



63 Zillicoa Street
Asheville, NC 28801
© Genova Diagnostics



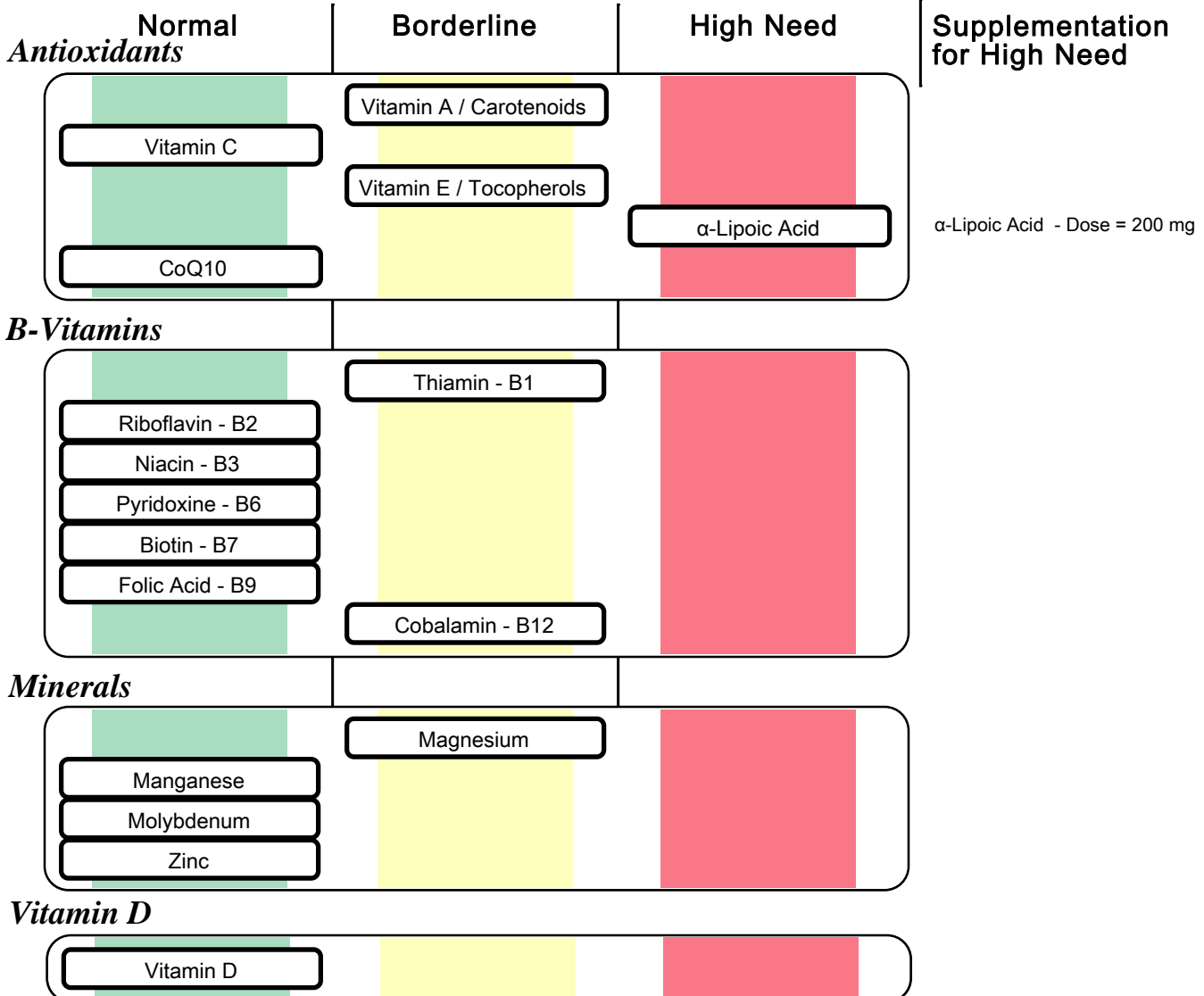
OPTIMAL NUTRITION EVALUATION

Patient: **EMILY TEST**
DOB: January 18, 1948
Sex: M
MRN: 1233087832

Order Number: **M7260273**
Completed: November 27, 2018
Received: November 26, 2018
Collected: November 26, 2018

Test Office
Test PROD Test MD, DO, ND
84 Peachtree Road
Between 85th & 86th St Ste 1B
Asheville, NC 28803

ONE Results Overview



SUGGESTED SUPPLEMENT SCHEDULE

Supplements	Daily Recommended Intake (DRI)	Patient's Daily Recommendations	Provider Daily Recommendations
Antioxidants			
Vitamin A / Carotenoids	3,000 IU	5,000 IU	
Vitamin C	90 mg	250 mg	
Vitamin E / Tocopherols	22 IU	200 IU	
α-Lipoic Acid		200 mg	
CoQ10		30 mg	
B-Vitamins			
Thiamin - B1	1.2 mg	25 mg	
Riboflavin - B2	1.3 mg	10 mg	
Niacin - B3	16 mg	20 mg	
Pyridoxine - B6	1.7 mg	10 mg	
Biotin - B7	30 mcg	100 mcg	
Folic Acid - B9	400 mcg	400 mcg	
Cobalamin - B12	2.4 mcg	500 mcg	
Minerals			
Magnesium	420 mg	600 mg	
Manganese	2.3 mg	3.0 mg	
Molybdenum	45 mcg	75 mcg	
Zinc	11 mg	10 mg	
Digestive Support			
Probiotics		10 billion CFU	
Pancreatic Enzymes		0 IU	
Other Vitamins			
Vitamin D	600 IU	1,000 IU	
Amino Acid		Amino Acid	
	mg/day		mg/day
Arginine	994	Methionine	384
Asparagine	252	Phenylalanine	0
Cysteine	161	Serine	90
Glutamine	51	Taurine	255
Glycine	1,304	Threonine	0
Histidine	145	Tryptophan	0
Isoleucine	272	Tyrosine	0
Leucine	469	Valine	0
Lysine	979		

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 Suggested Supplemental Schedule 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.

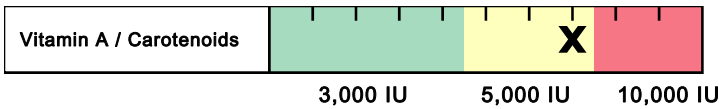
Key

	Normal		Borderline		High Need
--	--------	--	------------	--	-----------

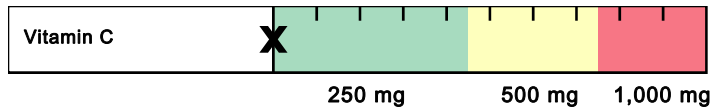
ONE^{FMV} Interpretation At-A-Glance

Nutritional Needs

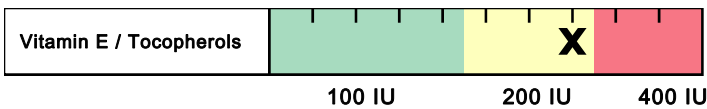
Antioxidants



- ▶ 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.



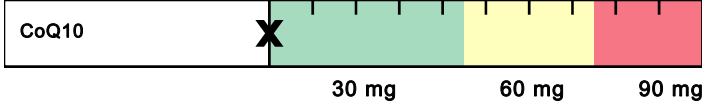
- ▶ Vitamin C is an antioxidant (also used in the regeneration of other antioxidants). It is involved in cholesterol metabolism, the production & function of WBCs and antibodies, and the synthesis of collagen, norepinephrine and carnitine.
- ▶ Deficiency may occur with oral contraceptives, aspirin, diuretics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



- ▶ 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.



- ▶ 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 alpha-keto acids and amino acids.
- ▶ High biotin intake can compete with lipoic acid for cell membrane entry.
- ▶ Optimal levels of 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 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 (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.



- ▶ 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
- ▶ Causes of Deficiency
- ▶ Complications of Deficiency
- ▶ Food Sources



Interpretation At-A-Glance

Nutritional Needs

B-Vitamins



- ▶ 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.



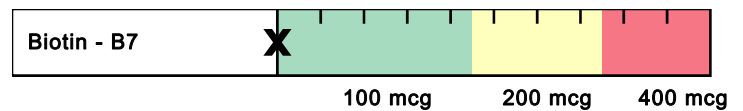
- ▶ B2 is a key component of enzymes involved in antioxidant function, energy production, detoxification, methionine metabolism and vitamin activation.
- ▶ Low B2 may result from chronic alcoholism, some anti-psychotic medications, oral contraceptives, tricyclic antidepressants, quinacrine or adriamycin.
- ▶ 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.



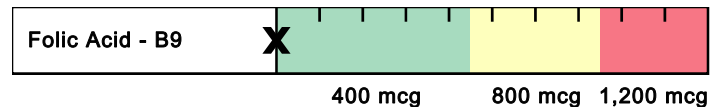
- ▶ B3 is used to form NAD and NADP, involved in energy production from food, fatty acid & cholesterol synthesis, cell signaling, DNA repair & cell differentiation.
- ▶ Low B3 may result from deficiencies of tryptophan (B3 precursor), B6, B2 or Fe (cofactors in B3 production), or from long-term isoniazid 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.



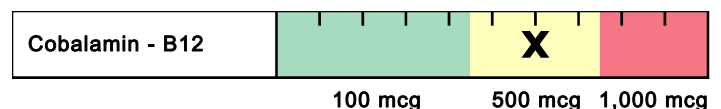
- ▶ B6 (as P5P) is a cofactor for enzymes involved in glycogenolysis & gluconeogenesis, and synthesis of neurotransmitters, heme, B3, RBCs and nucleic acids.
- ▶ Low B6 may result from chronic alcoholism, long-term diuretics, estrogens (oral contraceptives and HRT), anti-TB meds, penicillamine, L-DOPA 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 is a cofactor for enzymes involved in functions such as fatty acid (FA) 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 use, 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 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.



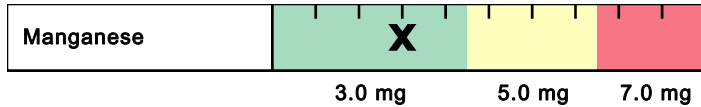
- ▶ B12 plays important roles in energy production from fats & proteins, methylation, synthesis of hemoglobin & RBCs, and maintenance of nerve cells, DNA & RNA.
- ▶ Low B12 may result from alcoholism, malabsorption, hypochlorhydria (e.g., from atrophic gastritis, H. pylori infection, pernicious anemia, 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.



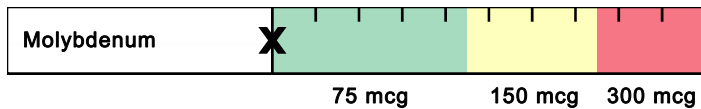
Interpretation At-A-Glance

Nutritional Needs

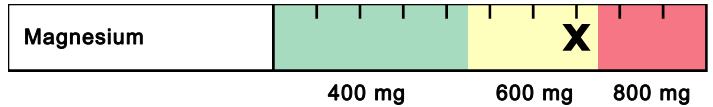
Minerals



- 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 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).

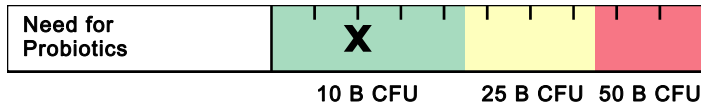


- Magnesium is involved in >300 metabolic reactions. Key areas include energy production, bone & ATP formation, muscle & nerve conduction and cell signaling.
- Deficiency may occur with malabsorption, alcoholism, hyperparathyroidism, renal disorders (wasting), diabetes, diuretics, digoxin or high doses 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.

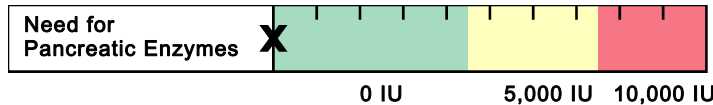


- Zinc plays a vital role in immunity, protein metabolism, heme synthesis, growth & development, reproduction, digestion and antioxidant function.
- Low levels may occur with malabsorption, alcoholism, chronic diarrhea, diabetes, excess Cu or Fe, diuretics, ACE inhibitors, H2 blockers or digoxin.
- Deficiency 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.

Digestive Support



- Probiotics have many functions. These include: production of some B vitamins and vitamin K; enhancement of digestion & absorption; decreasing severity of diarrheal illness; modulation 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.



- 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.



Interpretation At-A-Glance

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



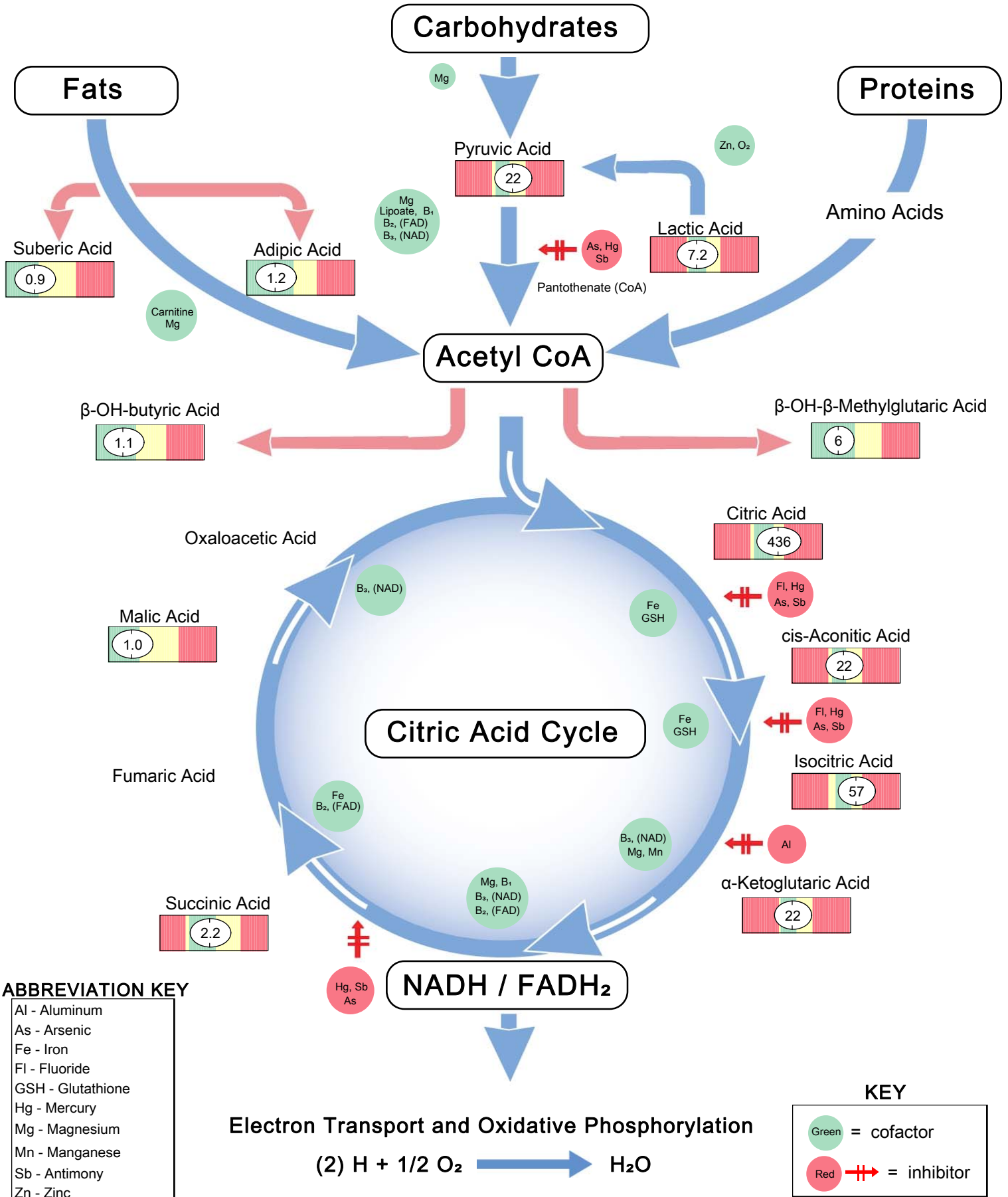
- Methylation is an enzymatic process that is critical for both synthesis and inactivation. DNA, estrogen and neurotransmitter metabolism are all dependent on appropriate methylation activity.
- B vitamins and other nutrients (methionine, magnesium, selenium) functionally support catechol-O-methyltransferase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

Krebs Cycle At-A-Glance



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

Metabolic Analysis Markers (Urine)

Malabsorption and Dysbiosis Markers

Malabsorption Markers Reference Range

Indoleacetic Acid (IAA)	1.8	<= 4.2
Phenylacetic Acid (PAA)	0.02	<= 0.12

Bacterial Dysbiosis Markers

Dihydroxyphenylpropionic Acid (DHPPA)	2.0	<= 5.3
3-Hydroxyphenylacetic Acid	3.6	<= 8.1
4-Hydroxyphenylacetic Acid	14	<= 29
Benzoic Acid	0.02	<= 0.05
Hippuric Acid	288	<= 603

Yeast / Fungal Dysbiosis Markers

Arabinose	35	<= 96
Citramalic Acid	2.2	<= 5.8
Tartaric Acid	<dl	<= 15

Cellular Energy & Mitochondrial Metabolites

Carbohydrate Metabolism Reference Range

Lactic Acid	7.2	1.9-19.8
Pyruvic Acid	22	7-32
β-OH-Butyric Acid (BHBA)	1.1	<= 2.8

Energy Metabolism

Citric Acid	436	40-520
Cis-Aconitic Acid	22	10-36
Isocitric Acid	57	22-65
α-Ketoglutaric Acid (AKG)	22	4-52
Succinic Acid	2.2	0.4-4.6
Malic Acid	1.0	<= 3.0
β-OH-β-Methylglutaric Acid (HMG)	6	<= 15

Fatty Acid Metabolism

Adipic Acid	1.2	<= 2.8
Suberic Acid	0.9	<= 2.1

Creatinine Concentration

Creatinine ♦	15.5	3.1-19.5 mmol/L
--------------	------	-----------------

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

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.

© Genova Diagnostics · A. L. Peace-Brewer, PhD, D(ABMLI), Lab Director · CLIA Lic. #34D0655571 · Medicare Lic. #34-8475

Neurotransmitter Metabolites

Reference Range

Vanilmandelic Acid	2.6	0.4-3.6
Homovanillic Acid	3.5	1.2-5.3
5-OH-indoleacetic Acid	9.1	3.8-12.1
3-Methyl-4-OH-phenylglycol	0.14	0.02-0.22
Kynurenic Acid	5.1	<= 7.1
Quinolinic Acid	6.6	<= 9.1
Kynurenic / Quinolinic Ratio	0.77	>= 0.44

Vitamin Markers

Reference Range

α-Ketoadipic Acid	0.6	<= 1.7
α-Ketoisovaleric Acid	0.50	<= 0.97
α-Ketoisocaproic Acid	0.50	<= 0.89
α-Keto-β-Methylvaleric Acid	1.0	<= 2.1
Formiminoglutamic Acid (FIGlu)	0.4	<= 1.5
Glutaric Acid	0.28	<= 0.51
Isovalerylglycine	1.5	<= 3.7
Methylmalonic Acid	1.0	<= 1.9
Xanthurenic Acid	0.63	<= 0.96
3-Hydroxypropionic Acid	9	5-22
3-Hydroxyisovaleric Acid	12	<= 29

Toxin & Detoxification Markers

Reference Range

α-Ketophenylacetic Acid (from Styrene)	0.28	<= 0.46
α-Hydroxyisobutyric Acid (from MTBE)	4.8	<= 6.7
Orotic Acid	0.62	0.33-1.01
Pyroglutamic Acid	31	16-34

Tyrosine Metabolism

Reference Range

Homogentisic Acid	7	<= 19
2-Hydroxyphenylacetic Acid	0.55	<= 0.76

Metabolic Analysis Reference Ranges are Age Specific

Amino Acids (Urine FMV)

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

Nutritionally Essential Amino Acids

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

Nonessential Protein Amino Acids

Amino Acid	Reference Range
Alanine	26-275
Asparagine	12-115
Aspartic Acid	<= 9
Cysteine (FMV urine)	9-60
Cystine (FMV Urine)	10-116
γ-Aminobutyric Acid	<= 3
Glutamic Acid	2-16
Glutamine	85-518
Proline	1-9
Tyrosine	19-135

Creatinine Concentration

Reference Range
Creatinine ♦ 3.1-19.5 mmol/L

Amino Acid reference ranges are age specific.

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

Methodology: LC/MS/MS, Alkaline Picrate

Intermediary Metabolites

B Vitamin Markers	Reference Range
α-Amino adipic	6-56
α-Amino-N-butyric Acid	2-21
β-Aminoisobutyric Acid	4-194
Cystathionine	4-48
3-Methylhistidine	47-232

Urea Cycle Markers

Citrulline	0.7-3.4
Ornithine	3-17
Urea ♦	150-380 mmol/g creatinine

Glycine/Serine Metabolites

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

Dietary Peptide Related Markers

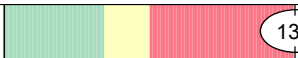
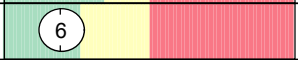
Reference Range
Anserine (dipeptide) 0.7-76.1
Carnosine (dipeptide) 1-32
1-Methylhistidine 18-887
β-Alanine <= 18

Oxidative Stress Markers

Oxidative Stress Markers

Reference Range

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

Lipid Peroxides (urine)		13.8	<=10.0 micromol/g Creat.
8-OHdG (urine)		6	<=15 mcg/g Creat.

Vitamin D (Serum)

Inside Range

Reference Range

Methodology: Chemiluminescent

25 - Hydroxyvitamin D ♦	55	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. Treatment is at the discretion of the treating clinician.

Holick MF, et al. *J Clin Endocrinol Metab.* 2011;96(7):1911-1930.

Vitamin D Council: <https://www.vitamindcouncil.org/>

Lab Comments

Please note the reference range for 25-Hydroxyvitamin D has been updated.

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.

Interpretation At-A-Glance Details**Antioxidants****Vitamin A / Carotenoids****Contributing Biomarkers:**

Cystine
Cysteine
Lipid Peroxides

Vitamin E / Tocopherols**Contributing Biomarkers:**

Cystine
Cysteine
Lipid Peroxides

 α -Lipoic Acid**Contributing Biomarkers:**

Lipid Peroxides
Pyroglutamic Acid
Methionine

Glutathione**Contributing Biomarkers:**

Citric Acid
Lipid Peroxides

Plant-based Antioxidants**Contributing Biomarkers:**

Cystine
Cysteine
Lipid Peroxides

B-Vitamins**Thiamin - B1****Contributing Biomarkers:**

5-OH-Indoleacetic Acid
Pyruvic Acid

Riboflavin - B2**Contributing Biomarkers:**

Pyruvic Acid

Interpretation At-A-Glance Details**Pyridoxine - B6****Contributing Biomarkers:**

Cysteine
Quinolinic Acid

Cobalamin - B12**Contributing Biomarkers:**

Cysteine
Methionine

Minerals**Manganese****Contributing Biomarkers:**

5-OH-Indoleacetic Acid

Magnesium**Contributing Biomarkers:**

Citric Acid
Ethanolamine
Phosphoethanolamine
Isocitric Acid

Digestive Support**Need for Probiotics****Contributing Biomarkers:**

Phosphoethanolamine

Metabolic Analysis 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.

All these markers are within their reference ranges; there are no abnormalities.

Amino Acid Commentary

<dl = Unable to calculate results due to less than detectable levels of analyte.

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.

All of the measured levels of amino acids and associated analytes are within normal limits. There is no indication of impaired amino acid metabolism. Renal clearance is normal per a normal 24-hour creatinine level.

Anserine, a dietary peptide, is measured to be lower than the reference range. Anserine comes from certain fish and fowl protein. It is typically low or absent for individuals who eat low protein diets or who follow vegetarian or vegan diets. There is no clinical significance for low anserine.

Phosphoethanolamine is measured to be low. Like ethanolamine, phosphoethanolamine is an intermediate in the serine-to-choline metabolism sequence. It is a precursor of phosphatidylcholine, choline and the neurotransmitter, acetylcholine. Formation of phosphoethanolamine from ethanolamine requires phosphorylation, a magnesium-dependent process. The most common reasons for insufficient phosphoethanolamine are magnesium deficiency or dysfunction, ethanolamine deficiency and serine deficiency. Low phosphoethanolamine is significant if cholinergic functions are limited.

Oxidative Stress 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.

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.

Sufficient levels:

Vitamin D is a hormone produced in the skin during exposure to sunlight or consumed in the diet, and converted to its active form, calcitriol, in the liver and kidneys. Vitamin D helps regulate serum calcium and phosphorus levels by increasing intestinal absorption of calcium and stimulating tubular reabsorption of calcium. Vitamin D also affects numerous other functions in the body.

Recommended levels are protective against osteoporosis as well as infection, autoimmune disease, hypertension, arteriosclerosis, diabetes and insulin resistance, musculoskeletal pain, epilepsy, and migraine.



63 Zillicoa Street
Asheville, NC 28801
© Genova Diagnostics



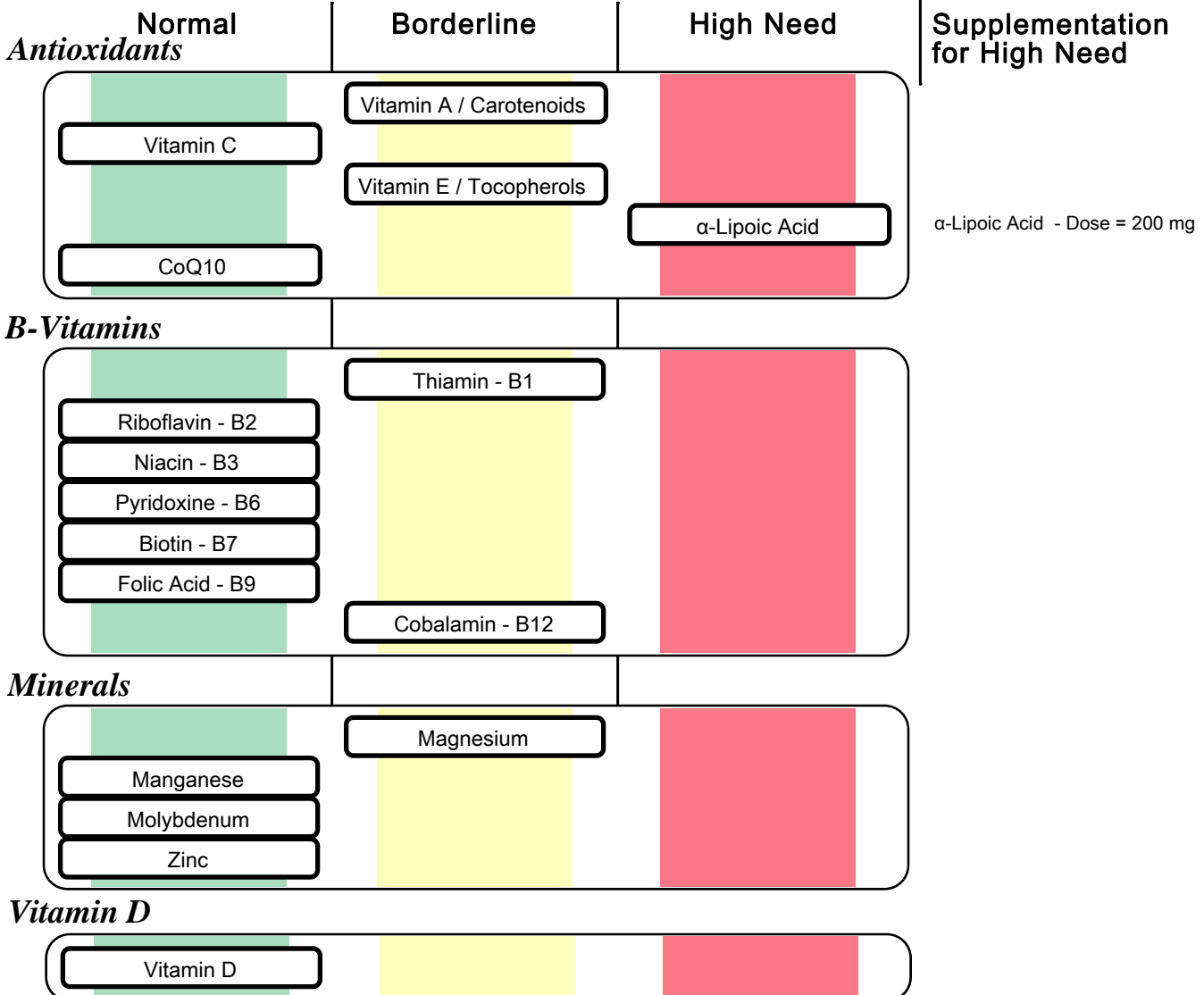
OPTIMAL NUTRITION EVALUATION

Patient: **EMILY TEST**
DOB: January 18, 1948
Sex: M
MRN: 1233087832

Order Number: **M7260273**
Completed: November 27, 2018
Received: November 26, 2018
Collected: November 26, 2018

Test Office
Test PROD Test MD, DO, ND
84 Peachtree Road
Between 85th & 86th St Ste 1B
Asheville, NC 28803

ONE Results Overview



SUGGESTED SUPPLEMENT SCHEDULE

Supplements	Daily Recommended Intake (DRI)	Patient's Daily Recommendations	Provider Daily Recommendations
Antioxidants			
Vitamin A / Carotenoids	3,000 IU	5,000 IU	
Vitamin C	90 mg	250 mg	
Vitamin E / Tocopherols	22 IU	200 IU	
α-Lipoic Acid		200 mg	
CoQ10		30 mg	
B-Vitamins			
Thiamin - B1	1.2 mg	25 mg	
Riboflavin - B2	1.3 mg	10 mg	
Niacin - B3	16 mg	20 mg	
Pyridoxine - B6	1.7 mg	10 mg	
Biotin - B7	30 mcg	100 mcg	
Folic Acid - B9	400 mcg	400 mcg	
Cobalamin - B12	2.4 mcg	500 mcg	
Minerals			
Magnesium	420 mg	600 mg	
Manganese	2.3 mg	3.0 mg	
Molybdenum	45 mcg	75 mcg	
Zinc	11 mg	10 mg	
Digestive Support			
Probiotics		10 billion CFU	
Pancreatic Enzymes		0 IU	
Other Vitamins			
Vitamin D	600 IU	1,000 IU	
Amino Acid		Amino Acid	
	mg/day		mg/day
Arginine	994	Methionine	384
Asparagine	252	Phenylalanine	0
Cysteine	161	Serine	90
Glutamine	51	Taurine	255
Glycine	1,304	Threonine	0
Histidine	145	Tryptophan	0
Isoleucine	272	Tyrosine	0
Leucine	469	Valine	0
Lysine	979		

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 Suggested Supplemental Schedule 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.

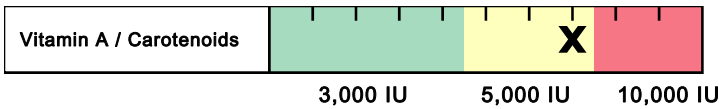
Key

Normal	Borderline	High Need

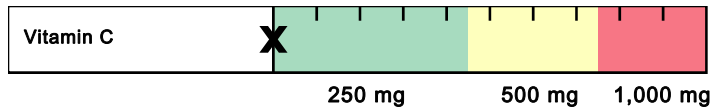
ONE^{FMV} Interpretation At-A-Glance

Nutritional Needs

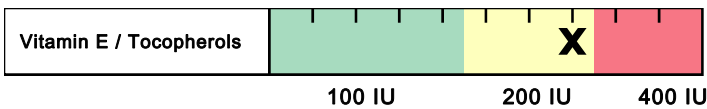
Antioxidants



- ▶ 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 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.



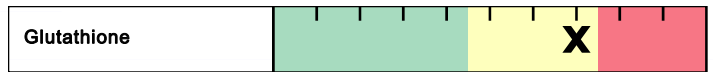
- ▶ Alpha-tocopherol (body's main form of vitamin E) functions as an antioxidant, regulates cell signaling, influences immune function and inhibits coagulation.
- ▶ Deficiency may occur with malabsorption, cholestyramine, colestipol, isoniazid, orlistat, olestra and certain anti-convulsants (e.g., phenobarbital, 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.



- ▶ 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 alpha-keto acids and amino acids.
- ▶ High biotin intake can compete with lipoic acid for cell membrane entry.
- ▶ Optimal levels of 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 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 (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.



- ▶ 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
- ▶ Causes of Deficiency
- ▶ Complications of Deficiency
- ▶ Food Sources



Interpretation At-A-Glance

Nutritional Needs

B-Vitamins



- ▶ 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.



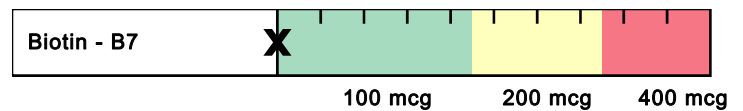
- ▶ B2 is a key component of enzymes involved in antioxidant function, energy production, detoxification, methionine metabolism and vitamin activation.
- ▶ Low B2 may result from chronic alcoholism, some anti-psychotic medications, oral contraceptives, tricyclic antidepressants, quinacrine or adriamycin.
- ▶ 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.



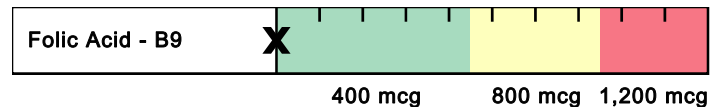
- ▶ B3 is used to form NAD and NADP, involved in energy production from food, fatty acid & cholesterol synthesis, cell signaling, DNA repair & cell differentiation.
- ▶ Low B3 may result from deficiencies of tryptophan (B3 precursor), B6, B2 or Fe (cofactors in B3 production), or from long-term isoniazid 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.



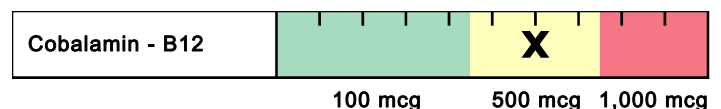
- ▶ B6 (as P5P) is a cofactor for enzymes involved in glycogenolysis & gluconeogenesis, and synthesis of neurotransmitters, heme, B3, RBCs and nucleic acids.
- ▶ Low B6 may result from chronic alcoholism, long-term diuretics, estrogens (oral contraceptives and HRT), anti-TB meds, penicillamine, L-DOPA 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 is a cofactor for enzymes involved in functions such as fatty acid (FA) 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 use, 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 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.

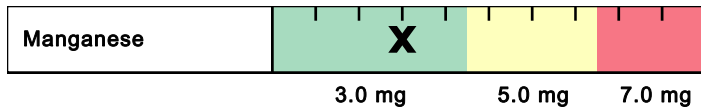


- ▶ B12 plays important roles in energy production from fats & proteins, methylation, synthesis of hemoglobin & RBCs, and maintenance of nerve cells, DNA & RNA.
- ▶ Low B12 may result from alcoholism, malabsorption, hypochlorhydria (e.g., from atrophic gastritis, H. pylori infection, pernicious anemia, 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.

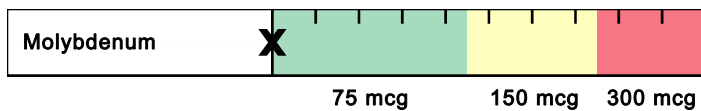
ONE^{FMV} Interpretation At-A-Glance

Nutritional Needs

Minerals



- ▶ 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 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).

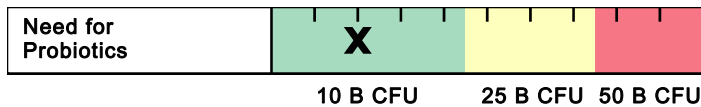


- ▶ Magnesium is involved in >300 metabolic reactions. Key areas include energy production, bone & ATP formation, muscle & nerve conduction and cell signaling.
- ▶ Deficiency may occur with malabsorption, alcoholism, hyperparathyroidism, renal disorders (wasting), diabetes, diuretics, digoxin or high 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.

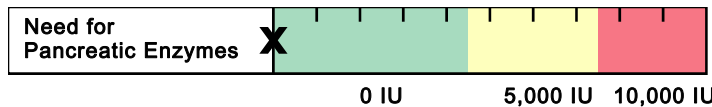


- ▶ Zinc plays a vital role in immunity, protein metabolism, heme synthesis, growth & development, reproduction, digestion and antioxidant function.
- ▶ Low levels may occur with malabsorption, alcoholism, chronic diarrhea, diabetes, excess Cu or Fe, diuretics, ACE inhibitors, H2 blockers or digoxin.
- ▶ 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.

Digestive Support



- ▶ Probiotics have many functions. These include: production of some B vitamins and vitamin K; enhancement of digestion & absorption; decreasing severity of diarrheal illness; modulation 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.



- ▶ 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.



Interpretation At-A-Glance

Functional Imbalances



- 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.

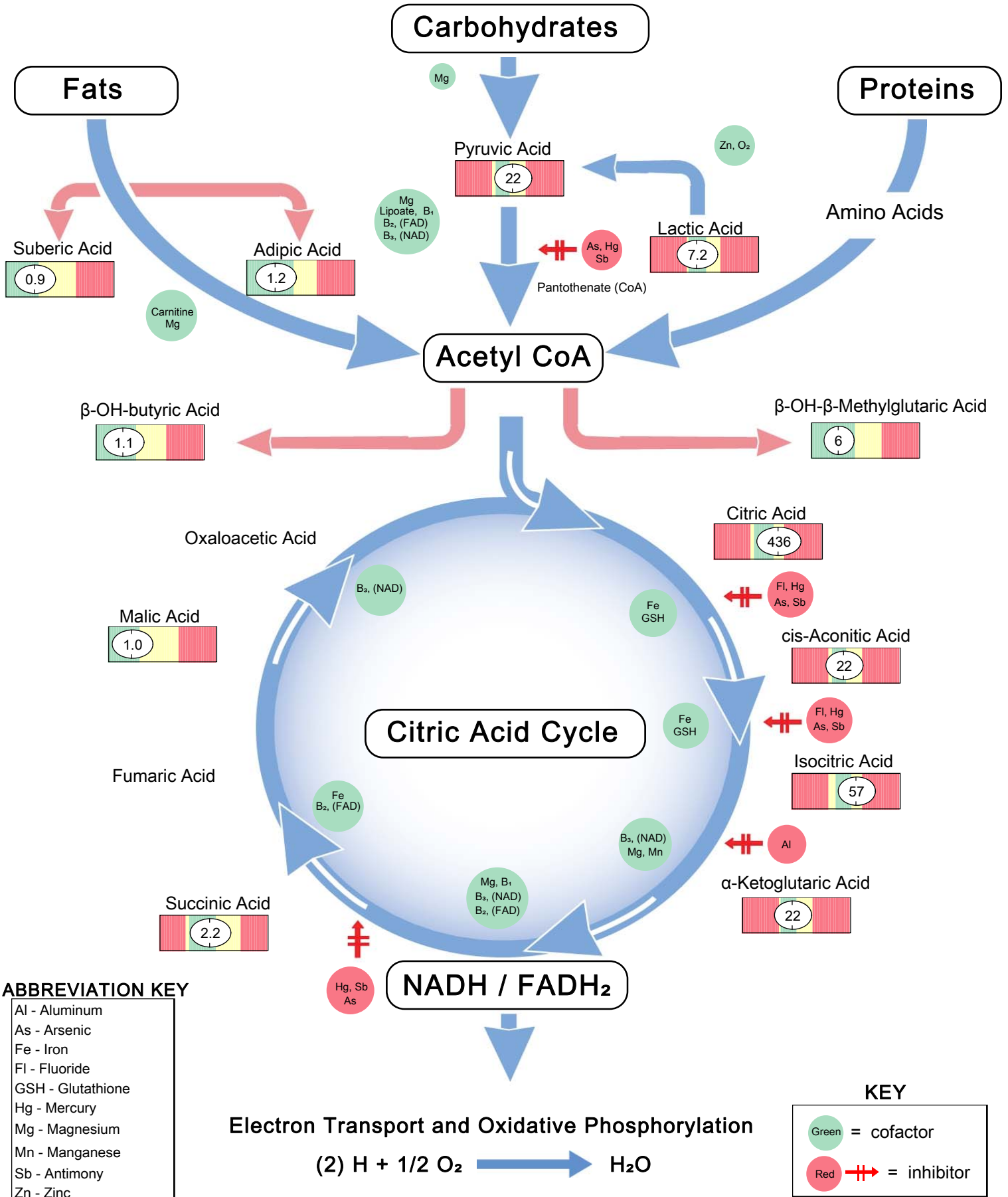


- Methyl tert-Butyl Ether (MTBE) is a common gasoline additive used to increase octane ratings, and has been found to contaminate ground water supplies where gasoline is stored. Inhalation of MTBE may cause nose and throat irritation, as well as headaches, nausea, dizziness and mental confusion. Animal 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.



- 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.

Krebs Cycle At-A-Glance



ABBREVIATION KEY

Al	- Aluminum
As	- Arsenic
Fe	- Iron
Fl	- Fluoride
GSH	- Glutathione
Hg	- Mercury
Mg	- Magnesium
Mn	- Manganese
Sb	- Antimony
Zn	- Zinc

KEY

Green	= cofactor
Red	⊘ = inhibitor

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

Metabolic Analysis Markers (Urine)

Malabsorption and Dysbiosis Markers

Malabsorption Markers Reference Range

Indoleacetic Acid (IAA)	1.8	<= 4.2
Phenylacetic Acid (PAA)	0.02	<= 0.12

Bacterial Dysbiosis Markers

Dihydroxyphenylpropionic Acid (DHPPA)	2.0	<= 5.3
3-Hydroxyphenylacetic Acid	3.6	<= 8.1
4-Hydroxyphenylacetic Acid	14	<= 29
Benzoic Acid	0.02	<= 0.05
Hippuric Acid	288	<= 603

Yeast / Fungal Dysbiosis Markers

Arabinose	35	<= 96
Citramalic Acid	2.2	<= 5.8
Tartaric Acid	<dl	<= 15

Cellular Energy & Mitochondrial Metabolites

Carbohydrate Metabolism Reference Range

Lactic Acid	7.2	1.9-19.8
Pyruvic Acid	22	7-32
β-OH-Butyric Acid (BHBA)	1.1	<= 2.8

Energy Metabolism

Citric Acid	436	40-520
Cis-Aconitic Acid	22	10-36
Isocitric Acid	57	22-65
α-Ketoglutaric Acid (AKG)	22	4-52
Succinic Acid	2.2	0.4-4.6
Malic Acid	1.0	<= 3.0
β-OH-β-Methylglutaric Acid (HMG)	6	<= 15

Fatty Acid Metabolism

Adipic Acid	1.2	<= 2.8
Suberic Acid	0.9	<= 2.1

Creatinine Concentration

Reference Range

Creatinine ♦	15.5	3.1-19.5 mmol/L
--------------	------	-----------------

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

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.

© Genova Diagnostics · A. L. Peace-Brewer, PhD, D(ABMLI), Lab Director · CLIA Lic. #34D0655571 · Medicare Lic. #34-8475

Neurotransmitter Metabolites

Reference Range

Vanilmandelic Acid	2.6	0.4-3.6
Homovanillic Acid	3.5	1.2-5.3
5-OH-indoleacetic Acid	9.1	3.8-12.1
3-Methyl-4-OH-phenylglycol	0.14	0.02-0.22
Kynurenic Acid	5.1	<= 7.1
Quinolinic Acid	6.6	<= 9.1
Kynurenic / Quinolinic Ratio	0.77	>= 0.44

Vitamin Markers

Reference Range

α-Ketoadipic Acid	0.6	<= 1.7
α-Ketoisovaleric Acid	0.50	<= 0.97
α-Ketoisocaproic Acid	0.50	<= 0.89
α-Keto-β-Methylvaleric Acid	1.0	<= 2.1
Formiminoglutamic Acid (FIGlu)	0.4	<= 1.5
Glutaric Acid	0.28	<= 0.51
Isovalerylglycine	1.5	<= 3.7
Methylmalonic Acid	1.0	<= 1.9
Xanthurenic Acid	0.63	<= 0.96
3-Hydroxypropionic Acid	9	5-22
3-Hydroxyisovaleric Acid	12	<= 29

Toxin & Detoxification Markers

Reference Range

α-Ketophenylacetic Acid (from Styrene)	0.28	<= 0.46
α-Hydroxyisobutyric Acid (from MTBE)	4.8	<= 6.7
Orotic Acid	0.62	0.33-1.01
Pyroglutamic Acid	31	16-34

Tyrosine Metabolism

Reference Range

Homogentisic Acid	7	<= 19
2-Hydroxyphenylacetic Acid	0.55	<= 0.76

Metabolic Analysis Reference Ranges are Age Specific

Amino Acids (Urine FMV)

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

Nutritionally Essential Amino Acids

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

Nonessential Protein Amino Acids

Amino Acid	Reference Range
Alanine	26-275
Asparagine	12-115
Aspartic Acid	<= 9
Cysteine (FMV urine)	9-60
Cystine (FMV Urine)	10-116
γ-Aminobutyric Acid	<= 3
Glutamic Acid	2-16
Glutamine	85-518
Proline	1-9
Tyrosine	19-135

Creatinine Concentration

Reference Range
Creatinine ♦ 3.1-19.5 mmol/L

Amino Acid reference ranges are age specific.

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

Methodology: LC/MS/MS, Alkaline Picrate

Intermediary Metabolites

B Vitamin Markers	Reference Range
α-Amino adipic	6-56
α-Amino-N-butyric Acid	2-21
β-Aminoisobutyric Acid	4-194
Cystathionine	4-48
3-Methylhistidine	47-232

Urea Cycle Markers

Citrulline	0.7-3.4
Ornithine	3-17
Urea ♦	150-380 mmol/g creatinine

Glycine/Serine Metabolites

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

Dietary Peptide Related Markers

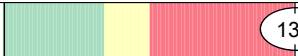
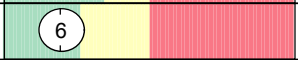
Reference Range
Anserine (dipeptide) 0.7-76.1
Carnosine (dipeptide) 1-32
1-Methylhistidine 18-887
β-Alanine <= 18

Oxidative Stress Markers

Oxidative Stress Markers

Reference Range

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

Lipid Peroxides (urine)		13.8	<=10.0 micromol/g Creat.
8-OHdG (urine)		6	<=15 mcg/g Creat.

Vitamin D (Serum)

Inside Range

Reference Range

Methodology: Chemiluminescent

25 - Hydroxyvitamin D ♦	55	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. Treatment is at the discretion of the treating clinician.

Holick MF, et al. *J Clin Endocrinol Metab.* 2011;96(7):1911-1930.

Vitamin D Council: <https://www.vitamindcouncil.org/>

Lab Comments

Please note the reference range for 25-Hydroxyvitamin D has been updated.

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.

Metabolic Analysis 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.

All these markers are within their reference ranges; there are no abnormalities.

Amino Acid Commentary

<dl = Unable to calculate results due to less than detectable levels of analyte.

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.

All of the measured levels of amino acids and associated analytes are within normal limits. There is no indication of impaired amino acid metabolism. Renal clearance is normal per a normal 24-hour creatinine level.

Anserine, a dietary peptide, is measured to be lower than the reference range. Anserine comes from certain fish and fowl protein. It is typically low or absent for individuals who eat low protein diets or who follow vegetarian or vegan diets. There is no clinical significance for low anserine.

Phosphoethanolamine is measured to be low. Like ethanolamine, phosphoethanolamine is an intermediate in the serine-to-choline metabolism sequence. It is a precursor of phosphatidylcholine, choline and the neurotransmitter, acetylcholine. Formation of phosphoethanolamine from ethanolamine requires phosphorylation, a magnesium-dependent process. The most common reasons for insufficient phosphoethanolamine are magnesium deficiency or dysfunction, ethanolamine deficiency and serine deficiency. Low phosphoethanolamine is significant if cholinergic functions are limited.

Oxidative Stress 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.

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.

Sufficient levels:

Vitamin D is a hormone produced in the skin during exposure to sunlight or consumed in the diet, and converted to its active form, calcitriol, in the liver and kidneys. Vitamin D helps regulate serum calcium and phosphorus levels by increasing intestinal absorption of calcium and stimulating tubular reabsorption of calcium. Vitamin D also affects numerous other functions in the body.

Recommended levels are protective against osteoporosis as well as infection, autoimmune disease, hypertension, arteriosclerosis, diabetes and insulin resistance, musculoskeletal pain, epilepsy, and migraine.