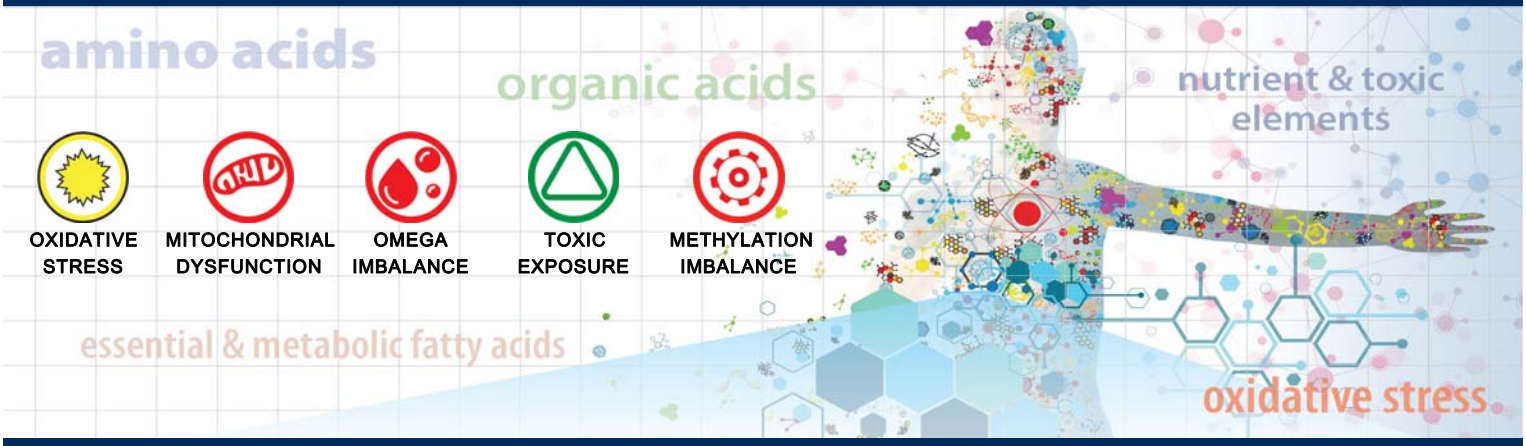
GENOVA DIAGNOSTICS
63 Zillicoa Street
Asheville, NC 28801

NutrEval FMV amino acids

Patient: **SAMPLE PATIENT**
DOB:
Sex:
MRN:

3000 NutrEval FMV - Urine and Blood

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	Need for Mitochondrial Support	Need for Inflammation Support	Need for Reduced Exposure	Need for Methylation Support
Oxidative Stress	**Mitochondrial Dysfunction**	**Omega Imbalance**	**Toxic Exposure**	**Methylation Imbalance**
7	8	9	0	9
Cystine ▼	Glutathione ▼	Omega-3 Index ▼	Lead ●	Methylmalonic Acid ●
Cysteine ▼	CoQ10 ▼	Omega 6/3 Ratio ▼	Mercury ●	Methionine ▼
Lipid Peroxides ●	Magnesium ▼	α-Linolenic Acid ▼	α-Hydroxyisobutyric Acid ●	Glutathione ▼
8-OHdG ●	FIGLU ●	Arachidonic Acid ▼	α-Ketophenylacetic Acid ●	FIGLU ●
Glutathione ▼	Methylmalonic Acid ●	Linoleic Acid ▼	Arsenic ●	Sarcosine ●
Taurine ▼	Glutaric Acid ●	γ-Linolenic Acid ▼	Cadmium ●	Vanilmandelic Acid ▼
Citric Acid ▼	Lactic Acid ▼	Dihomo-γ-linolenic Acid ▼	Pyroglutamic Acid ▼	Arginine ▼
Cis-Aconitic Acid ▼	Pyruvic Acid ▼		Orotic Acid ▼	Glycine ▼
	Citric Acid ▼		Citric Acid ▼	Serine ▼
	Cis-Aconitic Acid ▼		Cis-Aconitic Acid ▼	Creatinine ●
	Isocitric Acid ▼		Isocitric Acid ▼	
	α-Ketoglutaric Acid ▼		Glutaric Acid ●	
	Succinic Acid ▼			
	Malic Acid ●			
	Adipic Acid ●			
	Suberic Acid ●			
	Manganese ▼			

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	5,000 IU	
Vitamin C		90 mg	1,000 mg	
Vitamin E / Tocopherols		22 IU	200 IU	
α-Lipoic Acid			200 mg	
CoQ10			90 mg	
Glutathione				
Plant-based Antioxidants				
B-Vitamins				
Thiamin - B1		1.2 mg	10 mg	
Riboflavin - B2		1.3 mg	10 mg	
Niacin - B3		16 mg	50 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	500 mcg	
Minerals				
Magnesium		420 mg	800 mg	
Manganese		2.3 mg	7.0 mg	
Molybdenum		45 mcg	75 mcg	
Zinc		11 mg	30 mg	
Essential Fatty Acids				
Omega-3 Fatty Acids		500 mg	2,000 mg	
GI Support				
Digestive Support/Enzymes			10,000 IU	
Microbiome Support/Probiotics			10 billion CFU	
Vitamin D				
Vitamin D		600 IU	4,000 IU	

Amino Acids

Arginine	1,149	Methionine	1,004
Asparagine	1,129	Phenylalanine	1,111
Cysteine	671	Serine	2,015
Glutamine	3,413	Taurine	1,448
Glycine	4,485	Threonine	1,086
Histidine	2,105	Tryptophan	638
Isoleucine	1,168	Tyrosine	1,149
Leucine	2,314	Valine	1,328
Lysine	2,381		

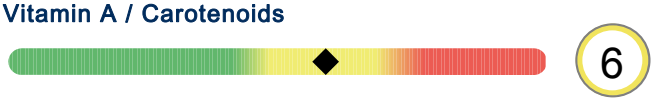
Recommendations for age and gender-specific supplementation are set by comparing levels of nutrient functional need to optimal levels as described in the peer-reviewed literature. They are provided as guidance for short-term support of nutritional deficiencies only.

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 / Carotenoids

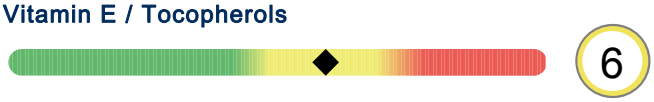


- Beta-carotene & other carotenoids are converted to vitamin A (retinol), involved in vision, antioxidant & immune function, gene expression & cell growth.
- Vitamin A deficiency may occur with chronic alcoholism, zinc deficiency, hypothyroidism, or oral contraceptives containing estrogen & progestin.
- 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

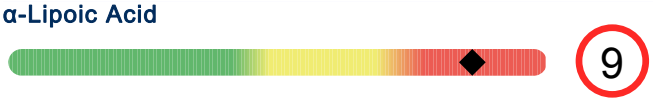
- Vitamin C is an antioxidant (also used in the regeneration of other antioxidants). It is involved in cholesterol metabolism, the production & function of WBCs and antibodies, and the synthesis of collagen, norepinephrine and carnitine.
- Deficiency may occur with oral contraceptives, aspirin, diuretics 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.

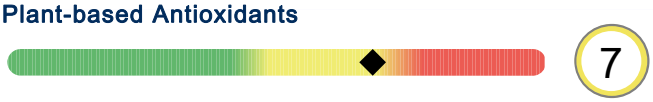
CoQ10

- 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

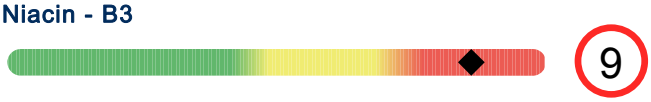
Thiamin - B1

- 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 deficiencies 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.

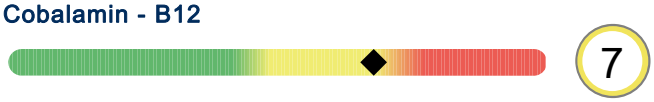
Biotin - B7

- 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.

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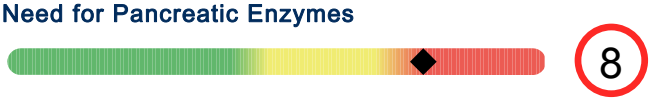
Interpretation At-A-Glance

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.

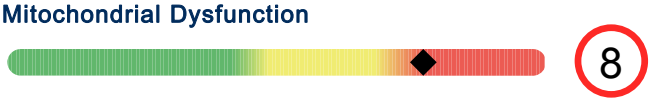
Need for Pancreatic Enzymes



- 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.

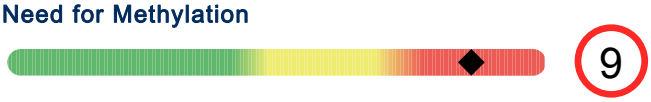
Functional Imbalances

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.

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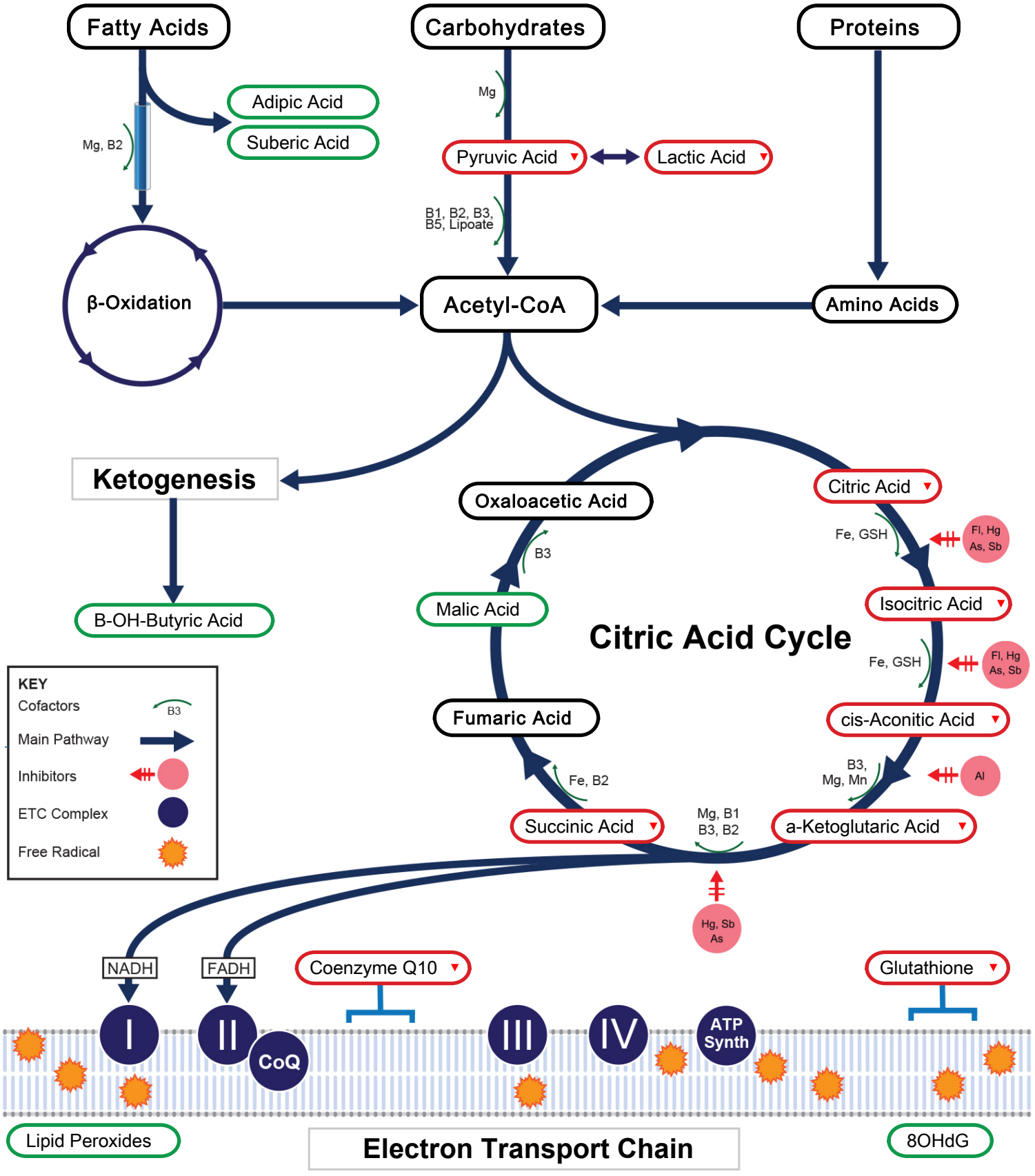
Oxidative Stress & Mitochondrial Dysfunction



All biomarkers reported in mmol/mol creatinine unless otherwise noted.

Organic Acids

Malabsorption & Dysbiosis Markers

Malabsorption Markers

		Reference Range
Indoleacetic Acid	0.3	<= 4.2
Phenylacetic Acid	0.04	<= 0.12

Dysbiosis Markers

		Reference Range
Dihydroxyphenylpropionic Acid (DHPPA)	0.3	<= 5.3
3-Hydroxyphenylacetic Acid	0.4	<= 8.1
4-Hydroxyphenylacetic Acid	2	<= 29
Benzoic Acid	0.01	<= 0.05
Hippuric Acid	2	<= 603

Yeast / Fungal Dysbiosis Markers

		Reference Range
D-Arabinitol	1	<= 36
Citramalic Acid	0.4	<= 5.8
Tartaric Acid	2	<= 15

Vitamin Markers

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

		Reference Range
α-Ketoadipic Acid	0.4	<= 1.7
α-Ketoisovaleric Acid	0.49	<= 0.97
α-Ketoisocaproic Acid	0.22	<= 0.89
α-Keto-β-Methylvaleric Acid	0.4	<= 2.1
Glutaric Acid	0.02	<= 0.51
Isovalerylglycine	0.4	<= 3.7

Methylation Markers (Folate, B12)

		Reference Range
Formiminoglutamic Acid (FIGlu)	0.7	<= 1.5
Methylmalonic Acid	0.5	<= 1.9

Biotin Markers

		Reference Range
3-Hydroxypropionic Acid	3	5-22
3-Hydroxyisovaleric Acid	2	<= 29

Cellular Energy & Mitochondrial Markers

Fatty Acid Metabolism

		Reference Range
Adipic Acid	0.4	<= 2.8
Suberic Acid	0.3	<= 2.1

Carbohydrate Metabolism

		Reference Range
Pyruvic Acid	3	7-32
Lactic Acid	0.6	1.9-19.8
α-Hydroxybutyric Acid	0.27	<= 0.83
β-OH-Butyric Acid	0.5	<= 2.8
β-OH-β-Methylglutaric Acid	1	<= 15

Energy Metabolism

		Reference Range
Citric Acid	6	40-520
cis-Aconitic Acid	2	10-36
Isocitric Acid	6	22-65
α-Ketoglutaric Acid	3	4-52
Succinic Acid	0.2	0.4-4.6
Malic Acid	0.4	<= 3.0

Neurotransmitter Metabolites

Kynurenine Markers (Vitamin B6)

		Reference Range
Kynurenic Acid	0.3	<= 7.1
Quinolinic Acid	0.3	<= 9.1
Kynurenic / Quinolinic Ratio	1.00	>= 0.44
Xanthurenic Acid	0.28	<= 0.96

Catecholamine Markers

		Reference Range
Homovanillic Acid	1.1	1.2-5.3
Vanilmandelic Acid	0.3	0.4-3.6
3-Methyl-4-OH-phenylglycol	0.01	0.02-0.22

Serotonin Markers

		Reference Range
5-OH-indoleacetic Acid	1.8	3.8-12.1

Toxin & Detoxification Markers

		Reference Range
Pyroglutamic Acid	4	16-34
α-Ketophenylacetic Acid (from Styrene)	0.19	<= 0.46
α-Hydroxyisobutyric Acid (from MTBE)	0.5	<= 6.7
Orotic Acid	0.18	0.33-1.01

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

Metabolic Analysis Reference Ranges are Age Specific

Methodology: Colorimetric, thiobarbituric acid reactive substances (TBARS), Alkaline Picrate, Hexokinase/G-6-PDH, HPLC, GC/MS

Organic Acids

Oxalate Markers

		Reference Range
Glyceric Acid	1.0	3.5-16.4
Glycolic Acid	0	<= 67
Oxalic Acid	0	<= 78

All biomarkers reported in mmol/mol creatinine.

Creatinine Concentration

		Reference Range
Creatinine ◆	8.8	3.1-19.5 mmol/L

Oxidative Stress Markers

Antioxidants

		Reference Range
Glutathione (whole blood)	363	>= 669 micromol/L
Coenzyme Q10, Ubiquinone (serum)	0.45	0.46-1.72 mcg/mL

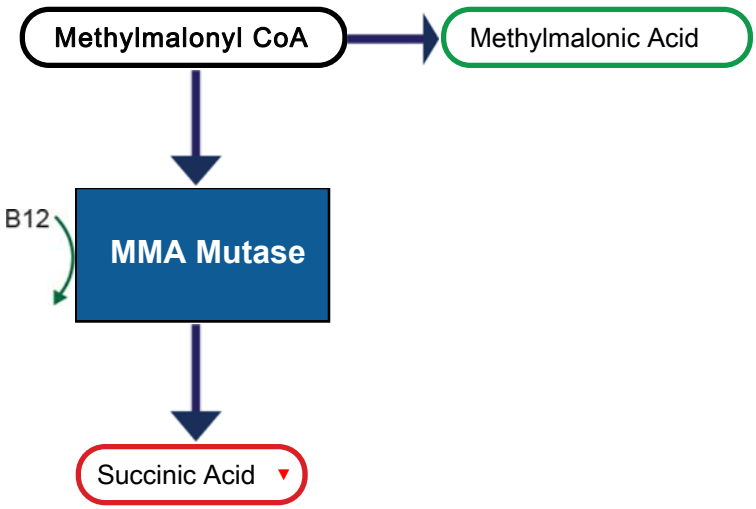
Oxidative Damage

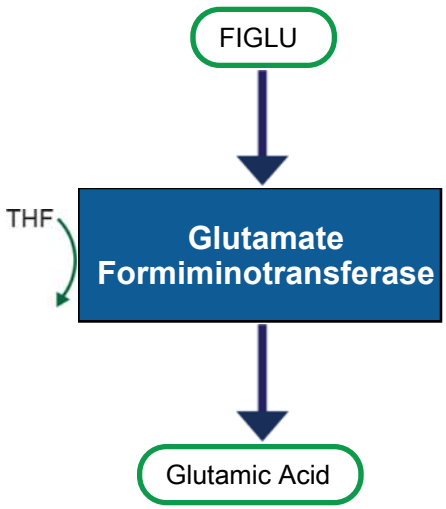
		Reference Range
Lipid Peroxides (urine)	0.2	<= 10.0 micromol/g Creat.
8-OHdG (urine)	2	<= 15 mcg/g Creat.

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

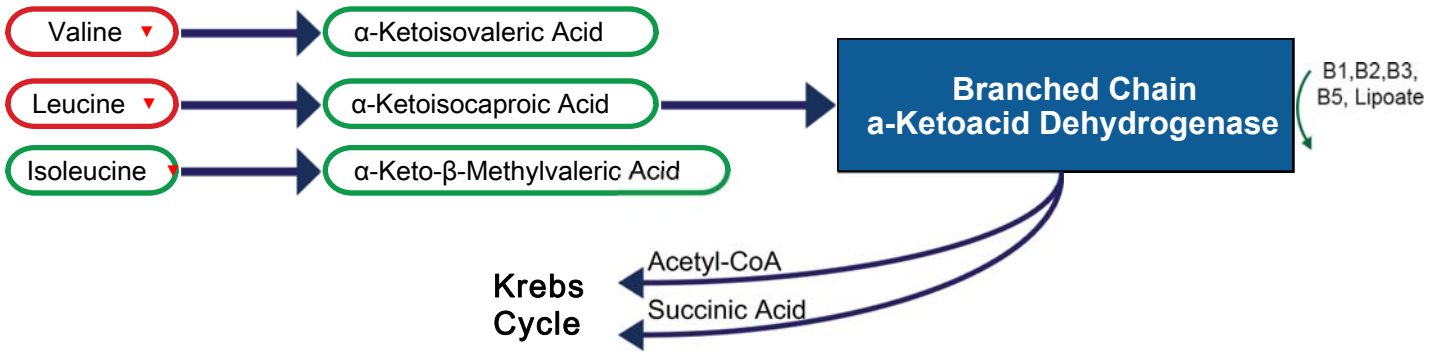
Pathways

Methylation Markers





Branch-Chain Amino Acid Metabolism



All biomarkers reported in micromol/g creatinine unless otherwise noted.

Amino Acids (FMV)

Nutritionally Essential Amino Acids

Amino Acid		Reference Range
Arginine	2	3-43
Histidine	8	102-763
Isoleucine	<dl	3-25
Leucine	1	6-61
Lysine	2	15-231
Methionine	1	2-16
Phenylalanine	1	7-92
Taurine	1	39-568
Threonine	4	9-97
Tryptophan	2	8-58
Valine	1	5-43

Nonessential Protein Amino Acids

Amino Acid		Reference Range
Alanine	1	26-275
Asparagine	4	12-115
Aspartic Acid	<dl	<= 9
Cysteine	4	9-60
Cystine	4	10-116
γ-Aminobutyric Acid	1	<= 3
Glutamic Acid	<dl	2-16
Glutamine	4	85-518
Proline	0	1-9
Tyrosine	8	19-135

Creatinine Concentration

		Reference Range
Creatinine◆	8.8	3.1-19.5 mmol/L

Amino Acid reference ranges are age specific.

Methodology: LC/MS/MS, Alkaline Picrate

Intermediary Metabolites

B-Vitamin Markers

		Reference Range
α-Aminoadipic	1	6-56
α-Amino-N-butyric Acid	1	2-21
β-Aminoisobutyric Acid	1	4-194
Cystathionine	1	4-48

Urea Cycle Markers

Citrulline	0.5	0.7-3.4
Ornithine	1	3-17
Urea◆	107	150-380 mmol/g creatinine

Glycine/Serine Metabolites

Glycine	16	47-435
Serine	8	24-140
Ethanolamine	2	40-226
Phosphoethanolamine	0	1-9
Phosphoserine	<dl	2-13
Sarcosine	0.3	<= 1.0

Dietary Peptide Related Markers

		Reference Range
Anserine (dipeptide)	0.5	0.7-76.1
Carnosine (dipeptide)	0	1-32
1-Methylhistidine	1	18-887
3-Methylhistidine	4	47-232
β-Alanine	1	<= 18

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	0.05	>= 0.09 wt %
Eicosapentaenoic (EPA) 20:5 n3	0.15	>= 0.16 wt %
Docosapentaenoic (DPA) 22:5 n3	1.00	>= 1.14 wt %
Docosahexaenoic (DHA) 22:6 n3	1.0	>= 2.1 wt %
% Omega-3s	3.0	>= 3.8

Omega-9 Fatty Acids

Analyte		Reference Range
	(olive oil)	
Oleic 18:1 n9	5	10-13 wt %
Nervonic 24:1 n9	1.0	2.1-3.5 wt %
% Omega-9s	10.0	13.3-16.6

Saturated Fatty Acids

Analyte		Reference Range
	(meat, dairy, coconuts, palm oils)	
Palmitic C16:0	15	18-23 wt %
Stearic C18:0	10	14-17 wt %
Arachidic C20:0	0.20	0.22-0.35 wt %
Behenic C22:0	0.80	0.92-1.68 wt %
Tricosanoic C23:0	0.10	0.12-0.18 wt %
Lignoceric C24:0	1.0	2.1-3.8 wt %
Pentadecanoic C15:0	0.05	0.07-0.15 wt %
Margaric C17:0	0.20	0.22-0.37 wt %
% Saturated Fats	35.0	39.8-43.6

Omega-6 Fatty Acids

Analyte		Reference Range
	(vegetable oil, grains, most meats, dairy)	
Linoleic (LA) 18:2 n6	8.0	10.5-16.9 wt %
γ-Linolenic (GLA) 18:3 n6	0.02	0.03-0.13 wt %
Dihomo-γ-linolenic (DGLA) 20:3 n6	1.00	>= 1.19 wt %
Arachidonic (AA) 20:4 n6	10	15-21 wt %
Docosatetraenoic (DTA) 22:4 n6	1.00	1.50-4.20 wt %
Eicosadienoic 20:2 n6	0.01	<= 0.26 wt %
% Omega-6s	25.0	30.5-39.7

Monounsaturated Fatty Acids

Omega-7 Fatty Acids

Analyte		Reference Range
Palmitoleic 16:1 n7	0.01	<= 0.64 wt %
Vaccenic 18:1 n7	0.01	<= 1.13 wt %

Trans Fats

Analyte		Reference Range
Elaidic 18:1 n9t	0.01	<= 0.59 wt %

Delta-6-Desaturase Activity

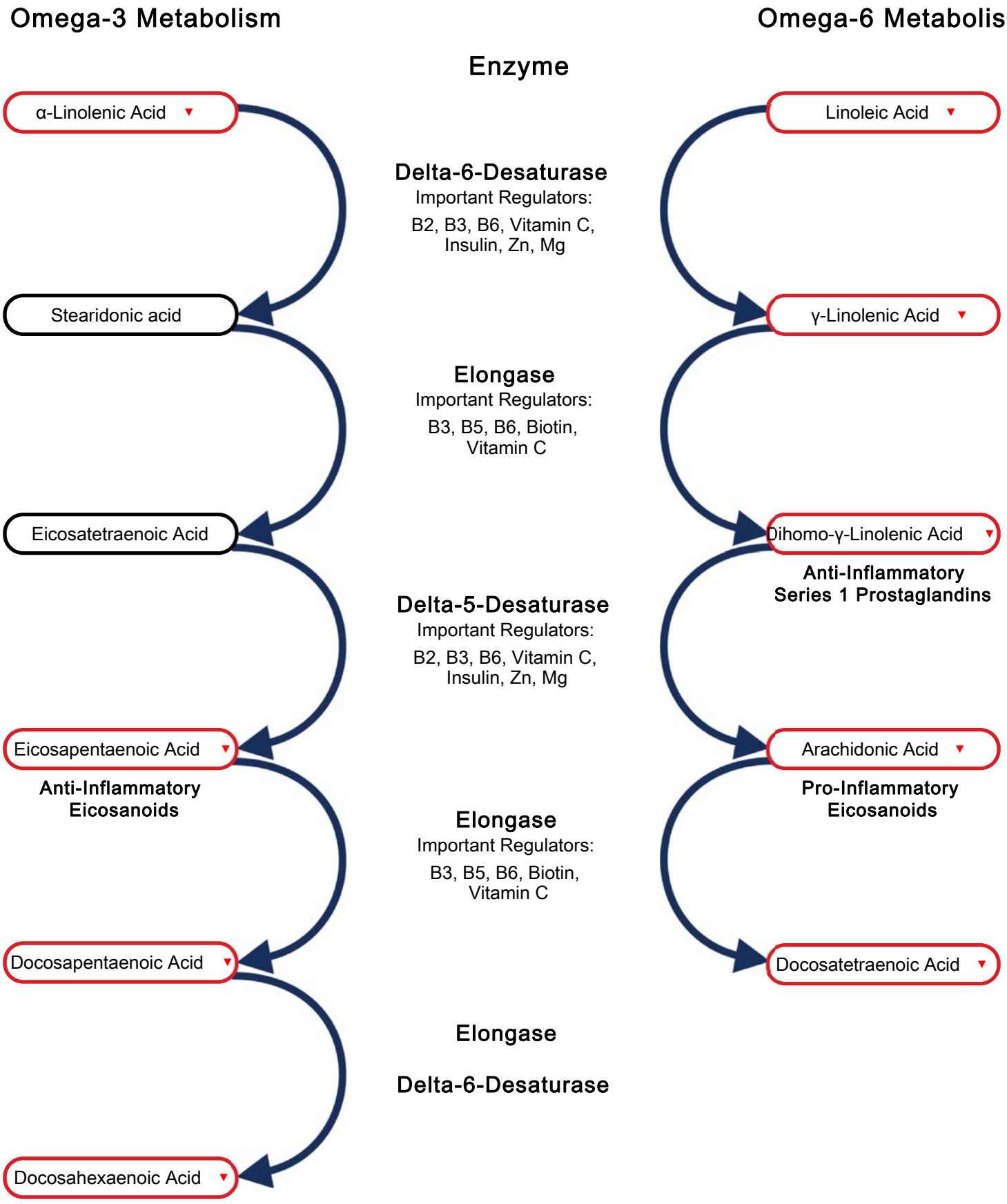
	Upregulated Functional Impaired	
Linoleic / DGLA 18:2 n6 / 20:3 n6	5.0	6.0-12.3

Cardiovascular Risk

Analyte		Reference Range
Omega-6s / Omega-3s	3.0	3.4-10.7
AA / EPA 20:4 n6 / 20:5 n3	10	12-125
Omega-3 Index	3.0	>= 4.0

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

Fatty Acid Metabolism



Methodology: ICP-MS

Elemental Markers

Nutrient Elements

Element		Reference Range
Copper *(plasma)*	0.1	75.3-192.0 mcg/dL
Magnesium *(RBC)*	25.0	30.1-56.5 mcg/g
Manganese *(whole blood)*	2.0	3.0-16.5 mcg/L
Potassium *(RBC)*	2,000	2,220-3,626 mcg/g
Selenium *(whole blood)*	100	109-330 mcg/L
Zinc *(plasma)*	30.0	64.3-159.4 mcg/dL

Toxic Elements*

Element		Reference Range
Lead	0.50	<= 2.81 mcg/dL
Mercury	1.00	<= 4.35 mcg/L
Arsenic	1.0	<= 13.7 mcg/L
Cadmium	0.50	<= 1.22 mcg/L

* All toxic Elements are measured in whole blood. The reference ranges for Lead, Mercury, and Cadmium are derived from the 95th percentile from NHANES

The Elemental reference ranges are based on an adult population.

Elemental testing performed by Genova Diagnostics, Inc. 3425 Corporate Way, Duluth, GA 30096 - Robert M. David, PhD, Lab Director - CLIA Lic. #11D0255349 - Medicare Lic. #34-8475

Vitamin D (Serum)

Methodology: Chemiluminescent

	Result		Reference Range
25 - Hydroxyvitamin D ◆	4	L	30-100 ng/mL

Deficiency:	<20 ng/mL
Insufficiency:	20-29 ng/mL
Sufficient:	30-100 ng/mL
Recommended:	50-80 ng/mL
Excessive:	>100 ng/mL

There is no consensus in the literature regarding optimal levels of 25-Hydroxyvitamin D. Higher levels of 25-Hydroxyvitamin D may be concerning in patients with renal failure. Levels below 30 ng/mL are considered insufficient by most medical associations

Reference:

Holick MF, et al. *J Clin Endocrinol Metab.* 2011;96(7):1911-1930.
Vitamin D Council: https://www.vitamindcouncil.org/

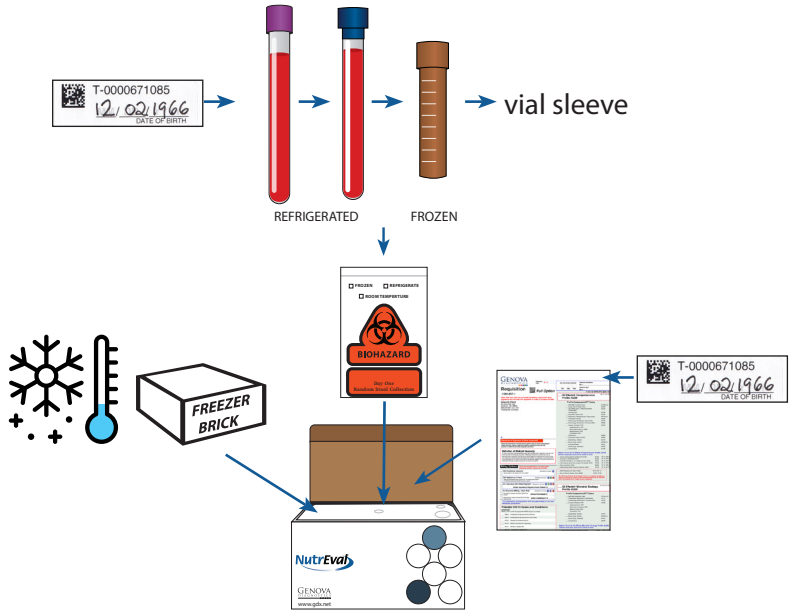
The performance characteristics of all assays have been verified by Genova Diagnostics, Inc. Unless otherwise noted with ◆, the assay has not been cleared by the U.S. Food and Drug Administration.

FINAL PREP AND SHIPPING

1. **Place biohazard bag with blood tubes, frozen freezer brick,** and absorbent material in foam insulator box inside the outer collection box.
2. ***Make sure patient urine and cheek swab collections (if ordered) are included***

RETURN CHECKLIST

- **All tubes with peel** and **stick labels** with **patient's date of birth**
- **FROZEN AMBER TRANSFER TUBE**
- **REFRIGERATED EDTA LAVENDER-TOP TUBE**
- **REFRIGERATED NA-EDTA BLUE-TOP, K2-EDTA BLUE-TOP, OR NA HEPARIN TUBE**
- **TEST REQUISITION**
- All frozen urine tubes Inside biohazard bag with absorbent pads
- Cheek swabs (if ordered)
- All materials and frozen freezer brick Inside Genova Box



SHIP THE SPECIMEN(S) TO THE LAB

Specimen(s) must be returned in the Genova Diagnostics box.
Please refer to the shipping instruction insert found in your collection box.

GENOVA DIAGNOSTICS®

800.522.4762 ·www.gdx.net

NutrEval® Clinician Collection Instructions

For Test **#3000**

Test prep, FAQs, and the collection video can be found at **www.gdx.net/nutrevalprep** or **scan the QR Code**.

Shipping Notice:
Finish collection and ship **Monday through Friday**.
US holidays can affect shipping times.

COLLECTION MATERIALS - KEEP OUTER BOX FOR SHIPPING TO LAB

CLINICIAN BLOOD DRAW COLLECTION

EDTA lavender-top tube | Amber transfer tube | SST red tiger-top tube | Na-EDTA blue-top tube **or** K2-EDTA blue-top tube **or** Na Heparin blue-top tube | Pipette

The Na-EDTA blue-top tube, Na Heparin blue-top tube or the K2-EDTA blue-top tube are interchangeable for this specimen collection pack. Please Note: These are trace mineral tubes, not standard tubes.

- FOAM INSULATOR BOX
- FREEZER BRICK
- BIOHAZARD BAGS WITH ABSORBENT MATERIAL
- RUBBER BAND
- TEST REQUISITION FORM
- PEEL AND STICK LABELS
- VIAL SLEEVE
- FEDEX® ENVELOPE
- BILLABLE STAMP

TEST REQUISITION FORM - RETURN WITH SHIPPING BOX

Complete all sections using the **paper form** included

or

online at www.gdx.net/mygdx **for clinicians**
www/gdx.net/prc **for patients**

Watch the How-to Video at
www.gdx.net/mygdx or www/gdx.net/prc

Both methods require the **paper form to be returned with the pack.**

PEEL AND STICK COLLECTION LABELS

Fill out all the peel and **stick labels with patient's date of birth (DOB) (mm/dd/yyyy)** and **apply to all the tubes, the swab envelope, and the requisition.**
There may be extra labels left over.

Do not write on the tubes.

IMPORTANT PREP BEFORE COLLECTION

- Abnormal kidney function or use of diuretics may influence test results.

MEDICATIONS MAY IMPACT RESULTS

- Discontinuing medications is at the discretion of the physician. Valproic acid, acetaminophen, and berberine HCl can interfere with select analytes.

4 DAYS BEFORE THE TEST:

- Some clinicians choose to discontinue non-essential nutritional supplements to get a "baseline" reading.
- Some clinicians choose to continue nutritional supplementation to assess the efficacy of treatments.

24 HOURS BEFORE THE TEST:

- Patient should eat their usual diet. Avoid over-consuming any single food or extreme diets.
- Fluid intake should be limited to six 8-ounce glasses of fluid.

NIGHT BEFORE THE TEST:

- Patients must fast overnight prior to the blood draw.
- Freeze the enclosed freezer brick a minimum of 8 hours before shipping.

REMIND THE PATIENT:

- All patient's urine tubes must be frozen a minimum of 2 hours prior to blood draw appointment.

For more details, please visit
www.gdx.net/tests/prep

BLOOD COLLECTION

Please collect all tubes in one session.

1. **Label each tube with the patient's date of birth using peel and stick labels.**
2. **Clean** the skin thoroughly with isopropyl alcohol before venipuncture, and use only stainless steel needles
3. **DRAW BLOOD -** Use rubber band if needed
4. **BLOOD PROCESSING:** (Must be completed within 45 minutes after blood collection.)

NA-EDTA, K2-EDTA, OR NA HEPARIN BLUE-TOP TUBE

Gently invert the tube 10-15 times
Refrigerate

RETURN TO LAB

RED SST TIGER-TOP TUBE

Clot for 15 min. while standing in a rack
Centrifuge 15 min. at 3000 RPM
Transfer serum to amber transfer tube

DISCARD

AMBER TRANSFER TUBE

Freeze

RETURN TO LAB

EDTA LAVENDER TOP TUBE

Gently invert 5 times
Do not shake
Refrigerate

RETURN TO LAB