Interpretation At-A-Glance Details

Antioxidants

Vitamin A / Carotenoids

Contributing Biomarkers:
Cystine
Cysteine
Lipid Peroxides

Vitamin C

Contributing Biomarkers:
Cystine
Cysteine
Glutathione

Vitamin E / Tocopherols

Contributing Biomarkers:
Cystine
Cysteine
Lipid Peroxides

α-Lipoic Acid

Contributing Biomarkers:
Glutathione
Lipid Peroxides

Glutathione

Contributing Biomarkers:
Glutathione
Lipid Peroxides

Plant-based Antioxidants

Contributing Biomarkers:
Cystine
Cysteine
Glutathione
Lipid Peroxides

B-Vitamins

Thiamin - B1

Contributing Biomarkers:
α-Keto-β-Methylvaleric Acid
Serine

Interpretation At-A-Glance Details

Riboflavin - B2	**Contributing Biomarkers:** Glutaric Acid
Niacin - B3	**Contributing Biomarkers:** Kynurenic Acid
Pyridoxine - B6	**Contributing Biomarkers:** Kynurenic Acid Methionine Serine
Folic Acid - B9	**Contributing Biomarkers:** Formiminoglutamic Acid Serine
Cobalamin - B12	**Contributing Biomarkers:** Formiminoglutamic Acid Succinic Acid

Minerals

Molybdenum	**Contributing Biomarkers:** Taurine
Magnesium	**Contributing Biomarkers:** Ethanolamine Phosphoethanolamine

Essential Fatty Acids

Need for Essential Fatty Acids	**Contributing Biomarkers:** Omega 3 Index

Digestive Support

Interpretation At-A-Glance Details

Need for Probiotics

Contributing Biomarkers:
Benzoic Acid
Citramalic Acid

Need for Pancreatic Enzymes

Contributing Biomarkers:
1-Methylhistidine

Functional Imbalances

Mitochondrial Dysfunction

Contributing Biomarkers:
Glutathione

Need for Methylation

Contributing Biomarkers:
Glutathione

Metabolic Analysis Markers

Commentary

Commentary is provided to the practitioner for educational purposes, and should not be interpreted as diagnostic or as treatment recommendations. Diagnosis and treatment decisions are the practitioner's responsibility.

Benzoic acid is a common food component, especially in fruits and in particular berries/cranberries. It is also a common food additive/preservative. Benzoic acid is also formed by gut microflora metabolism of phenylalanine and dietary polyphenols. Elevated levels may thus reflect dietary intake (for example strawberries), imbalanced gut flora or a high intake of polyphenols or phenylalanine. Older studies note a relationship between decreased cognitive function and increased BA in the urine.

Citramalic Acid is elevated. With a chemical structure very similar to that of malic acid, citramalate may cause metabolic interference with malate. This is of concern because malic acid has extra-mitochondrial functions, as with the "malate shuttle" for carrying reducing equivalents (protons) into the mitochondria. While the metabolic interference aspect is uncertain, the presence of citramalate in the urine indicates intestinal dysbiosis. Not formed in human tissues, citramalate may be formed by anaerobic bacteria such as clostridia, as well as by yeast/fungi. A stool analysis with bacteriology or microbiology is suggested.

Cis-aconitic Acid (CAA) is measured to be subnormal, while its precursor, citric acid is not deficient. This may occur with low carbohydrate diets, fasting or anorexic conditions; citric acid may then be only marginal. On the other hand, normal or elevated citric acid with low cis-aconitic acid may be the result of urinary citrate wasting (leading to deficiency) or of weakness in the enzyme that transforms citrate into cis-aconitate. This enzyme (aconitase) requires cysteine or glutathione in the reduced state and ferrous iron (Fe+2). Oxidant stress can inhibit aconitase as can toxic elements that bind to sulfhydryl groups (mercury, arsenic, antimony). Fluorine or fluoride that forms fluorocitrate is also a very potent inhibitor of aconitase.

Succinic acid participates in the citric acid cycle, acting to donate electrons to the mitochondrial electron transport and leading to formation of fumaric acid. Common in foods such as cantaloupe, it is also a food additive, providing flow-altering effects and a tart flavor. It appears that lacto-ovo vegetarians may show decreased levels in the urine and chronic fatigue patients may also show low levels, although studies on this topic are mixed. Low levels may also be an indicator of B12 or folate deficiency.

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Elevated **serine** is measured; **glycine** is within normal limits. Metabolic disorders of genetic origin affecting only serine are not documented. Mildly elevated serine can be a sign of vitamin B6 insufficiency or pyridoxal 5-phosphate coenzyme dysfunction.

Essential & Metabolic Fatty Acids Markers (RBCs)

Commentary

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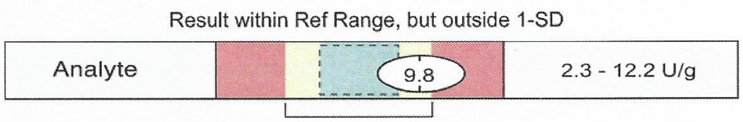
The **Reference Range** is a statistical interval representing 95% or 2 Standard Deviations (2 S.D.) of the reference population. One Standard Deviation (1 S.D.) is a statistical interval representing 68% of the reference population. Values between 1 and 2 S.D. are not necessarily abnormal. Clinical correlation is suggested. (See example below)



Fatty Acids and Your Health

Doctors and nutritionists used to think that all fat was merely a way for the body to store calories for later use as energy, since, as we all know too well, if we eat excess food, our body converts those calories to fat. Only in the last century have we discovered that some fats are absolutely essential to health. Our bodies cannot make these fats, and so we must get them from our food, or our health will suffer. These Essential Fatty Acids (EFAs) have many functions in the body: they are the precursors for local "hormones"; they regulate all inflammation as well as all smooth muscle contraction and relaxation. These local hormones are given names like prostaglandins, leukotrienes and thromboxanes. EFAs are also essential components for all cell membranes. Their importance for health cannot be overemphasized since the brain, nerves, eyes, connective tissue, skin, blood vessels, and every cell in the body depend on a proper balance of essential fatty acids for optimal function. It is the fats found in red blood cell membranes, known as phospholipids, that this test measures.

Essential fatty acids are classified into fat "families": omega 3 fats and omega 6 fats. Non-essential fat "families" include omega-9 fats, saturated fats, omega-7 fats, and trans-fats. Optimal health depends on the proper balance of all fats - both essential and non-essential fats - in the diet. Proper balance means adequate amounts of each individual fat, without having too much, and maintaining proper balance between the various "families" of fats. Fat health also means avoiding potentially harmful fats such as trans fats found in shortening, margarine, fried foods and dairy. A proper balance of fatty acids will lead to mental health and proper nerve function, a healthy heart and circulatory system, reduced inflammation in general, proper gastrointestinal and lung function, a more balanced immune system, and even healthy skin, hair and nails. Fatty acid balance is also critical for the health of all pregnant women and their babies since the developing brain and nervous system of the baby requires large amounts of EFAs that must come from the mother. Fatty acid imbalances have been seen in many disease processes including heart disease, hypertension, insulin resistance and diabetes, asthma, painful menstruation, pre-menstrual syndrome (PMS), depression, attention deficit hyperactivity disorder (ADHD), senility, obsessive-compulsive disorder, and post-partum depression.

This Essential and Metabolic Fatty Acid Analysis allows your health care practitioner to examine the fats found in your red blood cell membranes. These fats represent the types of fats your body has available to make cell membranes and the local "hormones" that control inflammation and smooth muscle contraction throughout the body. Following your health care practitioner's advice on diet and fatty acid supplementation is likely to restore your fatty acids to a state of healthy balance.

Results of Your Individual Essential and Metabolic Fatty Acid Analysis

Linoleic acid (LA) is within the reference range, but below the functional physiologic range. LA is found in large

Commentary

quantities in virtually all vegetable oils (corn, peanut, soy, sunflower, safflower, canola, etc.). Given the large quantities of vegetable oil in the typical western diet, LA is usually seen only in people on a fat-free or severely fat-restricted diet. LA is the precursor essential fat for GLA, DGLA and arachidonic acid. Other dietary sources of LA include avocados, nuts, and seeds.

Linoleic acid stimulates normal cellular division and cellular repair. Inadequate LA may result in eczema-like skin eruptions, behavioral disturbances, increased thirst, growth retardation, and impaired wound healing.

Dihomo Gamma Linolenic Acid (DGLA) is within the reference range, but below the functional physiologic range. DGLA is the main precursor fat for the production of highly anti-inflammatory eicosanoids, especially the series 1 prostaglandins. Low DGLA is often associated with inflammatory conditions such as heart disease, arthritis, inflammatory bowel disorders, eczema, and psoriasis. Since DGLA-derived eicosanoids also promote smooth muscle relaxation, low DGLA levels may contribute to increased smooth muscle contraction, and subsequently to conditions like hypertension, asthma, painful menstruation, and irritable bowel syndrome.

Low DGLA can result from impaired conversion of linoleic acid into gamma-linolenic acid (and subsequently into DGLA) or from an increased conversion of DGLA into arachidonic acid or both. Delta-6 desaturase is the enzyme responsible for converting LA into GLA and may be impaired with age, alcohol use, genetic defect, or nutrient deficiency. An elevated linoleic/DGLA ratio or an elevated eicosadienoic/DGLA ratio (see p.3 of this report) would strongly suggest impaired delta-6 desaturase activity. Supplementation with GLA-containing oils like evening primrose, borage or black currant seed oils bypasses delta-6 desaturase.

A low DGLA/arachidonic acid ratio (see p.3 of this report) would indicate a likely increased activity of delta-5 desaturase. Insulin activates delta-5 desaturase. A high carbohydrate (sugars and starch) diet increases insulin secretion and action in the body. Consumption of a higher protein and higher fiber and complex carbohydrate diet reduces insulin action in the body. Eicosapentaenoic acid (EPA) supplementation, found in fish and fish oils, has also been shown to reduce delta-5 desaturase activity, reducing the conversion of DGLA into AA.

Pentadecanoic acid and/or Tricosanoic acid are above the reference range. Odd chain fatty acids are produced when endogenous fatty acid synthesis begins with propionic acid (3-carbon fatty acid) as substrate rather than acetic acid (2-carbon). Propionate is found in high quantities in butter and other dairy products. Propionate is also one of the short chain fatty acids produced by our gut bacteria in the fermentation (digestion) of water-soluble fiber. With adequate B12 and biotin, propionate can be converted into succinate for use in the citric acid cycle and energy production. High levels of odd chain fatty acids in cell membranes may indicate an increased need for B12 and biotin, or may result from an exceptionally high water-soluble fiber diet.

Oxidative Stress Markers

Commentary

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Commentary

Testing Methodology: ICP-MS

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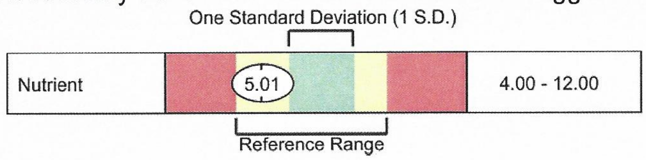

The reference range for Lead is set at NHANES 95th percentile.
https://www.cdc.gov/biomonitoring/pdf/FourthReport_UpdatedTables_Volume1_Jan2017.pdf

The reference range for Cadmium is set at NHANES 95th percentile.
https://www.cdc.gov/biomonitoring/pdf/FourthReport_UpdatedTables_Volume1_Jan2017.pdf

The reference range for Mercury is set at NHANES 95th percentile.
https://www.cdc.gov/biomonitoring/pdf/FourthReport_UpdatedTables_Volume1_Jan2017.pdf