Metabolomix+

REDESIGNED
REIMAGINED

CLINICIAN INFORMATION

METABOLOMIX+ : A NON-INVASIVE PERSONALIZED ASSESSMENT

Metabolomix+ is a urinary nutritional evaluation that includes key organic acids and amino acids to evaluate the functional need for antioxidants, B-vitamins, minerals, digestive support, and amino acids.

Metabolomix+ also includes the option of additional Essential & Metabolic Fatty Acids, Toxic and Nutrient Elements, plus Genomics.

The Metabolomix+ provides targeted nutrient therapeutics designed to give insight into:

- Mood disorders[1,2]
- Cardiovascular disease[3,4]
- Metabolic syndrome[5,6]
- Fatigue[7,8]
- Obesity and weight issues[9,10]
- Cognitive decline[11,12]
- Athletic optimization[13,14]
- Malnutrition[15]

Metabolomix+ consists of:

- **Organic Acids** – providing insight into nutritional cofactor needs, digestive issues, cellular energy production, neurotransmitter metabolism, detoxification, **and now oxalates.**
- **Amino Acid Analysis** – features 37 urine amino acids. This assesses nutritionally essential and non-essential amino acids, as well as intermediary metabolites that augment an understanding of B vitamin need, and need for support of protein digestion and absorption.
- **Oxidative Stress Analysis** – highlights the body's current state of oxidative stress and reserve capacity.

Why Use Metabolomix+?

Studies suggest that even a balanced diet may not provide all essential nutrients. Metabolomix + can help to support you and your patients by:

- Identifying nutritional insufficiencies that may be at the root cause of complex chronic conditions
- Providing at-home specimen collection
- Offering an easy-to-use "Interpretation At-A-Glance" that provides patients with valuable information about the function of nutrients, their dietary sources, and the causes and complications of their deficiencies
- Giving insight into potential digestion and absorption abnormalities

The Metabolomix+ report offers functional pillars with a built-in scoring system to guide therapy in a systems-based fashion. The report also contains dynamic biochemical pathway charts for clearer understanding

- **Add-on Components**
  -Bloodspot Essential Metabolic Fatty Acids
  -Urine Nutrient & Toxic Elements
  -Genomic SNPs

FATIGUE

MOOD DISORDERS

WEIGHT ISSUES

GENOVA DIAGNOSTICS

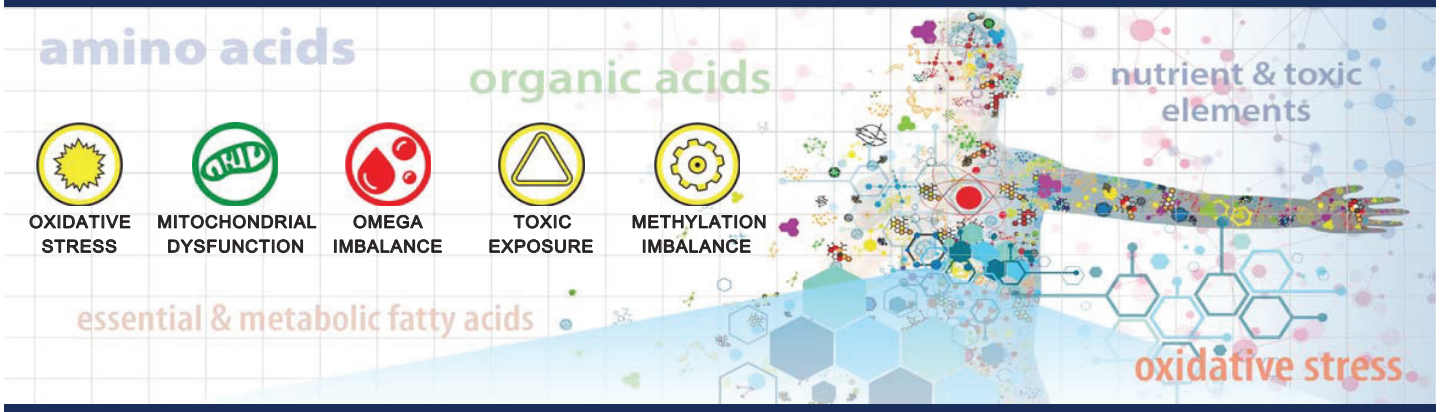
Results Overview

GENOVA DIAGNOSTICS
63 Zillicoa Street
Asheville, NC 28801

Metabolomix+

3200 Metabolomix+ - FMV Urine

Results Overview



Functional Imbalance Scores

Key 0-4 : Minimal Need for Support | 5-7 : Moderate Need for Support | 8-10 : High Need for Support

Need for Antioxidant Support

Oxidative Stress

5

Cystine	▼
Cysteine	●
Lipid Peroxides	●
8-OHdG	●
Taurine	▼
Citric Acid	△
cis-Aconitic Acid	●

Need for Mitochondrial Support

Mitochondrial Dysfunction

0

Magnesium	▼
FIGLU	●
Methylmalonic Acid	●
Glutaric Acid	△
Lactic Acid	●
Pyruvic Acid	△
Citric Acid	△
cis-Aconitic Acid	●
Isocitric Acid	●
α-Ketoglutaric Acid	●
Succinic Acid	▼
Malic Acid	△
Adipic Acid	●
Suberic Acid	●
Manganese	▲

Need for Inflammation Support

Omega Imbalance

8

Omega-3 Index	▽
Omega 6/3 Ratio	●
α-Linolenic Acid	▼
Arachidonic Acid	▲
Linoleic Acid	▼
γ-Linolenic Acid	▼
Dihomo-γ-linolenic Acid	▽

OMEGA IMBALANCE AVAILABLE WITH OPTIONAL ADD-ONS

Need for Reduced Exposure

Toxic Exposure

7

Lead	▲
Mercury	●
α-Hydroxyisobutyric Acid	●
α-Ketophenylacetic Acid	●
Arsenic	●
Cadmium	▲
Pyroglutamic Acid	●
Orotic Acid	●
Citric Acid	△
cis-Aconitic Acid	●
Isocitric Acid	●
Glutaric Acid	△

Need for Methylation Support

Methylation Imbalance

7

Methylmalonic Acid	●
Methionine	△
FIGLU	●
Sarcosine	▲
Vanilmandelic Acid	●
Arginine	▼
Glycine	●
Serine	▲
Creatinine	▼

Suggested Supplement Schedule

Nutrient Need Overview

	Nutrient Need (0 1 2 3 4 5 6 7 8 9 10)	DRI	Suggested Recommendations	Provider Recommendations
Antioxidants				
Vitamin A		3,000 IU	3,000 IU	
Vitamin C		90 mg	250 mg	
Vitamin E / Tocopherols		22 IU	100 IU	
α-Lipoic Acid			100 mg	
CoQ10			30 mg	
Glutathione				
Plant-based Antioxidants				
B-Vitamins				
Thiamin - B1		1.2 mg	50 mg	
Riboflavin - B2		1.3 mg	25 mg	
Niacin - B3		16 mg	30 mg	
Pyridoxine - B6		1.7 mg	25 mg	
Biotin - B7		30 mcg	100 mcg	
Folic Acid - B9		400 mcg	800 mcg	
Cobalamin - B12		2.4 mcg	100 mcg	
Minerals				
Magnesium		420 mg	800 mg	
Manganese		2.3 mg	3.0 mg	
Molybdenum		45 mcg	75 mcg	
Zinc		11 mg	20 mg	
Essential Fatty Acids				
Omega-3 Fatty Acids		500 mg	2,000 mg	
GI Support				
Digestive Support/Enzymes			10,000 IU	
Microbiome Support/Probiotics			50 billion CFU	

Amino Acids (mg/day)

Arginine	1,460	Methionine	0
Asparagine	0	Phenylalanine	0
Cysteine	0	Serine	0
Glutamine	0	Taurine	1,212
Glycine	0	Threonine	0
Histidine	2,190	Tryptophan	0
Isoleucine	1,168	Tyrosine	0
Leucine	1,308	Valine	10
Lysine	1,730		

Recommendations for age and gender-specific supplementation are set by comparing levels of nutrient functional need to optimal levels as described in the peer-reviewed literature. They are provided as guidance for short-term support of nutritional deficiencies only.

The Nutrient Need Overview is provided at the request of the ordering practitioner. Any application of it as a therapeutic intervention is to be determined by the ordering practitioner.

Interpretation At-A-Glance

Antioxidant Needs

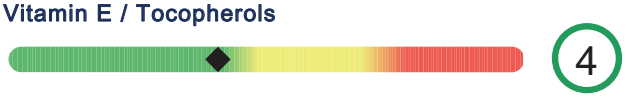
Vitamin A

- Beta-carotene & other carotenoids are converted to vitamin A (retinol), involved in vision, antioxidant & immune function, gene expression & cell growth.
- Vitamin A deficiency may occur with chronic alcoholism, zinc deficiency, hypothyroidism, or oral contraceptives containing estrogen & progestin.
- Deficiency may result in night blindness, impaired immunity, healing & tissue regeneration, increased risk of infection, leukoplakia or keratosis.
- Food sources include cod liver oil, fortified cereals & milk, eggs, sweet potato, pumpkin, carrot, cantaloupe, mango, spinach, broccoli, kale & butternut squash.

Vitamin C

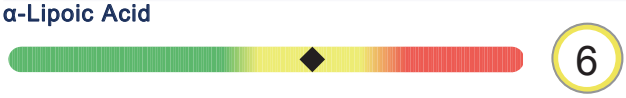
- Vitamin C is an antioxidant (also used in the regeneration of other antioxidants). It is involved in cholesterol metabolism, the production & function of WBCs and antibodies, and the synthesis of collagen, norepinephrine and carnitine.
- Deficiency may occur with oral contraceptives, aspirin, diuretics or NSAIDs.
- Deficiency can result in scurvy, swollen gingiva, periodontal destruction, loose teeth, sore mouth, soft tissue ulcerations, or increased risk of infection.
- Food sources include oranges, grapefruit, strawberries, tomato, sweet red pepper, broccoli and potato.

Vitamin E / Tocopherols



- Alpha-tocopherol (body's main form of vitamin E) functions as an antioxidant, regulates cell signaling, influences immune function and inhibits coagulation.
- Deficiency may occur with malabsorption, cholestyramine, colestipol, isoniazid, orlistat, olestra and certain anti-convulsants (e.g., phenobarbital, phenytoin).
- Deficiency may result in peripheral neuropathy, ataxia, muscle weakness, retinopathy, and increased risk of CVD, prostate cancer and cataracts.
- Food sources include oils (olive, soy, corn, canola, safflower, sunflower), eggs, nuts, seeds, spinach, carrots, avocado, dark leafy greens and wheat germ.

α-Lipoic Acid



- α-Lipoic acid plays an important role in energy production, antioxidant activity (including the regeneration of vitamin C and glutathione), insulin signaling, cell signaling and the catabolism of α-keto acids and amino acids.
- High biotin intake can compete with lipoic acid for cell membrane entry.
- Optimal levels of α-lipoic acid may improve glucose utilization and protect against diabetic neuropathy, vascular disease and age-related cognitive decline.
- Main food sources include organ meats, spinach and broccoli. Lesser sources include tomato, peas, Brussels sprouts and brewer's yeast.

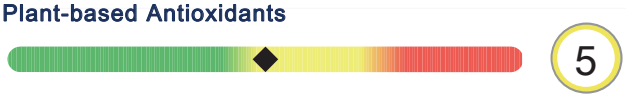
CoQ10

- CoQ10 is a powerful antioxidant that is synthesized in the body and contained in cell membranes. CoQ10 is also essential for energy production & pH regulation.
- CoQ10 deficiency may occur with HMG-CoA reductase inhibitors (statins), several anti-diabetic medication classes (biguanides, sulfonylureas) or beta-blockers.
- Low levels may aggravate oxidative stress, diabetes, cancer, congestive heart failure, cardiac arrhythmias, gingivitis and neurologic diseases.
- Main food sources include meat, poultry, fish, soybean, canola oil, nuts and whole grains. Moderate sources include fruits, vegetables, eggs and dairy.

Glutathione

- Glutathione (GSH) is composed of cysteine, glutamine & glycine. GSH is a source of sulfate and plays a key role in antioxidant activity and detoxification of toxins.
- GSH requirement is increased with high-fat diets, cigarette smoke, cystinuria, chronic alcoholism, chronic acetaminophen use, infection, inflammation and toxic exposure.
- Deficiency may result in oxidative stress & damage, impaired detoxification, altered immunity, macular degeneration and increased risk of chronic illness.
- Food sources of GSH precursors include meats, poultry, fish, soy, corn, nuts, seeds, wheat germ, milk and cheese.

Plant-based Antioxidants



- Oxidative stress is the imbalance between the production of free radicals and the body's ability to readily detoxify these reactive species and/or repair the resulting damage with anti-oxidants.
- Oxidative stress can be endogenous (energy production and inflammation) or exogenous (exercise, exposure to environmental toxins).
- Oxidative stress has been implicated clinically in the development of neurodegenerative diseases, cardiovascular diseases and chronic fatigue syndrome.
- Antioxidants may be found in whole food sources (e.g., brightly colored fruits & vegetables, green tea, turmeric) as well as nutraceuticals (e.g., resveratrol, EGCG, lutein, lycopene, ginkgo, milk thistle, etc.).

KEY

Function of Nutrient | Cause of Deficiency | Complications of Deficiency | Food Sources of Nutrient

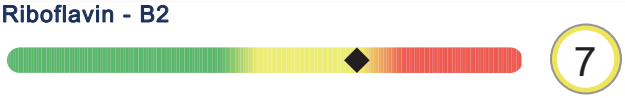
Interpretation At-A-Glance

B-Vitamin Needs

Thiamin - B1

- B1 is a required cofactor for enzymes involved in energy production from food, and for the synthesis of ATP, GTP, DNA, RNA and NADPH.
- Low B1 can result from chronic alcoholism, diuretics, digoxin, oral contraceptives and HRT, or large amounts of tea & coffee (contain anti-B1 factors).
- B1 deficiency may lead to dry beriberi (e.g., neuropathy, muscle weakness), wet beriberi (e.g., cardiac problems, edema), encephalopathy or dementia.
- Food sources include lentils, whole grains, wheat germ, Brazil nuts, peas, organ meats, brewer's yeast, blackstrap molasses, spinach, milk & eggs.

Riboflavin - B2



- B2 is a key component of enzymes involved in antioxidant function, energy production, detoxification, methionine metabolism and vitamin activation.
- Low B2 may result from chronic alcoholism, some anti-psychotic medications, oral contraceptives, tricyclic antidepressants, quinacrine or adriamycin.
- B2 deficiency may result in oxidative stress, mitochondrial dysfunction, low uric acid, low B3 or B6, high homocysteine, anemia or oral & throat inflammation.
- Food sources include milk, cheese, eggs, whole grains, beef, chicken, wheat germ, fish, broccoli, asparagus, spinach, mushrooms and almonds.

Niacin - B3

- B3 is used to form NAD and NADP, involved in energy production from food, fatty acid & cholesterol synthesis, cell signaling, DNA repair & cell differentiation.
- Low B3 may result from deciencies of tryptophan (B3 precursor), B6, B2 or Fe (cofactors in B3 production), or from long-term isoniazid or oral contraceptive use.
- B3 deficiency may result in pellagra (dermatitis, diarrhea, dementia), neurologic symptoms (e.g., depression, memory loss), bright red tongue or fatigue.
- Food sources include poultry, beef, organ meats, fish, whole grains, peanuts, seeds, lentils, brewer's yeast and lima beans.

Pyridoxine - B6

- B6 (as P5P) is a cofactor for enzymes involved in glycogenolysis & gluconeogenesis, and synthesis of neurotransmitters, heme, B3, RBCs and nucleic acids.
- Low B6 may result from chronic alcoholism, long-term diuretics, estrogens (oral contraceptives and HRT), anti-TB meds, penicillamine, L-DOPA or digoxin.
- B6 deficiency may result in neurologic symptoms (e.g., irritability, depression, seizures), oral inflammation, impaired immunity or increased homocysteine.
- Food sources include poultry, beef, beef liver, fish, whole grains, wheat germ, soybean, lentils, nuts & seeds, potato, spinach and carrots.

Biotin - B7

- Biotin is a cofactor for enzymes involved in functions such as fatty acid synthesis, mitochondrial FA oxidation, gluconeogenesis and DNA replication & transcription.
- Deficiency may result from certain inborn errors, chronic intake of raw egg whites, long-term TPN, anticonvulsants, high-dose B5, sulfa drugs & other antibiotics.
- Low levels may result in neurologic symptoms (e.g., paresthesias, depression), hair loss, scaly rash on face or genitals or impaired immunity.
- Food sources include yeast, whole grains, wheat germ, eggs, cheese, liver, meats, fish, wheat, nuts & seeds, avocado, raspberries, sweet potato and cauliflower.

Folic Acid - B9

- Folic acid plays a key role in coenzymes involved in DNA and SAMe synthesis, methylation, nucleic acids & amino acid metabolism and RBC production.
- Low folate may result from alcoholism, high-dose NSAIDs, diabetic meds, H2 blockers, some diuretics and anti-convulsants, SSRIs, methotrexate, trimethoprim, pyrimethamine, triamterene, sulfasalazine or cholestyramine.
- Folate deficiency can result in anemia, fatigue, low methionine, increased homocysteine, impaired immunity, heart disease, birth defects and CA risk.
- Food sources include fortified grains, green vegetables, beans & legumes.

Cobalamin - B12

- B12 plays important roles in energy production from fats & proteins, methylation, synthesis of hemoglobin & RBCs, and maintenance of nerve cells, DNA & RNA.
- Low B12 may result from alcoholism, malabsorption, hypochlorhydria (e.g., from atrophic gastritis, H. pylori infection, pernicious anemia, H2 blockers, PPIs), vegan diets, diabetic meds, cholestyramine, chloramphenicol, neomycin or colchicine.
- B12 deficiency can lead to anemia, fatigue, neurologic symptoms (e.g., paresthesias, memory loss, depression, dementia), methylation defects or chromosome breaks.
- Food sources include shellfish, red meat, poultry, fish, eggs, milk and cheese.

KEY

Function of Nutrient | Cause of Deficiency | Complications of Deficiency | Food Sources of Nutrient

Interpretation At-A-Glance

Mineral Needs

Magnesium

- Magnesium is involved in >300 metabolic reactions. Key areas include energy production, bone & ATP formation, muscle & nerve conduction and cell signaling.
- Deficiency may occur with malabsorption, alcoholism, hyperparathyroidism, renal disorders (wasting), diabetes, diuretics, digoxin or high doses of zinc.
- Low Mg may result in muscle weakness/spasm, constipation, depression, hypertension, arrhythmias, hypocalcemia, hypokalemia or personality changes.
- Food sources include dark leafy greens, oatmeal, buckwheat, unpolished grains, chocolate, milk, nuts & seeds, lima beans and molasses.

Manganese

- Manganese plays an important role in antioxidant function, gluconeogenesis, the urea cycle, cartilage & bone formation, energy production and digestion.
- Impaired absorption of Mn may occur with excess intake of Fe, Ca, Cu, folic acid, or phosphorous compounds, or use of long-term TPN, Mg-containing antacids or laxatives.
- Deficiency may result in impaired bone/connective tissue growth, glucose & lipid dysregulation, infertility, oxidative stress, inflammation or hyperammonemia.
- Food sources include whole grains, legumes, dried fruits, nuts, dark green leafy vegetables, liver, kidney and tea.

Molybdenum

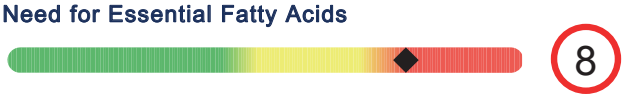
- Molybdenum is a cofactor for enzymes that convert sulfites to sulfate, and nucleotides to uric acid, and that help metabolize aldehydes & other toxins.
- Low Mo levels may result from long-term TPN that does not include Mo.
- Mo deficiency may result in increased sulfite, decreased plasma uric acid (and antioxidant function), deficient sulfate, impaired sulfation (detoxification), neurologic disorders or brain damage (if severe deficiency).
- Food sources include buckwheat, beans, grains, nuts, beans, lentils, meats and vegetables (although Mo content of plants depends on soil content).

Zinc

- Zinc plays a vital role in immunity, protein metabolism, heme synthesis, growth & development, reproduction, digestion and antioxidant function.
- Low levels may occur with malabsorption, alcoholism, chronic diarrhea, diabetes, excess Cu or Fe, diuretics, ACE inhibitors, H2 blockers or digoxin.
- Deficiency can result in hair loss and skin rashes, also impairments in growth & healing, immunity, sexual function, taste & smell and digestion.
- Food sources include oysters, organ meats, soybean, wheat germ, seeds, nuts, red meat, chicken, herring, milk, yeast, leafy and root vegetables.

Essential Fatty Acid Needs

Need for Essential Fatty Acids



- Omega-3 (O3) and Omega-6 (O6) fatty acids are polyunsaturated fatty acids that cannot be synthesized by the human body. They are classified as essential nutrients and must be obtained from dietary sources.
- The standard American diet is much higher in O6 than O3 fatty acids. Deficiency of EFAs may result from poor dietary intake and/or poor conversion from food sources.
- EFA deficiency is associated with decreased growth & development of infants and children, dry skin/rash, poor wound healing, and increased risk of infection, cardiovascular and inflammatory diseases.
- Dietary sources of the O6 Linoleic Acid (LA) include vegetable oils, nuts, seeds and some vegetables. Dietary sources of the O3 a-Linolenic Acid (ALA) include flaxseeds, walnuts, and their oils. Fish (mackerel, salmon, sardines) are the major dietary sources of the O3 fatty acids EPA and DHA.

KEY

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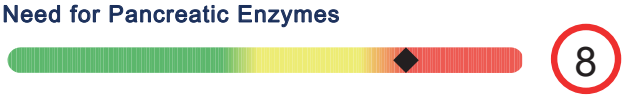
Interpretation At-A-Glance

Microbiome & Digestive Support

Need for Probiotics

- Probiotics have many functions. These include: production of some B vitamins and vitamin K; enhance digestion & absorption; decrease severity of diarrheal illness; modulate of immune function & intestinal permeability.
- Alterations of gastrointestinal microflora may result from C-section delivery, antibiotic use, improved sanitation, decreased consumption of fermented foods and use of certain drugs.
- Some of the diseases associated with microflora imbalances include: IBS, IBD, fibromyalgia, chronic fatigue syndrome, obesity, atopic illness, colic and cancer.
- Food sources rich in probiotics are yogurt, kefir and fermented foods.

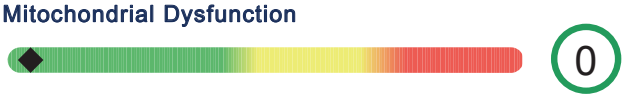
Need for Pancreatic Enzymes



- Pancreatic enzymes are secreted by the exocrine glands of the pancreas and include protease/peptidase, lipase and amylase.
- Pancreatic exocrine insufficiency may be primary or secondary in nature. Any indication of insufficiency warrants further evaluation for underlying cause (i.e., celiac disease, small intestine villous atrophy, small bowel bacterial overgrowth).
- A high functional need for digestive enzymes suggests that there is an impairment related to digestive capacity.
- Determining the strength of the pancreatic enzyme support depends on the degree of functional impairment. Supplement potency is based on the lipase units present in both prescriptive and non-prescriptive agents.

Functional Imbalances

Mitochondrial Dysfunction

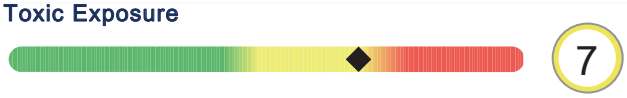


- Mitochondria are a primary site of generation of reactive oxygen species. Oxidative damage is considered an important factor in decline of physiologic function that occurs with aging and stress.
- Mitochondrial defects have been identified in cardiovascular disease, fatigue syndromes, neurologic disorders such as Parkinson's and Alzheimer's disease, as well as a variety of genetic conditions. Common nutritional deficiencies can impair mitochondrial efficiency.

Need for Methylation

- Methylation is an enzymatic process that is critical for both synthesis and inactivation. DNA, estrogen and neurotransmitter metabolism are all dependent on appropriate methylation activity.
- B vitamins and other nutrients (methionine, magnesium, selenium) functionally support catechol-O-methyltransferase (COMT), the enzyme responsible for methylation.

Toxic Exposure



- Methyl tert-Butyl Ether (MTBE) is a common gasoline additive used to increase octane ratings, and has been found to contaminate ground water supplies where gasoline is stored. Inhalation of MTBE may cause nose and throat irritation, as well as headaches, nausea, dizziness and mental confusion. Animal studies suggest that drinking MTBE may cause gastrointestinal irritation, liver and kidney damage and nervous system effects.
- Styrene is classified by the US EPA as a "potential human carcinogen," and is found widely distributed in commercial products such as rubber, plastic, insulation, fiberglass, pipes, food containers and carpet backing.
- Levels of these toxic substances should be examined within the context of the body's functional capacity for methylation and need for glutathione.

KEY

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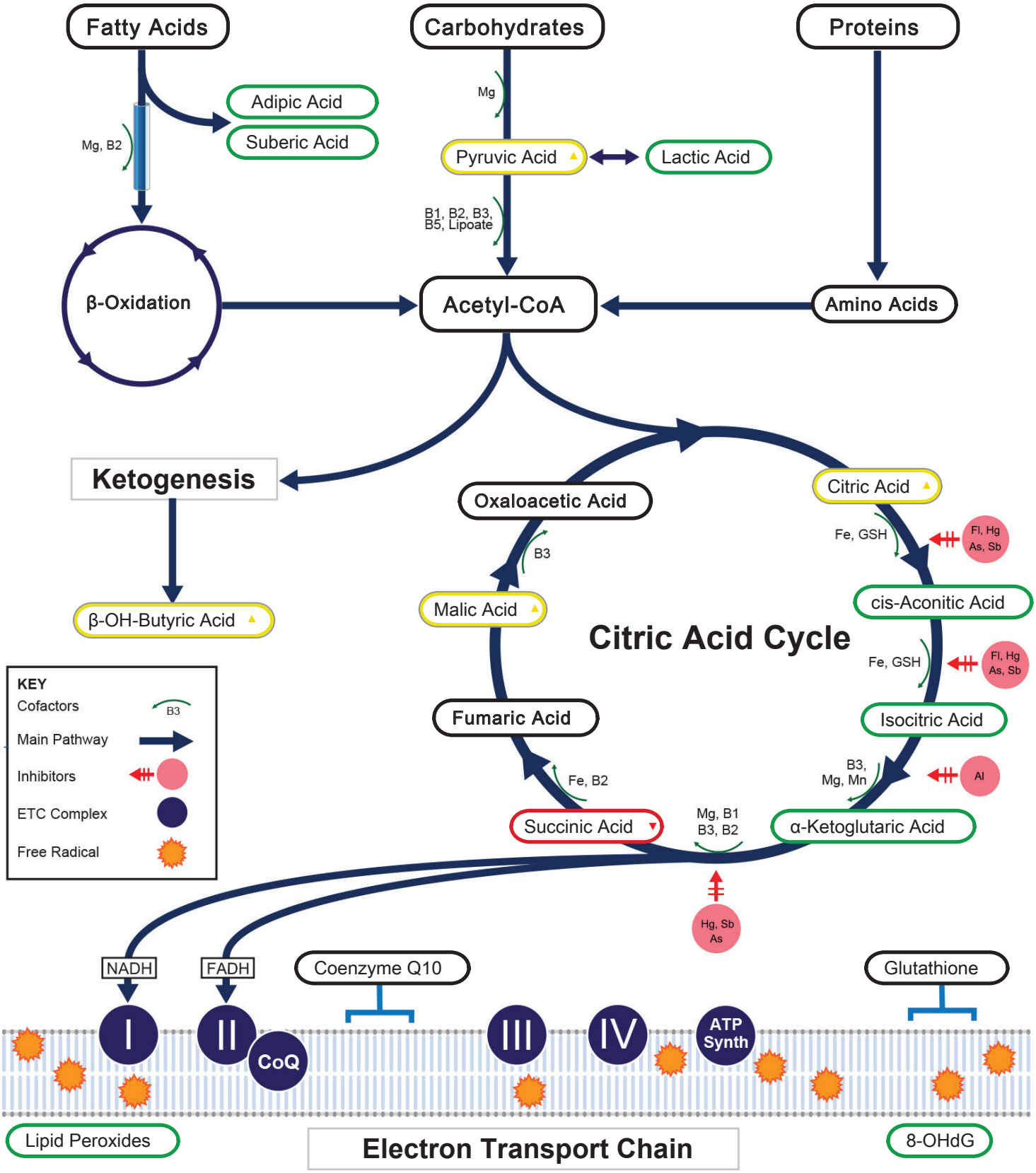
Oxidative Stress & Mitochondrial Dysfunction



Organic Acids

Malabsorption & Dysbiosis Markers

Malabsorption Markers

		Reference Range
Indoleacetic Acid	3.1	<= 4.2
Phenylacetic Acid	0.16	<= 0.12

Dysbiosis Markers

		Reference Range
Dihydroxyphenylpropionic Acid (DHPPA)	5.8	<= 5.3
3-Hydroxyphenylacetic Acid	<dl	<= 8.1
4-Hydroxyphenylacetic Acid	<dl	<= 29
Benzoic Acid	0.07	<= 0.05
Hippuric Acid	361	<= 603

Yeast / Fungal Dysbiosis Markers

		Reference Range
D-Arabinitol	12	<= 36
Citramalic Acid	5.1	<= 5.8
Tartaric Acid	<dl	<= 15

Vitamin Markers

Branched-Chain Catabolites (B1, B2, B3, ALA)

		Reference Range
α-Ketoadipic Acid	0.7	<= 1.7
α-Ketoisovaleric Acid	0.95	<= 0.97
α-Ketoisocaproic Acid	0.64	<= 0.89
α-Keto-β-Methylvaleric Acid	1.6	<= 2.1
Glutaric Acid	0.47	<= 0.51
Isovalerylglycine	<dl	<= 3.7

Methylation Markers (Folate, B12)

		Reference Range
Formiminoglutamic Acid (FIGlu)	<dl	<= 1.5
Methylmalonic Acid	1.3	<= 1.9

Biotin Markers

		Reference Range
3-Hydroxypropionic Acid	7	5-22
3-Hydroxyisovaleric Acid	<dl	<= 29

Cellular Energy & Mitochondrial Markers

Fatty Acid Metabolism

		Reference Range
Adipic Acid	<dl	<= 2.8
Suberic Acid	<dl	<= 2.1

Carbohydrate Metabolism

		Reference Range
Pyruvic Acid	27	7-32
Lactic Acid	6.8	1.9-19.8
α-Hydroxybutyric Acid	44.65	<= 0.83
β-OH-Butyric Acid	2.1	<= 2.8
β-OH-β-Methylglutaric Acid	<dl	<= 15

Energy Metabolism

		Reference Range
Citric Acid	404	40-520
cis-Aconitic Acid	19	10-36
Isocitric Acid	50	22-65
α-Ketoglutaric Acid	15	4-52
Succinic Acid	<dl	0.4-4.6
Malic Acid	2.9	<= 3.0

Neurotransmitter Metabolites

Kynurenine Markers (Vitamin B6)

		Reference Range
Kynurenic Acid	<dl	<= 7.1
Quinolinic Acid	3.3	<= 9.1
Kynurenic / Quinolinic Ratio	NR	>= 0.44
Xanthurenic Acid	<dl	<= 0.96

Catecholamine Markers

		Reference Range
Homovanillic Acid	2.0	1.2-5.3
Vanilmandelic Acid	1.6	0.4-3.6
3-Methyl-4-OH-phenylglycol	0.10	0.02-0.22

Serotonin Markers

		Reference Range
5-OH-indoleacetic Acid	11.2	3.8-12.1

Toxin & Detoxification Markers

		Reference Range
Pyroglutamic Acid	21	16-34
α-Ketophenylacetic Acid (from Styrene)	0.17	<= 0.46
α-Hydroxyisobutyric Acid (from MTBE)	3.9	<= 6.7
Orotic Acid	0.54	0.33-1.01

Methodology: GCMS, LC/MS/MS, Alkaline Picrate, Colorimetric

Organic Acid Reference Ranges are Age Specific

Organic Acids

Oxalate Markers

		Reference Range
Glyceric Acid	23.7	3.5-16.4
Glycolic Acid	59	<= 67
Oxalic Acid	66	<= 78

All biomarkers reported in mmol/mol creatinine.

Creatinine Concentration

		Reference Range
Creatinine ◆	1.8	3.1-19.5 mmol/L

Oxidative Stress Markers

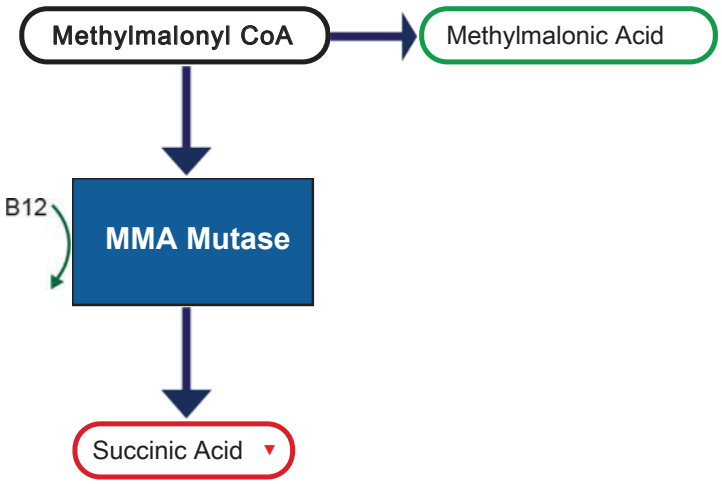
Oxidative Damage

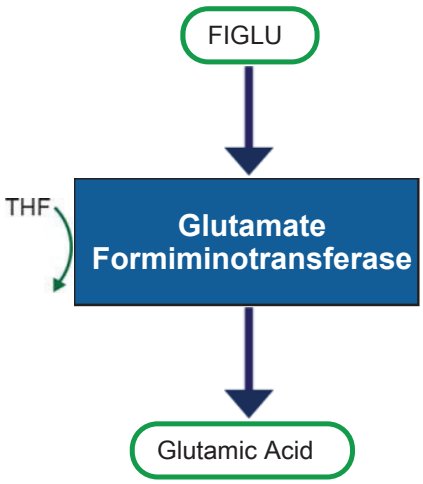
		Reference Range
Lipid Peroxides (urine)	5.9	<= 10.0 micromol/g Creat.
8-OHdG (urine)	<DL	<= 15 mcg/g Creat.

The Oxidative Stress reference ranges are based on an adult population.

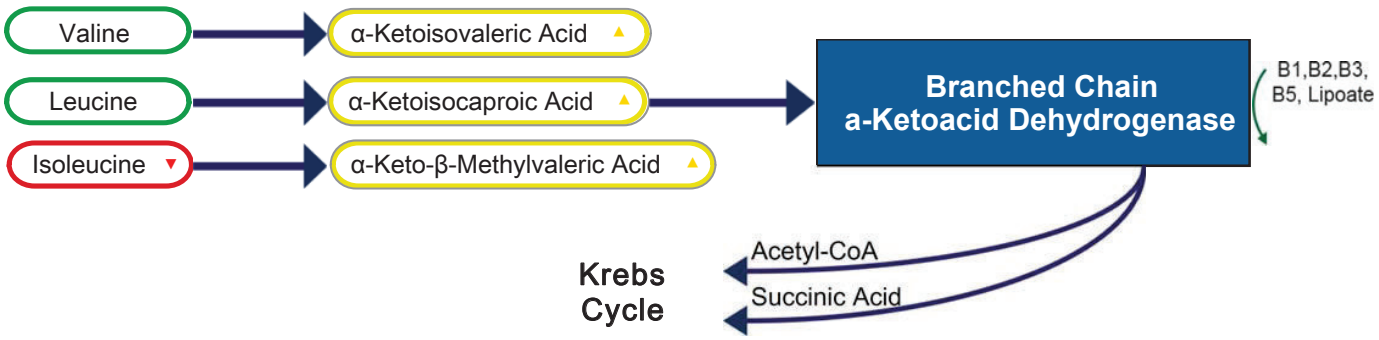
Pathways

Methylation Markers





Branch-Chain Amino Acid Metabolism



Amino Acids (FMV)

Nutritionally Essential Amino Acids

Amino Acid		Reference Range
Arginine	<dl	3-43
Histidine	<dl	102-763
Isoleucine	<dl	3-25
Leucine	7	6-61
Lysine	15	15-231
Methionine	11	2-16
Phenylalanine	25	7-92
Taurine	21	39-568
Threonine	51	9-97
Tryptophan	24	8-58
Valine	11	5-43

Nonessential Protein Amino Acids

Amino Acid		Reference Range
Alanine	87	26-275
Asparagine	75	12-115
Aspartic Acid	<dl	<= 9
Cysteine	27	9-60
Cystine	<dl	10-116
γ-Aminobutyric Acid	2	<= 3
Glutamic Acid	12	2-16
Glutamine	200	85-518
Proline	4	1-9
Tyrosine	40	19-135

Creatinine Concentration

		Reference Range
Creatinine◆	1.9	3.1-19.5 mmol/L

Intermediary Metabolites

B-Vitamin Markers

		Reference Range
α-Aminoadipic Acid	19	6-56
α-Amino-N-butyric Acid	12	2-21
β-Aminoisobutyric Acid	25	4-194
Cystathionine	<dl	4-48

Urea Cycle Markers

		Reference Range
Citrulline	6.0	0.7-3.4
Ornithine	10	3-17
Urea◆	149	150-380 mmol/g creatinine

Glycine/Serine Metabolites

		Reference Range
Glycine	161	47-435
Serine	149	24-140
Ethanolamine	349	40-226
Phosphoethanolamine	5	1-9
Phosphoserine	<dl	2-13
Sarcosine	1.9	<= 1.0

Dietary Peptide Related Markers

		Reference Range
Anserine (dipeptide)	0.6	0.7-76.1
Carnosine (dipeptide)	5	1-32
1-Methylhistidine	<dl	18-887
3-Methylhistidine	<dl	47-232
β-Alanine	<dl	<= 18

Amino Acid reference ranges are age specific.

Methodology: LC/MS/MS, Alkaline Picrate

OPTIONAL ADD-ON

3202 Add-on Bloodspot Essential & Metabolic Fatty Acids – Bloodspot

Methodology: GCMS

Essential & Metabolic Fatty Acids Markers (RBCs)

Omega-3 Fatty Acids

Analyte		Reference Range
	(cold water fish, flax, walnut)	
α-Linolenic (ALA) 18:3 n3	0.11	>= 0.28 wt %
Eicosapentaenoic (EPA) 20:5 n3	0.14	>= 0.12 wt %
Docosapentaenoic (DPA) 22:5 n3	1.09	>= 0.34 wt %
Docosahexaenoic (DHA) 22:6 n3	1.7	>= 0.8 wt %
% Omega-3s	3.0	>= 1.6

Omega-9 Fatty Acids

Analyte		Reference Range
	(olive oil)	
Oleic 18:1 n9	13	14-21 wt %
Nervonic 24:1 n9	3.0	1.1-1.8 wt %
% Omega-9s	16.6	17.3-22.5

Saturated Fatty Acids

Analyte		Reference Range
	(meat, dairy, coconuts, palm oils)	
Palmitic C16:0	21	19-27 wt %
Stearic C18:0	17	9-12 wt %
Arachidic C20:0	0.23	0.24-0.40 wt %
Behenic C22:0	0.95	0.88-1.61 wt %
Tricosanoic C23:0	0.14	0.19-0.26 wt %
Lignoceric C24:0	2.8	1.1-1.9 wt %
Pentadecanoic C15:0	0.04	0.14-0.30 wt %
Margaric C17:0	0.23	0.24-0.45 wt %
% Saturated Fats	42.3	39.8-43.6

Omega-6 Fatty Acids

Analyte		Reference Range
	(vegetable oil, grains, most meats, dairy)	
Linoleic (LA) 18:2 n6	15.0	18.8-28.3 wt %
γ-Linolenic (GLA) 18:3 n6	0.14	0.15-0.54 wt %
Dihomo-γ-linolenic (DGLA) 20:3 n6	1.17	>= 1.02 wt %
Arachidonic (AA) 20:4 n6	17	7-12 wt %
Docosatetraenoic (DTA) 22:4 n6	2.74	0.45-1.25 wt %
Eicosadienoic 20:2 n6	0.39	<= 0.26 wt %
% Omega-6s	36.4	30.5-39.7

Monounsaturated Fatty Acids

Omega-7 Fatty Acids

		Reference Range
Palmitoleic 16:1 n7	0.29	<= 2.58 wt %
Vaccenic 18:1 n7	1.23	<= 1.65 wt %

Trans Fats

Elaidic 18:1 n9t	0.15	<= 0.59 wt %

Delta-6-Desaturase Activity

	Upregulated Functional Impaired	
Linoleic / DGLA 18:2 n6 / 20:3 n6	12.8	12.6-31.5

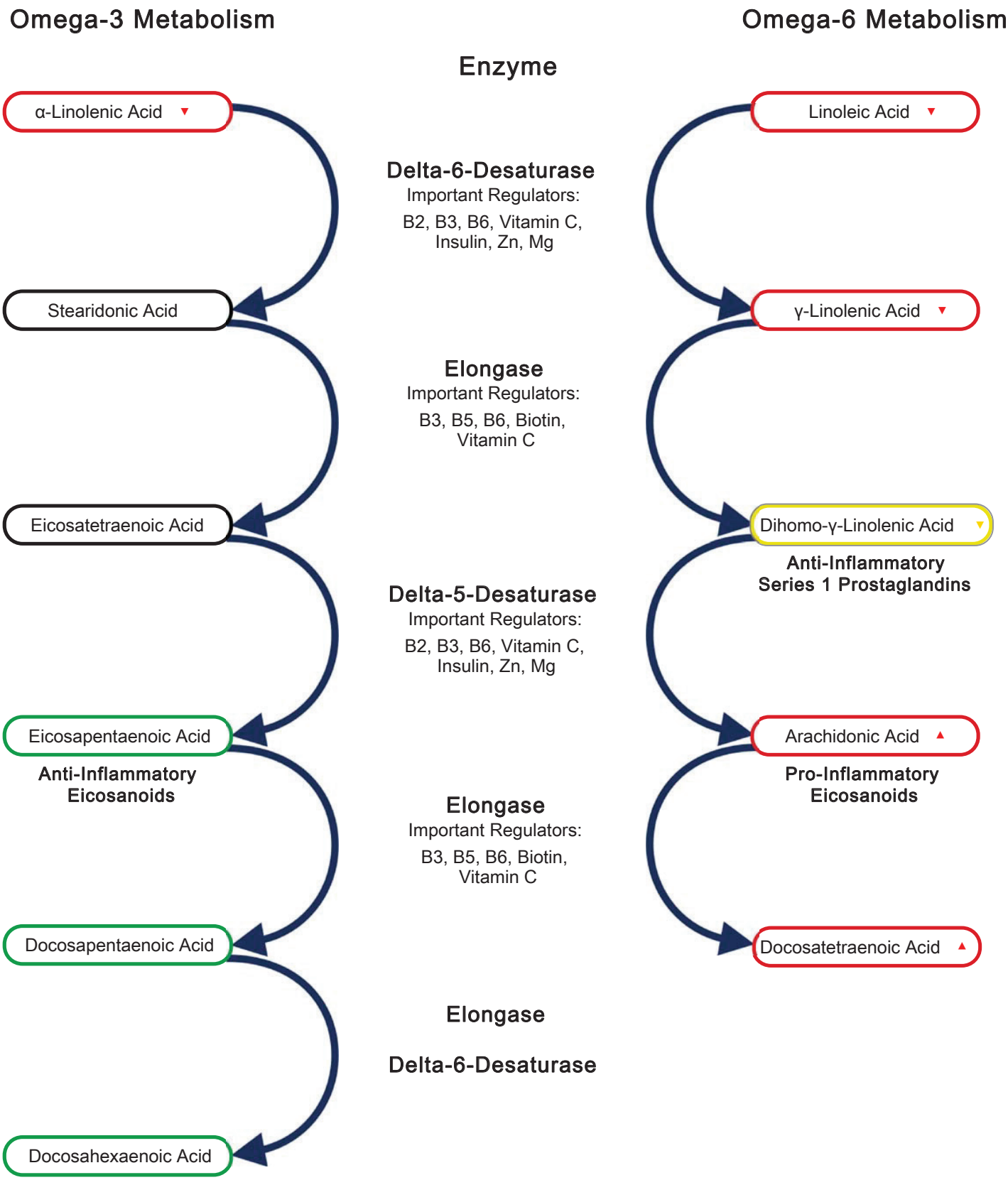
Cardiovascular Risk

Analyte		Reference Range
Omega-6s / Omega-3s	11.9	8.5-27.4
AA / EPA 20:4 n6 / 20:5 n3	118	10-86
Omega-3 Index	4.6	>= 4.0

The Essential Fatty Acid reference ranges are based on an adult population.

OPTIONAL ADD-ON

Fatty Acid Metabolism



OPTIONAL ADD-ON

3204 Add - on Comprehensive Urine Elements - FMV Urine

Methodology: ICP-MS and Alkaline Picrate

Elemental Markers

Toxic Elements

Element	Results in ug/g creatinine	Reference Range
Lead	5.6	<= 1.4
Mercury	0.28	<= 2.19
Aluminum	5.0	<= 22.3
Antimony	0.130	<= 0.149
Arsenic	1	<= 50
Barium	3.4	<= 6.7
Bismuth	2.00	<= 2.28
Cadmium	0.71	<= 0.64
Cesium	5.0	<= 10.5
Gadolinium	0.015	<= 0.019
Gallium	0.020	<= 0.028
Nickel	1.20	<= 3.88
Niobium	0.050	<= 0.084
Platinum	0.025	<= 0.033
Rubidium	14	<= 2,263
Thallium	0.220	<= 0.298
Thorium	3.500	<= 4.189
Tin	5.22	<= 2.04
Tungsten	0.150	<= 0.211
Uranium	0.010	<= 0.026

Nutrient Elements

Element	Results in ug/g creatinine	Reference Range
Chromium	0.6	0.6-9.4
Cobalt	1.50	0.01-2.60
Copper	121.0	4.0-11.4
Iron	5	5-64
Lithium	14	9-129
Manganese	11.20	0.03-1.16
Molybdenum	15	15-175
Selenium	274	32-333
Strontium	275	47-346
Vanadium	2.0	0.1-3.2
Zinc	84	63-688

Element	Results in mg/g creatinine	Reference Range
Calcium	250	37-313
Magnesium	37	41-267
Potassium	2,656	759-4,653
Sulfur	1,000	367-1,328

Creatinine Concentration

	Reference Range
Urine Creatinine ◆	mmol/L

References

1. Baranyi A, Amouzadeh-Ghadikolai O, von Lewinski D, et al. Branched-Chain Amino Acids as New Biomarkers of Major Depression - A Novel Neurobiology of Mood Disorder. PloS one. 2016;11(8):e0160542-e0160542.
2. Su K-P, Matsuoka Y, Pae C-U. Omega-3 Polyunsaturated Fatty Acids in Prevention of Mood and Anxiety Disorders. Clin Psychopharmacol Neurosci. 2015;13(2):129-137.
3. Harris WS. The omega-3 index: from biomarker to risk marker to risk factor. Curr Atheroscler Rep. 2009;11(6):411.
4. Fattore E, Massa E. Dietary fats and cardiovascular health: a summary of the scientific evidence and current debate. Int J Food Sci Nutr. 2018;69(8):916-927.
5. O'Connell BS. Select vitamins and minerals in the management of diabetes. Diab Spect. 2001;14(3):133-148.
6. Wang X, England A, Sinclair C, Merkosky F, Chan CB. Trans-11 vaccenic acid improves glucose homeostasis in a model of type 2 diabetes by promoting insulin secretion via GPR40. J Funct Foods. 2019;60:103410.
7. Nozaki S, Tanaka M, Mizuno K, et al. Mental and physical fatigue-related biochemical alterations. Nutrition. 2009;25(1):51-57.
8. Schlemmer M, Suchner U, Schäpers B, et al. Is glutamine deficiency the link between inflammation, malnutrition, and fatigue in cancer patients? Clin Nutr. 2015;34(6):1258-1265.
9. Simopoulos AP. An increase in the omega-6/omega-3 fatty acid ratio increases the risk for obesity. Nutrients. 2016;8(3):128.
10. Zheng Y, Ceglarek U, Huang T, et al. Weight-loss diets and 2-y changes in circulating amino acids in 2 randomized intervention trials. Am J Clin Nutr. 2016;103(2):505-511.
11. Beydoun MA, Kaufman JS, Satia JA, Rosamond W, Folsom AR. Plasma n-3 fatty acids and the risk of cognitive decline in older adults: the Atherosclerosis Risk in Communities Study. Am J Clin Nutr. 2007;85(4):1103-1111.
12. Kühn S, Düzel S, Colzato L, et al. Food for thought: association between dietary tyrosine and cognitive performance in younger and older adults. Psych Res. 2019;83(6):1097-1106.
13. Gleeson M. Dosing and efficacy of glutamine supplementation in human exercise and sport training. J Nutr. 2008;138(10):2045s-2049s.
14. Woolf K, Manore MM. B-vitamins and exercise: does exercise alter requirements? Int J Sport Nutr Ex Metab. 2006;16(5):453-484.
15. Polge A, Bancel E, Bellet H, et al. Plasma amino acid concentrations in elderly patients with protein energy malnutrition. Age Ageing. 1997;26(6):457-462.

Metabolomix+ PROFILE

Analytes reported	Analytes reported	Analytes reported	Analytes reported	Analytes reported
Organic Acids	**Organic Acids**	**Amino Acids**	**Add-on Fatty Acids**	**Add-on Elements**
Malabsorption and Dysbiosis	**Vitamin Markers**	**Creatinine Concentration**	**Saturated Fatty Acids**	**Nutrient Elements***
Malabsorption Markers	a-Ketoadipic Acid •	Creatinine •	Behenic Acid •	Chromium* •
Indoleacetic Acid (AA) •	a-Ketoisovaleric Acid •	**Intermediary Metabolites**	Tricosanoic Acid •	Cobalt* •
Phenylacetic Acid (PAA) •	a-Ketoisocaproic Acid •	**B Vitamin Markers**	Lignoceric Acid •	Copper* •
Bacterial Dysbiosis Markers	a-Keto-ß-Methylvaleric Acid •	α-Aminoadipic Acid •	Pentadecanoic Acid •	Iron* •
Dihydroxyphenylpropionic Acid •	Formiminoglutamic Acid •	α-Amino-N-Butyric Acid •	Margaric Acid •	Lithium* •
3-Hyroxyproprionic Acid •	Glutaric Acid •	**Urea Cycle Markers**	% Saturated Fats •	Manganese* •
4-Hydroxyphenylpyruvic Acid •	Isovalerylglycine •	Citrulline •	**Omega 6 Fatty Acids**	Molybdenum* •
Benzoic Acid •	Methylmalonic Acid •	Ornithine •	Linoleic Acid •	Selenium* •
Hippuric Acid •	Xanthurenic Acid •	Urea •	γ-Linolenic Acid •	Strontium* •
Yeast/Fungal Dysbiosis Markers	3-Hydroxypropionic Acid •	**Glycine/Serine Metabolites**	Dihomo-γ-linolenic Acid •	Vanadium* •
D-Arabinitol •	3-Hydroxyisovaleric Acid •	Glycine •	Arachidonic •	Zinc* •
Citramalic Acid •	**Toxin and Detoxification Markers**	Serine •	Docosatetraenoic Acid •	Calcium* •
Tartaric Acid •	a-Ketophenylacetic Acid •	Ethanolamine •	Eicosadienoic Acid •	Magnesium* •
Cellular Energy and Mitochondrial Metabolites	a-Hydroxyisobutyric Acid •	Phenylalanine •	% Omega 6s •	Potassium* •
Carbohydrate Metabolism	Orotic Acid •	Phosphoethanolamine •	**Monounsaturated Fats**	Sulfur •
Lactic Acid •	Pyroglutamic Acid •	Phosphserine	**Omega 7 Fats**	**Toxic Elements**
Pyruvic Acid •	**Oxalates**	Sarcosine •	Palmitoleic Acid •	Lead •
α-Hydroxybutyric Acid •	Glyceric Acid •	**Dietary Peptide**	Vaccenic Acid •	Mercury •
β-Hydroxybutyric Acid •	Glycolic Acid •	Anserine •	**Trans Fat** •	Aluminium •
Energy Metabolism	Oxalic Acid •	Carnosine •	Elaidic Acid •	Antimony •
Citric Acid •	**Amino Acids**	1-Methylhistidine •	**Delta - 6 Desaturase Activity**	Arsenic •
cis-Aconitic Acid •	**Nutritionally Essential Amino Acids**	3-Methylhistidine •	Linoleic/DGLA ratio •	Barium •
Isocitric Acid •	Arginine •	ß-Alanine •	**Add-on Genomic Markers**	Bismuth •
α-Ketoglutaric Acid (AKG) •	Histidine •	**Oxidative Stress**	APO E (C112R + R158C) •	Cadmium •
Succinic Acid •	Isoleucine •	Lipid Peroxides (urine) •	COMT (V158M) •	Cesium •
Malic Acid •	Leucine •	8-OHdG (urine) •	MTHFR Combined •	Gadolinium •
ß-OH-ß-Methylglutaric Acid (HMG) •	Lysine •	**Add-on Fatty Acids**	TNFA •	Nickel •
Fatty Acid Metabolism	Methionine •	**Omega 3 Fatty Acids**		Niobium •
Adipic Acid •	Phenylalanine •	α-Linolenic Acid •		Platinum •
Suberic Acid •	Taurine •	Eicosapentaenoic Acid •		Rubidium •
Creatinine Concentration	Threonine •	Docosapentaenoic Acid •		Thallium •
Creatinine •	Tryptophan •	Docosahexaenoic Acid •		Thorium •
Neurotransmitter Metabolism Markers	Valine •	% Omega 3s •		Tin •
Vanilmandelic Acid •	**Nonessential Protein Amino Acids**	**Omega 9 Fatty Acids**		Tungsten •
Homovanillic Acid •	Alanine •	Oleic Acid •		Uranium •
5-OH-indoleacetic Acid •	Asparagine •	Nervonic Acid •		*NUTRIENT ELEMENTS AVAILABLE ONLY IF ADD-ON COMPREHENSIVE URINE ELEMENT PROFILE #3203 IS ORDERED
3-Methyl-4-OH-phenylglycol •	Aspartic Acid •	% Omega 9s •		
Kynurenic Acid •	Cysteine •	**Saturated Fatty Acids**		
Quinolinic Acid •	Cystine •	Palmitic Acid •		
Kynurenic / Quinolinic Ratio •	Gamma-Aminobutyric Acid •	Stearic Acid •		
	Glutamic Acid •	Arachidic Acid •		
	Glutamine •			
	Proline •			
	Tyrosine •			

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