine how RBCs reflect what one eats, but if a person eats about the same types of foods every week, the RBCs will reflect those foods. The FA composition of fasting RBCs depends on body stores (the result of what we ate during our lifetime), our recent meals, and the body's efforts to keep the composition of RBCs fairly constant (regulatory processes). RBCs are most effective in a few conditions [to be discussed in Dr. Siguel's forthcoming book]. We recommend that plasma FAs be measured in every person and in a few cases we also measure RBCs. We rarely measure RBCs in every person because of the cost of the analysis.

The FA composition of fasting plasma also depends on body stores (which is in part determined by what we ate during our lifetime), and our last meal [See EFALAB at www.efafood.com and/or Dr. Siguel's book for instructions on how to provide a good sample]. We usually measure the fatty acids in whole plasma (meaning all the fats in plasma) because it provides an overview of the metabolism of all the cells of the body. The advantage of plasma is that it measures all the fatty acids and provides clues to fatty acid metabolism and how effectively the body uses fatty acids. It is possible to measure the fatty acids in components of plasma, such as lipoproteins, triglycerides, cholesterol esters and phospholipids. These separate components are difficult to measure and are not practical except in rare cases. Obviously, lipid levels influence the fatty acids in whole plasma. People who have high cholesterol and triglyceride concentration will have a high concentration of FAs and the distribution (%) of FAs will be altered.

What is the fatty acid profile EFA-SR™?

The fatty acid profile **EFA-SR™** was invented by Dr. Siguel to evaluate deficiencies and abnormalities of the essential fats. Before 1985, it was believed that deficiencies and abnormalities of the EFAs were extremely rare (less than 1 in 100,000 people) and occurred only under unusual conditions (such as in patients with fat malabsorption that required intravenous feeding and did not receive lipids intravenously).

Dr. Siguel developed new techniques to measure the essential fats. Using his new technology, he found that essential fat deficiencies and abnormalities were very common in the US population (at least 25% of adults have some type of essential fat abnormality). Dr. Siguel evaluated and tested his methods in patients and research subjects, and published many articles on essential fats. He created a classification of deficiencies and disorders of essential fats. As a result of Dr. Siguel's research, the importance of essential fats became clear. Many companies began to sell vegetable oils rich in essential fats, and many organizations began to analyze fatty acids using methods similar to those used by Dr. Siguel.

Dr. Siguel patented some of his methods, and only organizations licensed by Dr. Siguel can use them. He used his extensive experience in analytical methods, computers, and medicine to develop the best technology to measure the essential fats and provide a meaningful report.

Dr. Siguel did his research and developed his methods years before other people began to study fatty acid abnormalities in humans. As a result, his methods are highly sophisticated and comprehensive. Dr. Siguel's methods are the ones that have been used to write the key papers in scientific journals which explain that fatty acid deficiency is common and characterize disorders of fatty acid abnormalities. Because his approach is patented, many companies choose to use other approaches that avoid paying licensing fees to Dr. Siguel.

Dr. Siguel explored and defined a new field of medicine. He created the terms that are used today, such as "parents" or "precursors" and "daughters" or "derivatives." He coined the term "essential fats" to refer to all the $\omega 3$ and $\omega 6$ fatty acids. He classified disorders as *relative* or *absolute deficiencies* or *insufficiencies*: each disorder has a different fatty acid profile and a different clinical presentation, and requires a different treatment.

Interpreting the results of a fatty acid profile is very complex. There are about 30 key fatty acids and more than 200 secondary ones. One issue is to report only the *key* essential fats, so that the irrelevant fatty acids do not confuse the test results. Some companies report too many fatty acids, which in the opinion of Dr. Siguel provide misleading results.

How can I tell what fatty acids I have been eating? How can I tell if I am fatty acid deficient?


The best overall test is the fatty acid profile **EFA-SR™** done on fasting plasma. A properly done and evaluated plasma fatty acid profile measures the amounts of all the important fatty acids. This is because the fat composition of RBCs is fairly stable (the body tries to keep RBCs healthy) it does not reflect biochemical abnormalities or overall body deficiencies.

Using RBC status to judge body stores of EFs is like using purchases of essential items like food, gas, clothing, or a home to judge a family's financial status. Although a family may appear to have ample money judging by what they buy or own (assets), they may actually have almost no net worth (= assets - liabilities) because they are borrowing on a credit card or bank mortgage. To look at someone's true financial situation, we must look at their *overall* finances.

The body is the same way. Some parts of the body almost always appear to be doing well, because the body tries to preserve them at all costs. For example, RBCs appear healthy most of the time.

However, sometimes people are so deficient in essential fats that even their RBCs look deficient. This is like when even your credit card is rejected because you owe so much money.

To get an accurate view of the whole body, we could take a person, put him/her in a blender and take a sample. Unfortunately, lawyers and patients have rejected this approach. The next approach is to use the plasma (liquid part of the blood) which communicates and transports things to all parts of the body. When the transport system is low in essential fats, we know that the body is low in essential fats. For these and other reasons, Dr. Siguel's research found that whole plasma is the best indicator of fatty acid status.

 Siguel EN, Lerman, RH. Fatty Acid Patterns in Patients With Angiographically Documented CAD. *Metabolism* 1994; 43:982-993. Shows link between EFA abnormalities and heart disease + abnormal cholesterol ratios.

In some patients, such as those with rare genetic conditions, research subjects, and patients with abnormal lipids, we also need to study the fatty acids in RBCs. Our research indicates that measures of RBCs are useful in research studies, where people change from one diet to another and we want to assess the change in diet. However, healthy people have a wide range of normal values for RBCs, and it is very difficult to separate normal from abnormal profiles using RBCs. Therefore, we recommend against using RBCs alone to test for fatty acids. ***RBC analysis should be used only in conjunction with plasma fatty acid profiles.***

How can I tell what fatty acids I need?

The best overall test is the fatty acid profile **EFA-SR™** done on plasma. In some people it is also necessary to evaluate the fatty acids in red cells (RBCs). This fatty acid profile will determine whether or not you are deficient or have a fatty acid abnormality and what fatty acids you need.

What is the difference between a fatty acid deficiency and a fatty acid abnormality?

The only EFAs humans need are linoleic and linolenic acid. In some rare cases, humans may need a few other polyunsaturated fatty acids of the $\omega 3$ or $\omega 6$ families. However, except for extremely rare disorders, humans do not need saturated, monounsaturated, branched chain, or other types of fatty acids that exist in nature. [Other animal species, bacteria, etc may need to eat these other fatty acids, but humans do not need to eat them.]

A *deficiency of fatty acids* refers to a deficiency of the EFAs, and, less commonly, to a deficiency of an EFA derivative. A *fatty acid abnormality* refers to an imbalance of fatty acids, an imbalance of essential fats, the production of excessive amounts of rare fatty acids, or the failure by the body to discard or burn some fatty acids.

An imbalance of essential fats is fairly common. It is also associated with an imbalance of SFAs and MUFAs. When people do not have enough essential fats, they accumulate SFAs and MUFAs. The fatty acid profile **EFA-SR™** evaluates deficiencies and imbalances of the SFAs, MUFAs, and essential fats.

In rare genetic disorders, humans have abnormalities of other fatty acids. Frequently, a specialized fatty acid profile is needed to identify those abnormalities. Most of these abnormalities are genetic and thus occur in children. Often, these children die young, and there is little that can be done to prevent their premature death. Patients with these rare abnormalities must be seen by a specialist.

How can I tell if I have a fatty acid abnormality?

The fatty acid profile **EFA-SR™** evaluates deficiencies and imbalances of the SFAs, MUFAs and essential fats. The report will evaluate an imbalance or metabolic abnormality of the essential

fats, SFAs, MUFAs. It may also detect some more rare abnormalities of long chain saturated fatty acids.

How many fatty acids should I measure? I heard that some laboratories measure 50 to 70 while others only measure 20 to 40. Which one is better?

There are more than 100 different types of fatty acids in human blood. Many are produced by plants and by bacteria in the foods we eat. We know very little about most of these fatty acids. However, we do know that most people have important abnormalities of the essential fats. Thus, except for in very rare conditions, our therapeutic approach is to improve the availability and use of the essential fats. Only in rare cases and for research purposes do we evaluate other fatty acids. Dr. Siguel has shown (and published his findings in peer-reviewed scientific papers) that there are more than 100 different fatty acids in human blood. The methods that he uses are considered state of the art by the most prestigious review groups in the US. After careful evaluation of thousands of fatty acids in humans, Dr. Siguel determined which fatty acids provide the most useful clinical information. The fatty acid profile **EFA-SR™**, accurately measures the key essential fats that are needed for diagnosis and treatment.

Dr. Siguel believes that it is important to accurately measure the *relevant* fatty acids and to *make meaningful clinical decisions*. Obtaining information on other irrelevant fatty acids confuses the issue and begs an inappropriate clinical decision. We have seen many fatty acid profiles that do not use Dr. Siguel's methods and contain a wide range of alleged abnormalities. Patients are told that they have an abnormality in a fatty acid when such abnormality either does not exist or is irrelevant. Sometimes it appears that people have made dramatic changes in their diet in response to fictitious abnormalities in their FA profile.

When one measures many irrelevant fatty acids, it is likely that some of them will fluctuate widely. A change in diet, a change in the chemical composition of plants or bacteria in the foods a person eats, the amount of exercise, the temperature of the environment, humidity, and hundreds of other factors can change the amount of many small FAs. Thus, the fatty acid profile is not useful without a clear understanding of which changes are meaningful and which changes are irrelevant.

I drive a sports utility vehicle. It makes many noises. If I were to quantify all the sounds it makes, I could find thousands of sounds. Some sounds are "normal;" that is, found in other similar vehicles. Others are "abnormal;" that is, not found in other vehicles or rarely found in our car. When I hear an *abnormal* sound, I worry. Fortunately, most abnormal sounds are due to the wind or to different types of junk in the cargo area (empty cans waiting to be returned, books, wiper fluid, sports equipment, etc). It is important that I concentrate only on the *important* noises; the ones that *help identify a serious problem in the car*. Otherwise, I would spend every day at the repair shop trying to find the cause of various noises. [And, as you well know, if you tell a repair shop that your car makes funny noises, the repair shop may find something (expensively) wrong with your car to fix.]

Similarly, if you look at changes in irrelevant fatty acids, you may find yourself taking inappropriate treatment or supplements that not only cost you money, but could make you sick.

What is the difference between the fatty acid profile **EFA-SR™ and other fatty acid profiles?**

The fatty acid profile **EFA-SR™** measures more than 100 fatty acids and *selects those that are clinically important*. (Many more fatty acids are available for research purposes.) Dr. Siguel could easily measure and report more than 100 fatty acids. Although it is cheaper to report all the fatty acids measured, Dr. Siguel explained in his publications and lectures that it is important to *carefully review and evaluate the results and report only the significant and important fatty acids*. The fatty acid profile **EFA-SR™** extracts those fatty acids that are important for diagnosis and

treatment from more than 100 fatty acids measured. The report prepares different ratios and graphs to describe the important relationships among these key fatty acids.

You can either worry about all the funny noises in your car, or you can have an expert identify the important noises and eliminate irrelevant noises that have nothing to do with the condition of the car. It is not difficult to report many noises in a car. What is difficult is to know which are the important noises, and what *those noises* mean in terms of potential problems in the car. Some car noises may be due to things in your trunk or junk in the car. Some noises suggest that it is time to lubricate your car. Some noises indicate that a tire is ready to fall off or that the transmission is falling apart. If you just list all the noises, you will waste time and money. What you really need is a test that separates the important noises from the rest, and tells you what the important noises mean in terms of your car's performance.

When we measure fatty acids in blood, we can report hundreds of fatty acids and other substances. Reporting all fatty acids is easier than reporting only the important ones. What is difficult is determining which changes are important and which changes are trivial. Most fatty acids change dramatically in response to many factors: your diet, the "diet" of your "diet" (composition of soil fruits and vegetables were grown in, water pollution and fish diet, chicken feed, etc), bacteria in the foods you eat, and more. With careful analysis, we could measure the small amounts of fatty acids that came from vegetables in the diets of the animals you ate. Most of these fatty acids have no significant clinical meaning at this time (we may perhaps be able to make sense from them in the future, or they may continue to be irrelevant).

The most important issue for most people is to have the *proper balance of essential fats* and to determine whether they have a relative or absolute deficiency or insufficiency. The treatment to follow and the amount of fatty acids to take depends on whether the abnormality is *absolute* (meaning the whole body has very low levels) or *relative* (meaning the body may have enough, but that there are other substances that interfere with proper utilization).

Dr. Siguel's report looks at many different indicators of the body's use of essential fats. His report can tell you whether you do not have enough essential fats but you are making excellent use of what essential fats you have, or whether you do have enough essential fats, but your body is not making appropriate use of them. If you have enough essential fats but your body is not making appropriate use of them, you may need to change your diet or vegetable oil type. [When you eat many oil supplements such as flax seed oil, the body gets a lot of linoleic and linolenic acid, but most of it is not usable as an essential fat.]

Many blood tests cannot tell the difference between an essential fat that the body uses *for structures and formation of the right mixture of hormones*, and an essential fat that the body uses *for energy or for production of the wrong mixture of hormones*. Dr. Siguel's test relies on markers of essential fat status to tell how well the body uses the essential fats to promote a healthy body.

I had a fatty acid profile last week, and I want to do a test to compare the results with the fatty acids I have been eating 1 month before my blood test.

This is not possible. Some people believe that, because red cells live an average life of 120 days, they can measure the fatty acids in red cells and determine diet for the past 120 days. Unfortunately, this is not true. If a person changes the diet dramatically, then the blood and RBCs reflect those changes fairly rapidly, sometimes within 48 hours.

I had a fatty acid profile last week, and I want to do a test to compare the results with the fatty acids I have been eating for 2 years before my blood test.

Adipose tissue (fat in your body) is formed as the net result of the surplus calories that you have eaten during your lifetime. Adipose tissue contains SFAs, MUFAs, linoleic acid, linolenic acid,

and very small amounts of other long chain EFAs. If you have been eating a lot of very long chain EFAs (what we call derivative EFAs) for many months, your adipose tissue may contain them in relatively large amounts. But if you stop eating them, they slowly disappear from your adipose tissue. Adipose tissue contains large reserves of EFAs, but does not store reserves of EFA derivatives.

A measurement of the amount (%) of linoleic (LA) and linolenic (ALA) acids in your adipose tissue reflects the total amount of the EFAs eaten during your lifetime. It takes a long time (weeks to months) to make a substantial change in the composition of adipose tissue. Measurement of adipose tissue composition is important to predict the effect of weight loss programs, for pregnant women who need to know if they have enough EFAs in store for their baby, and to evaluate the long term effects of a diet. However, most of the time, we can get similar results by studying blood.

To measure the fatty acids in adipose tissue, one takes a tiny biopsy (chunk of adipose tissue). Notice that the fatty acid composition varies from one type of adipose tissue to another (breast, chest, arm, buttock, etc).

Adipose tissue fatty acid composition is useful to evaluate the diet of animals.

What tests should I use to learn the effects of my recent change in diet?

Whole plasma is the best indicator of recent changes in diet.

What test should I use to know my EFA or PUFA status?

Whole plasma. Whole plasma is the best test for most people, and it is usually the only test that people need to have. Patients with cardiovascular disease, diabetes, and abnormal lipids should have fatty acids measured in both RBCs and whole plasma.

Why do I need a fatty acid profile? Why don't I just eat more flax seeds or other oils rich in EFAs?

To get enough nutrients and EFs, most people need only to eat a healthy diet rich in natural foods. One usually needs to eat at least 2,000 calories per day and burn the excess calories through exercise. However, many people have sedentary jobs and should eat less than 1,500 calories/day or they will gain weight (such as women and elderly people). On 1,500 calories per day, it is difficult to get enough nutrients, particularly EFs. Thus, many people need EF supplements.

If you eat a healthy diet, you may need some supplements of EFs, and a mixture of EFs would probably be enough. However, many people have been eating the wrong types of foods for many years, and are afraid they will develop heart disease or other health problems before they can eat enough EFs. Other people have no idea of what vegetable oils or foods are best for them. If you are in these categories, the fatty acid profile **EFA-SR™** will likely provide accurate guidelines about the types of EFs to eat. Whole plasma is usually the best test in these cases.

Some people have cardiovascular disease, diabetes, or other serious health problems, and they need to eat specialized mixtures of EFs to treat their conditions. If you are in one of these categories, the fatty acid profile **EFA-SR™** will help determine the unique mixture of EFs needed to bring your body's fat composition closer to optimal status. Many patients in this condition must eat large amounts of specific fatty acids; the fatty acid profile **EFA-SR™** is essential to provide adequate guidelines. If you have a serious health condition, you may need to be tested at least once per year (and sometimes twice per year) until you have replenished most of your EFs. If you try to eat a mixture of oils without knowing what your body needs, you are likely to feel better at first and then get worse. There is no such thing as an "essential mixture" that is best for everybody.

Most patients will improve with a mixture of 1 to 3 tablespoons of various vegetable oils or foods rich in EFs, such as flax seeds (or flax seed oil), soybean oil (or soybeans or tofu), safflower oil,

sunflower oil, and a few other oils. Most people do not need to eat fish oils or GLA: these substances are expensive, oxidize quickly, and can be counterproductive, causing long term problems. However, some patients have severe health problems and abnormalities of EFs. These patients need an analysis of plasma and RBCs to determine unusual mixtures of EFs needed to correct their problems. Some of these patients require fish oils, GLA, and other unusual fatty acids, often in substantial amounts. If you think you are in this category, you need expert attention.

Common mistakes people make when having their blood analyzed for EFs

People read the Internet and various health magazines to get ideas. Most of the writers do not conduct basic research in EFs. Only a handful of people in the world have done the basic research in essential fats needed to identify fatty acid abnormalities. Their publications are in scientific journals which are difficult to read. By the time their information gets filtered and reported in news media and the Internet, it contains many errors.

Dr. Siguel has lectured to the most popular natural health food trade shows, alternative health care meetings, medical and nutrition scientific conferences, and major medical centers in the US. He has published in well-established peer-reviewed journals (you can read his publications in www.efafood.com/credentials). He has also been interviewed by numerous reporters, including CBS, CNN, major TV stations, *Time* magazine, *Newsweek*, *Business Week*, the *New York Times*, *Longevity* magazine, *Allure* and many more. Dr. Siguel frequently visits web sites dealing with EFAs. Practically all sites and publications, including medical newsletters, contain major errors in their understanding of fatty acid metabolism (see www.EFAlab.com/goodlab).

The following are common errors that Dr. Siguel found while reviewing articles by various authors and while listening to questions sent to him by health professionals and consumers:

- People think that if they do not have enough of a fatty acid, they should eat more of it, and if they have too much, they should eat less of it. In reality, body levels of fatty acids depend on many factors and interactions with levels of other fatty acids. Frequently, the levels of one fatty acid may be high or low because another fatty acid is high or low (what Dr. Siguel calls relative abnormality). Just eating more of one fatty acid or avoiding another could make the condition worse.
- Many people think that reporting more fatty acids makes for a better test. They are unaware that more fatty acids reported often means more reporting errors.
- People fail to check the credentials of the people reporting and interpreting fatty acid profiles. While they would not send their children to study piano with a person whose expertise is in psychology and never studied piano, and would not ask a soccer player with no medical education to provide guidelines for antibiotics to treat an abscess, they may not realize that a person with a PhD in education or some related field may be interpreting their blood test. Look for credentials (expertise, publications, degrees) in biochemistry and medicine from the person who interprets your FAP.
- Taking many supplements without realizing that some of the people who recommend them are supported by manufacturers. Be sure to evaluate the credentials of the person who treats you, to insure that the person has experience treating people with biochemical abnormalities (which usually requires a medical degree) and experience with the chemistry of analyzing fatty acids (such as a PhD in biochemistry, chemistry or related field).

Common errors and misconceptions in interpreting FAPs

Ordering errors

Fatty acid profiles require very little blood and cause no harm, but they are expensive and may not be reimbursed by insurers. People must often determine whether it is cost effective for them to pay for the blood test. For most people, the test results will provide information that will help

them make decisions that are likely to improve their health. However, some people are unduly influenced or misled by things they read and therefore have unrealistic expectations about the test results. Like any other test, be sure that you understand what the likely test results are and how they will impact your diagnosis and treatment.

There are two major types of patients. One group has a substantial genetic defect that affects some aspect of fatty acid metabolism. This group usually develops severe disease in early childhood. The other group (the vast majority of people in the US) usually develops a progressive disease over a period of many years, mostly due to abnormalities or deficiencies attributed to inappropriate eating or some other health condition.

Genetic abnormalities

These patients must be evaluated by measuring specific fatty acids unique to their disorder. Among the genetic abnormalities are subjects who accumulate phytanic acid, very long chain SFAs, or MUFAs such as 26:0 and 26:1.

Acquired abnormalities

Imbalances or deficiencies of the essential fats. For these patients, we usually measure ~ 40 of the most important fatty acids needed to determine optimal fat intake.

Interpreting errors

There are hundreds of sources of errors described in books and articles by Dr. Siguel and others. The best defense is to use a laboratory supervised by a person with expertise in doing fatty acid analysis.

Beware of reports describing apparent "abnormalities" in rare fatty acids because they were found in quantities several standard deviations beyond "normal." We consider most of those reports misleading. Many fatty acid values are probably in error because of huge measurement errors. Errors occur because the laboratory technology used is not accurate enough, or because the lab did not pay attention to errors because the errors did not appear important.

As a general rule, fatty acids found in less than 1% of total fatty acids can easily have errors of 100% or more, depending on the technology used to measure them. Errors occur if the peak (substance) separation is not good enough (perhaps the lab used short columns, the wrong column, or a short method to save money). Often the computers used to calculate the area of a substance made an error in practically every sample they analyze.

The computer must calculate the area of a curve which is similar to a mixture of a triangle with a Gaussian curve, but where the baseline (base) fluctuates. Frequently, fatty acids and leftover junk from a previous column injection elute (come out) with another sample, creating spurious (false) peaks. These peaks may be very broad, causing the computer to miscalculate the amount of various substances. Almost every sample has at least one error of this type.

Dr. Siguel's methods pay particular attention to minimize these errors, including careful evaluation of the chromatogram and test results. One approach to prevent these spurious peaks is to clean the column after every sample (of course, this costs money). See tutorials at www.essentialfats.com for more errors.

More substances reported does not make for a better lab test. Instead, it is better to measure *only the important fatty acids* and *measure them accurately*. Many fatty acids separate poorly, and the technology gets confused and miscalculates their areas. Select a lab that individually reviews each peak for accuracy. Laboratories that report more than 40 peaks must be carefully scrutinized, because it is very costly and difficult to review so many fatty acids.

"Normal" variability in test results is ~ 30% for lipids and fatty acids accounting for > 5% of total fatty acids. This variability is due to normal fluctuations in blood composition, fluctuations in how the blood is drawn, evaporation after the blood is drawn, and normal variability in the methods used to measure fatty acids.

Specific fatty acids

The fatty acids 17:0, 19:0, and 23:0 are often added to the current sample as "internal standards" to calculate concentrations of other fatty acids. These three fatty acids are usually present in very tiny amounts, mostly from a few foods that we eat. Because large amounts of these fatty acids are used as internal standards, they may remain in the column for a while and appear as small peaks (substances) in subsequent sample injections that did not use those internal standards. Their concentration may vary dramatically as a result of a small change in a few foods. With rare exceptions, there is no significance attached to most changes in these fatty acids.

Very short chain fatty acids (length < C12) require special analytical methods. Their quantities can vary greatly due to random losses during the extraction procedure. A huge number of oxidation products of cholesterol and fatty acids appear on the chromatogram, usually close to the location of very long chain fatty acids such as 24:0, 24:1 and others. These fatty acids are in very small amounts and any junk left in the column or oxidation byproducts create the appearance of a larger peak.

Fatty acids subject to great error include all *trans* fatty acids and small peaks such as GLA, ALA, and EPA. In contrast. ARA and DHA are easy peaks to measure.

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I heard that the essential fats in some oils are destroyed or not useful. Should I avoid hexane extracted oils? How do I know which containers are better for oils?

Contrary to popular belief, the essential fats are fairly sturdy. Both commercial extraction with chemicals and so-called pressure extraction extract the oils from seeds with relatively minor destruction of essential fats. Neither method is clearly superior to the other. We have analyzed fatty acids in oils produced by many different companies and methods, and found some oils satisfactory and others not satisfactory. What is most important is the reputation of the company and the quality of its methods, not the specific methods used.

There are several different issues involved:

- Destruction of essential fats that exist in the original plant or seed or food;
- Destruction of other substances that exist in the original plant or seed or food. These substances may be important to the body or may help protect the fatty acids from oxidation (such as antioxidants like vitamin E);
- Production of byproducts of processing that can be harmful, such as isomers and many other changes in the structure of the fatty acids;

● Failure to eliminate toxic substances in the original food or seed or plant, such as pesticides, herbicides, and toxins inherent to the plant itself (many plants, like animals, have toxins).

● Storage conditions for the seed, plant, food or oil. Many times the foods are transported across countries (such as organic seeds). Often, they are stored for months in huge storage bins. They may be carried on trucks, trains, etc. There may also be a problem with bacterial contamination while the plant or seed is in storage. Organic labels may not protect against soil and water contamination, or insects while the seed or plant is in transit. Who cleans all the storage containers, transport trains, etc? Do they wash their hand and feet? How about the instruments they use? What about leftovers from previous shipments? Perhaps they carried toxic chemicals before they carried the seeds.

Organic processing tends to preserve more substances from the original food (such as a seed). Both health and unhealthy substances may be preserved, including those chemicals acquired in transit!

Many companies use small presses that generate a lot of heat to press the seed and extract the oil. The heat can produce changes in the chemical structure of the essential fats. This process may also extract pesticides and toxins in the seed. However, the seed retains more of its natural flavor and may contain more antioxidants and healthy substances found in the seed.

Chemical extraction may be better to remove toxic chemicals and produce a more pure oil, but it may also remove many other healthy products. Some companies intentionally remove antioxidants such as vitamin E, to sell them separately at a higher price. Many commercially produced oils are depleted of some desirable substances so that these substances can be sold as supplements. Usually the oils extracted without chemicals (physical pressure extraction) preserve many ingredients from the original seed.

Some products, such as fish oils, may become extensively damaged during the long months in transit and processing from the original poor dead fish to the expensive capsules that people purchase that help some seller reap gigantic profits. In our opinion, fish oils are one of the most dangerous products in the market. We recommend avoiding products made with fish oils or with animals fed fish oils. Fish oils should be reserved for those unusual conditions where there are no alternative foods or supplements.

Relevant quotes

● In a study that calls into question the currently accepted guidelines for good nutrition, two Boston University School of Medicine researchers have found that low levels of the EFAs, also known as PUFAs, are a major predictor of undesirable blood lipid levels, a well established risk factor for cardiovascular disease (findings presented at Am. College of Cardiology, 1994) (Boston Univ Medical Center News, 1994).

● Dr. Siguel found a link between plasma levels of trans fatty acids and the risk of cardiovascular disease. He reported that "saturated, trans fatty acids and total cholesterol are positively associated, whereas HDL/TC and PUFAs are negatively associated with CAD."

● Siguel EN, Lerman, RH. *Trans* fatty acid patterns in patients with angiographically documented CAD. *Am. J. Cardiology* 1993; 71:916-920.



Portions of this section have been excerpted from the book "[EFAs in Health and Disease](#)" (how to order, table of contents, references, notes, excerpts).

We welcome your questions and other technical issues that we can incorporate in this file.

Unfortunately we cannot respond to personal inquiries from people who had problems with fatty acid analyses performed by other laboratories. We can respond to scientific issues but we cannot provide interpretation of blood tests done by other labs. If you are dealing with a non-licensed practitioner, you may file a claim with the Board of Medicine of the appropriate state.

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