# Essential and Metabolic Fatty Acids

## Why is this test important?

Fatty acids and especially essential fatty acid (EFA)s are the core building blocks of our cell membranes, and so affect all cellular functions and communications.

Fatty acid abnormalities are frequently found in people with chronic inflammatory diseases, auto-immune diseases, heart disease, depression, behavior disorders, such as Attention Deficit Hyperactivity Disorder (ADHD), and senile neurological degeneration. Re-balancing the membrane levels of fatty acids can improve the clinical pictures in these cases.

We know that large amounts of docosahexaenoic acid (DHA) and arachidonic acid (AA) are necessary for normal fetal and neonatal neurological and brain development. These fats must come from the mother directly from the placenta or breast milk, which can put an enormous strain on the mother's reserve supplies. Many complications of pregnancy, such as pre-eclampsia, gestational diabetes and post-partum depression, are associated with low levels of DHA, EPA, and AA.

Women who want to become pregnant, and women who have had miscarriages or difficulty conceiving, should make sure their reserves are adequate for sustaining a fetus to term and beyond.

## What does this test involve?

A simple blood draw (lavender top) is required since we measure the fats from the phospholipids that compose the actual red blood cell membranes, the gold standard for measuring EFA reserves.

## What are the consequences of hormonal imbalances?

EFAs are utilized to make "local" hormones, known collectively as eicosanoids, which regulate all inflammation and smooth muscle contraction in the body. Unbalanced levels of EFAs can lead to chronic inflammatory states and can play a major role in the pathophysiology of many diseases including:

| | | | |
|---|---|---|---|
| **arthritis** | **senile dementia** | **depression** | **asthma** |
| **ADHD** | **cardiovascular disease** | **colitis** | **cachexia** |
| **Crohn's disease** | **aggressive behaviore** | **czema** | **auto-immune disease** |

Further, EFAs are essential building blocks for nerve and brain development in the fetus and neonate, and thus become critically important for normal brain development. Pregnant women without adequate EFAs often suffer from complications in their pregnancies such as gestational diabetes, pre-eclampsia, and post-partum depression.

Rarely will you find a single fatty acid out of balance. Indeed, there are a few patterns of EFAs that reflect the vast majority of the clinical pictures you are likely to encounter in your practice. These pictures can overlap, however, revealing more than one "problem."

# Omega-3 Fats

| Analyte | *Result* | *Suspect* | *Consider* |
|---|---|---|---|
| **Omega-3 Fats (ALA, EPA, DHA)**<br><br>*This is the most common abnormality and is due to the fact that dietary omega-6 fat consumption has skyrocketed in the last century (mainly from vegetable oil use) and omega-3 fat consumption has diminished (from processing oils that increase shelf life and destroy n-3 fats). The ratio of n-6 to n-3 fats in 1909 was estimated to be 4:1. By 1985 that ratio had risen to 25:1.*<br><br>*When supplementing any polyunsaturated oil, include additional antioxidants, especially vitamin E and carotenoids, to prevent oxidation.*<br><br>*The body needs about 10g of ALA to make 1g of EPA.* | Low | • Alpha-linolenic acid (ALA) | **Supplementation with:**<br>• Flax seeds and oil<br>• Walnuts and oil<br>• Unroasted nuts and seeds<br>• Dark leafy greens |
| | Low | Eicosapentaenoic acid (EPA)<br>OR<br>Docosapentaenoic acid (DHA) | **Supplementation with:**<br>• Cold water fatty fish<br>• Salmon<br>• Sardines<br>• Wild trout<br>• Herring<br>• Anchovies<br>• Tuna<br>• Mackerel<br>• Fish oils (EPA/DHA) are available in a variety of supplemental forms, from bulk oil to nitrogen-sealed capsules.<br>• An algae-derived DHA is available for vegetarians and pregnant women.divided dosing throughout the day. |
| | Low | Elevated linoleic acid (LA) and/or arachidonic acid (omega 6 fatty acids) | • Use only olive oil or high-oleic canola or high-oleic safflower oil for cooking.<br>• Avoid all other vegetable oils.<br>• Avoid all margarine and shortening. |

# Delta-6 Desaturase

| Analyte | *Result* | *Suspect* | *Consider* |
|---|---|---|---|
| **Delta-6 Desaturase**<br><br>*As much as 20% of the population may have impaired delta-6 desaturase (∅6d) activity. And ∅6d activity decreases dramatically in people as they age. This enzyme is used several times to desaturate the growing EFA chains, although the first conversion [or desaturation] is usually the most tell-tale, when LA is converted into GLA (and subsequently into DGLA). Appropriate therapy is always to give the pre-formed oil that bypasses the action of delta-6 desaturase.*<br><br>*Vitamin and mineral cofactors for optimum delta-6 desaturase activity: niacin (B3), pyridoxal-5-phosphate (B6), vitamin C, zinc, and magnesium* | Deficient | • High linoleic acid (LA)<br>AND<br>• Low di-homo-gamma linolenic acid (DGLA) | • supplementation with sources of GLA (easily converted to DGLA):<br>- Evening Primrose Oil<br>- Borage Oil<br>- Black Currant Seed Oil |
| | | If AA is also low, the problem is more severe. | • supplementation with sources of AA:<br>- Egg yolks<br>- Lean, grain-fed, steroid-free beef |
| | | Low EPA | • supplementation with EPA |
| | | High or normal EPA and low DHA | • supplementation with DHA |

# Dysglycemia and Hyperinsulinemia

| Analyte | | *Suspect* | *Consider* |
|---|---|---|---|
| **Dysglycemia and Hyperinsulinemia**<br><br>*One of the many effects of elevated insulin is the upregulation of the enzyme delta-5 desaturase, which converts DGLA into AA. DGLA is the most potent anti-inflammatory EFA, while AA is the most potent pro-inflammatory EFA. Thus, a major effect of high insulin levels is to put the body into a heightened pro-inflammatory state, with disastrous long-term consequences for health.*<br><br>*People who eat a diet high in carbohydrates, especially simple sugars, experience surges in insulin levels resulting in high levels of AA.* | | • Low DGLA<br>AND<br>• High AA | • Use only olive or high-oleic oils for cooking.<br>• Reduce the use of omega-6 vegetable oils. Supplement EPA, which slows the activity of delta-5 desaturase.<br>• Eat a diet free of simple sugars, with a relatively high percentage of protein and complex carbohydrates (beans, whole vegetables and fruits).<br>• Run a Metabolic Dysglycemia Profile to rule out diabetes, dysglycemia, insulin resistance, or hyperinsulinemia. |

# Miscellaneous Conditions

| *Suspect* | *Consider* |
|---|---|
| • Low oleic acid (18:2n-9)<br>*AND*<br>• high stearic acid (18:0) | • Increase use of olive oil as dietary oil.<br>• Supplement co-factors of desaturase enzymes:<br>- niacin (B3)<br>- pyridoxal-5-phosphate (B6)<br>- vitamin C<br>- zinc<br>- magnesium |
| • High trans fats<br>• Elaidic acid (18:1n9t)<br>[Indicates increased oxidative stress levels and a need for additional anti-oxidant protection.] | • Vitamin E and the carotenes are particularly indicated.<br>• Avoid all margarine, shortening and dairy products. |
| • Elevated levels of saturated fats<br>[This results in more rigid cell membranes, especially with longer-chain saturated fats. Increased rigidity and/or decreased fluidity decreases membrane receptor function. This can lead to hormone dysfunction or cell-cell communication difficulties.] | • Reduce saturated fats in the diet (meats, chicken, dairy).<br>• Use olive oil as main cooking oil.<br>• Supplement polyunsaturated fats as indicated by report.<br>• Promote increased metabolic rates through aerobic exercise. |



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