OPTION 1:

SPECTRACELL

MICRONUTRIENTS VIA BLOOD

MICRO.NUTRIENT

Driven *by Science*. Inspired *by You*.

Patient:

Accession ID:

Provider: Maximus Paul, ND

Order Status: Complete

6030 North Course Drive, Houston, TX 77072
1(800) 227-5227 I support@spectracell.com I www.spectracell.com

SpectraCell Laboratories
Science + Health + Solutions

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PATIENT

NAME

AGE

DOB

GENDER
Male

PATIENT ID

SPECIMEN

ACCESSION ID

DATE COLLECTED

ORDER ID
1161-00074347060-200716

DATE RECEIVED

DATE REPORTED

PROVIDER

ACCOUNT ID
74347060

CLIENT NAME
Maximus Paul, ND

ADDRESS

Welcome to your Micronutrient Profile,

Your body is unique and your story is too. Virtually all metabolic and developmental processes that take place in the body require micronutrients and strong evidence suggests that subtle vitamin, mineral, and antioxidant deficiencies can contribute to degenerative processes. These cellular deficiencies may suggest the underlying cause of a myriad of unwanted symptoms and, if corrected, can optimize physical and mental health performance.

The SpectraCell Advantage

Superior insights, earlier interventions, customized treament plans.

Functional

We measure the functional level and capability of nutrients present within your white blood cells, where metabolism takes place and where micronutrients do their job.

Long-term

This test measures intracellular micronutrient function over a period of 4-6 months, extending beyond static serum measurements.

Proprietary

Only SpectraCell offers the patented Spectrox® (reflects antioxidant capacity) and Immunidex (an overall measure of immune function).

What we measure:

We have measured the functional levels of 31 micronutrients, from vitamins and minerals to fatty acids and metabolites, as well as an overall measurement of antioxidant capacity and immune function to provide you with a powerful tool for optimal health, performance, and insight into any health condition. We provide your unique nutrient status in the following areas:

VITAMINS & MINERALS
Discover your body's unique vitamin and mineral requirements and the disparities that exist within your makeup.

AMINO ACIDS
Learn how well your amino acids, the building block of protein, are functioning within your cells.

ENERGY, FAT AND METABOLISM
Know how well your body is metabolizing micronutrients for energy production.

ANTIOXIDANT STATUS & IMMUNE FUNCTION
Understand your body's ability to manage oxidative stress and your immune response to infections and disease.

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PATIENT | PROVIDER: **Maximus Paul, ND** | DATE REPORTED | ACCESSION ID:

Results At-A-Glance

Functional Deficiencies

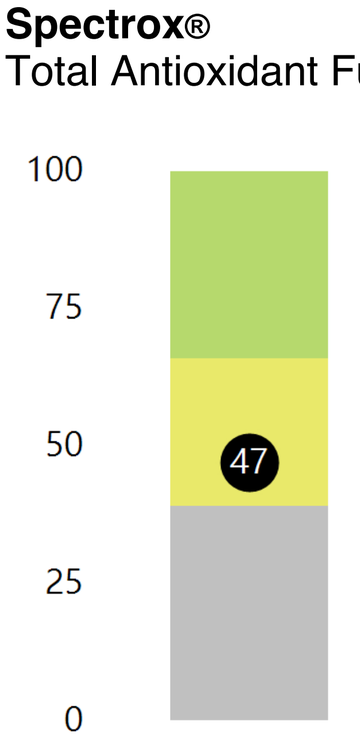
Abnormal	Suggested Supplementation *	Provider Comments
Asparagine	500 mg t.i.d. (1500 mg daily) Take 30 minutes prior to protein intake	
Magnesium	150 mg b.i.d. (300 mg daily) as aspartate, citrate, lysinate, glycinate, or malate	
Oleic Acid	Deficiency suggests impaired synthesis of long chain fatty acids. Take 2-3 tbsp olive oil + 1.8g daily of EPA + DHA	
Selenium	200 mcg daliy of selenium glycinate or selenomethionine for 3 months and then reduce to 100 mcg daily	

* The RDA (Recommended Daily Allowance) was first published in 1968 primarily for use in nutritional labeling of packaged foods. The DRI (Dietary Reference Intake), published in 1997, serves as replacements for the former RDA, although the actual values are generally within an order of magnitude, and are also primarily for use in nutritional labeling and fortification of packaged foods. In most cases, neither the RDA nor the DRI will be adequate to replete a nutrient in people who demonstrate a functional cellular deficiency of said nutrient. An evidence based approach was used to develop clinically relevant repletion recommendations, consisting of data from published studies and clinician expertise. However, the information presented is not intended nor implied to be a substitute for professional medical advice, diagnosis or treatment.

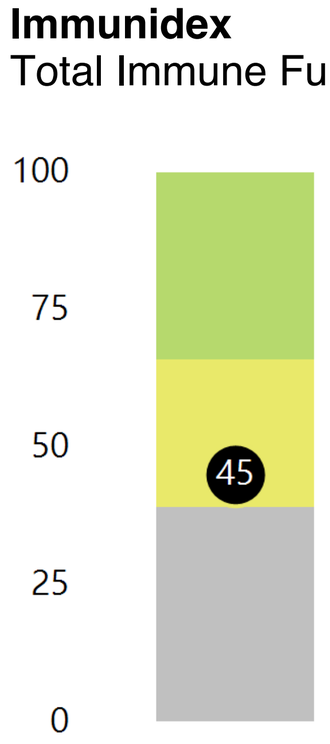
Borderline Deficiencies

Borderline	Provider Comments
Carnitine	
Folate	
Pantothenate	
Vitamin B2	
Vitamin K2	
Zinc	

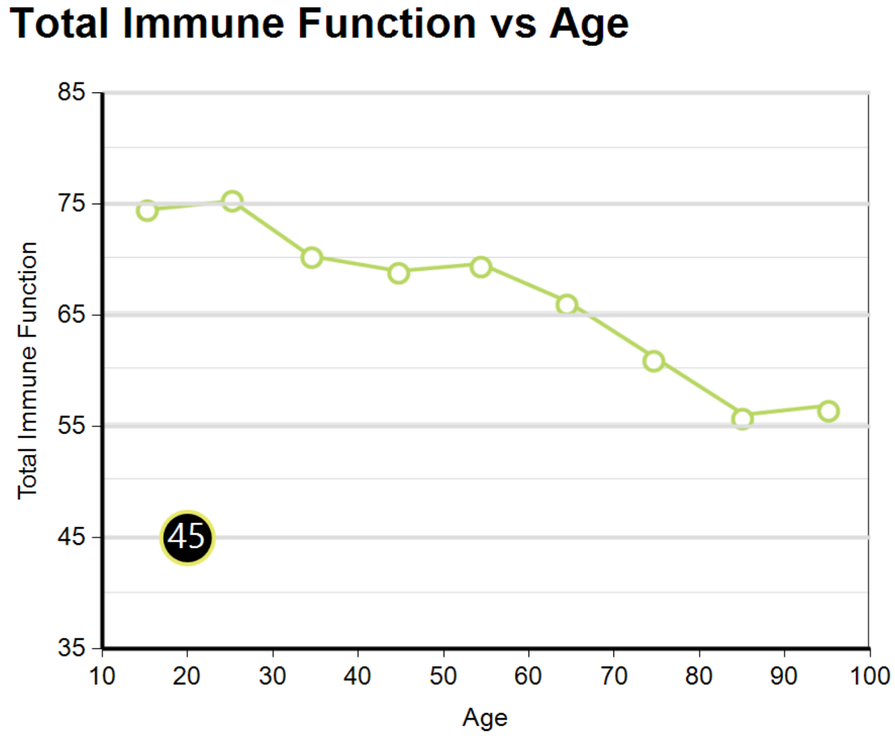
Spectrox®
Total Antioxidant Function



Immunidex
Total Immune Function



Total Immune Function vs Age



Deficient
Values in this range indicate a poor growth response. Cell function is compromised and likely requires nutrient repletion.

Average
Values in this range indicate an average growth response. Cell function is not yet optimal and may require nutrient repletion.

Strong
Values in the range indicate a stronger than average growth response. Cells are functioning well.

Spectrox®

Total Antioxidant Function is a measurement of overall antioxidant function. The patient's cells are oxidatively challenged and the cells' ability to resist damage is determined.

Immunidex

Total Immune Function is an indication of how well a person's T-lymphocytes are functioning by measuring their response to mitogen stimulation (ability to grow). Since lymphocyte function is widely considered a systemic measure of general health, a healthy (stronger) response is desired. A less-than-optimal response may improve with nutrient repletion.

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PATIENT: PROVIDER: **Maximus Paul, ND** DATE REPORTED: ACCESSION ID:

Micronutrients	Patient Results	Reference Range	Patient Result	Interpretation
B-VITAMINS				
Vitamin B1		>78%	84	
Vitamin B2		>53%	58	Borderline
Vitamin B3		>80%	87	
Vitamin B6		>54%	75	
Vitamin B12		>14%	26	
Folate		>32%	37	Borderline
Pantothenate		>7%	10	Borderline
Biotin		>34%	47	
AMINO ACIDS AND METABOLITES				
Serine		>30%	37	
Glutamine		>37%	44	
Asparagine		>39%	36	Deficient
Choline		>20%	31	
Inositol		>58%	72	
Carnitine		>46%	49	Borderline
Oleic Acid		>65%	61	Deficient
OTHER VITAMINS & MINERALS				
Vitamin D3		>50%	71	
Vitamin A		>70%	80	
Vitamin K2		>30%	34	Borderline
Manganese		>50%	67	
Calcium		>38%	47	
Zinc		>37%	42	Borderline
Copper		>42%	53	
Magnesium		>37%	37	Deficient
CARBOHYDRATE METABOLISM				
Fructose Sensitivity		>34%	46	
Glucose-Insulin Interaction		>38	51	
Chromium		>40%	54	
ANTIOXIDANTS				
Glutathione		>42%	49	
Cysteine		>41%	48	
Coenzyme Q10		>86%	97	
Selenium		>74%	73	Deficient
Vitamin E		>84%	88	
Alpha Lipoic Acid		>81%	93	
Vitamin C		>40%	73	

The reference ranges listed in the above table are valid for male and female patients 12 years of age or older.

Deficient
Values in this area represent a deficiency and may require nutrient repletion or dietary changes

Borderline
Values in this area represent a borderline deficiency and may indicate a need for nutrient repletion or dietary changes

Normal
Values in this area represent a normal result

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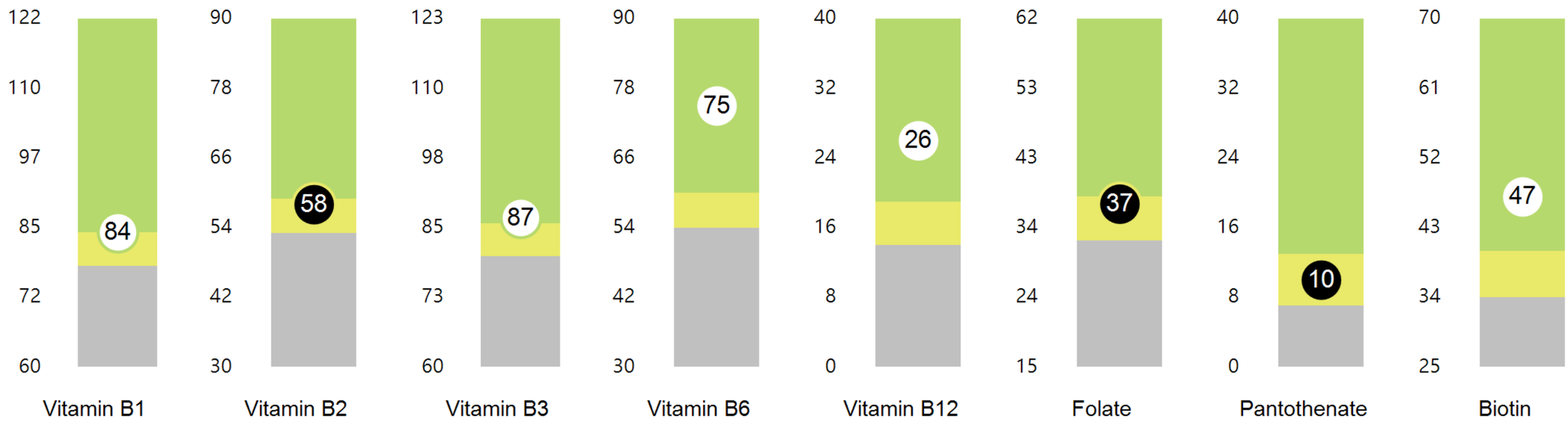
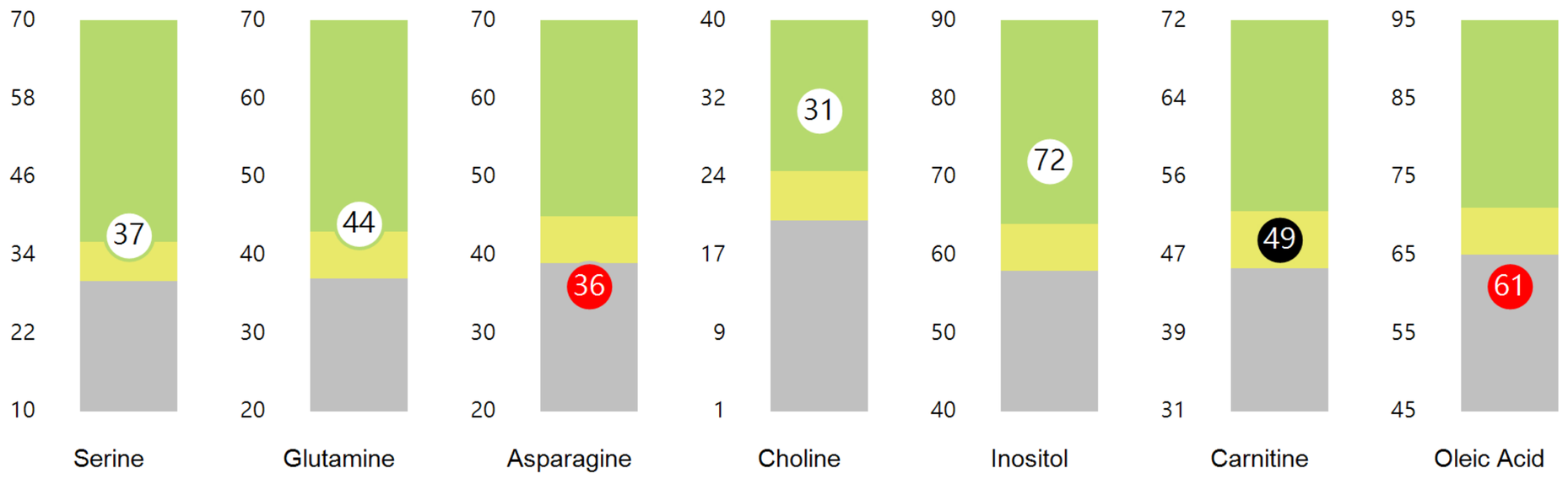
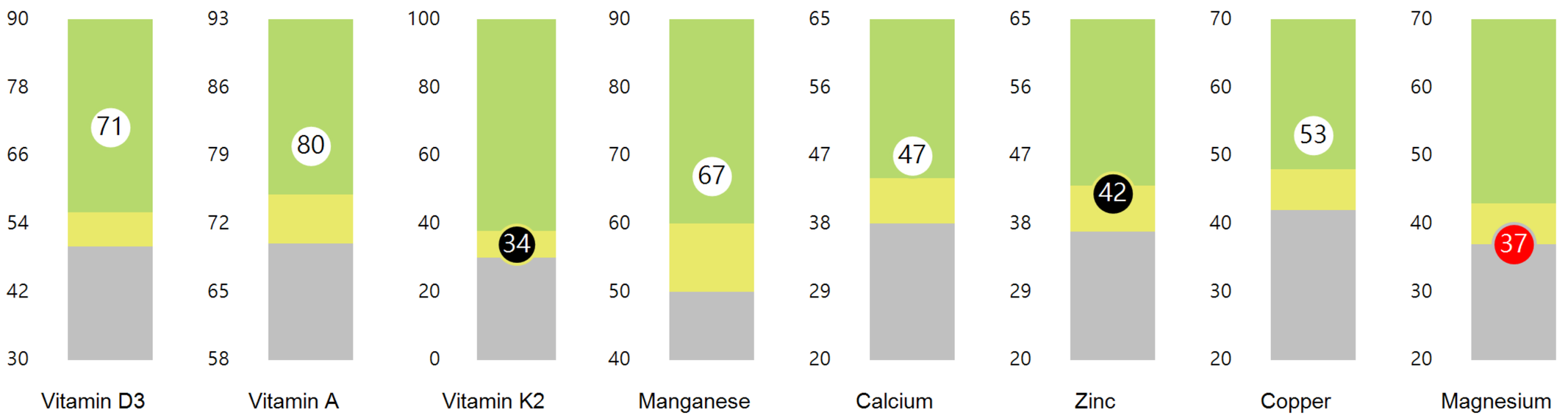
B-Complex Vitamins



Amino Acids & Metabolites



Other Vitamins & Minerals



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Borderline
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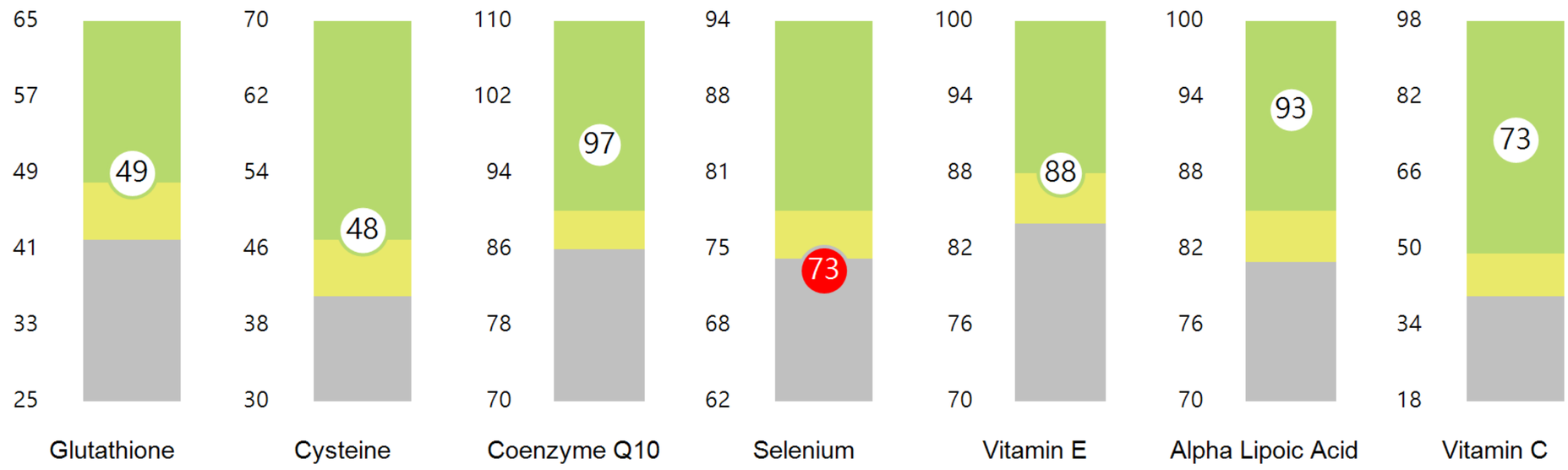
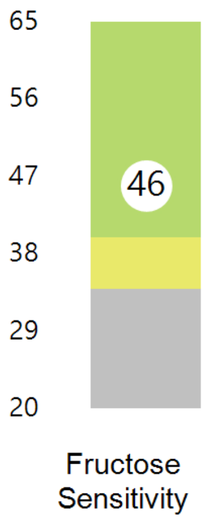
Normal
Values in this area represent a normal result

Individual Antioxidants

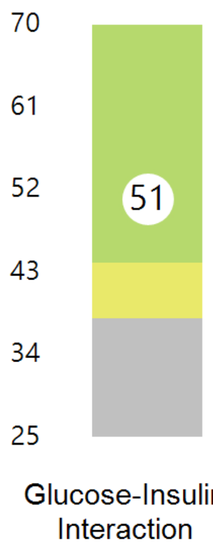


Carbohydrate Metabolism



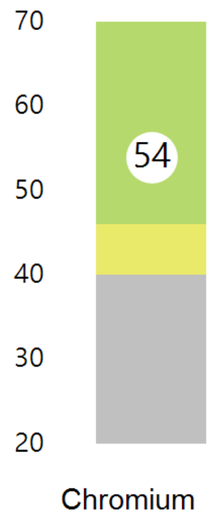
Fructose Sensitivity

This assay measures changes in the patient's lymphocyte growth response to a fructose challenge. Significant reduction in cell growth capacity is indicative of poor ability to metabolize fructose. This can be due to nutritional deficiencies of necessary cofactors in the fructose metabolizing pathway (e.g. copper, zinc) or may be due to genetic factors.



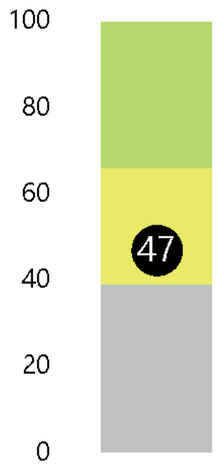
Glucose-Insulin Interaction

The patient's cells are challenged with glucose and their ability to grow in the presence or absence of insulin is determined. A significant decrease of cell growth is indicative of reduced ability to metabolize glucose.



Spectrox® - Total Antioxidant Function

Total Antioxidant Function is a measurement of overall antioxidant function. The patient's cells are oxidatively challenged and the cells' ability to resist damage is determined.



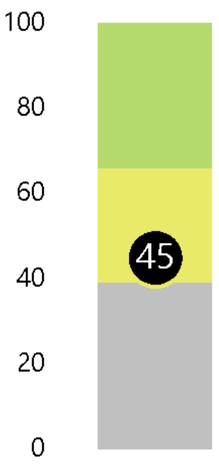
Total Antioxidant Function value above 65%
indicates a desirable status. Since antioxidants are protective nutrients, higher antioxidant function is desirable because it increase cells' ability to resist oxidative stress.

Total Antioxidant Function value between 40%-65%
indicates an average ability to resist oxidative stress.

Total Antioxidant Function value below 40%
indicates poor antioxidant function resulting in reduced ability to resist oxidative stress.

Immunidex - Total Immune Function

Total Immune Function is an indication of how well a person's T-lymphocytes are functioning by measuring their response to mitogen stimulation (ability to grow). Since lymphocyte function is widely considered a systemic measure of general health, a healthy (stronger) response is desired. A less-than-optimal response may improve with nutrient repletion.



Total Immune Function value above 65%
indicates a strong (healthy) cell-mediated immune response.

Total Immune Function value between 40% and 65%
indicates an average response.

Total Immune Function value below 40%
may indicate a weakened cell-mediated immune response.

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Overview of Test Methodology

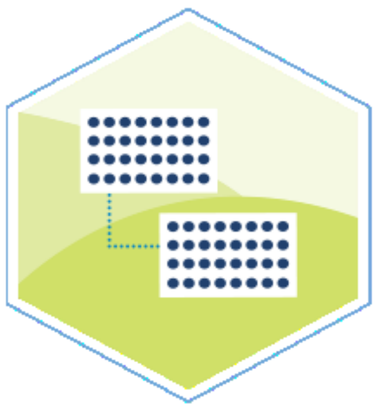
Cellular Function = Performance, Not Just Potential

Lymphocyte Proliferation Assay

1 ISOLATION
Lymphocytes are purified, washed, counted, and plated.

INCUBATION
Cells are incubated for 5 days in a defined culture medium containing optimal levels of all essential nutrients necessary to sustain their growth.

2



3 LABELING
The mitogen stimulated cells' growth are measured by the incorporation of radioactive thymidine.

HARVEST & COUNTING
Cells are harvested onto filter paper and counted.

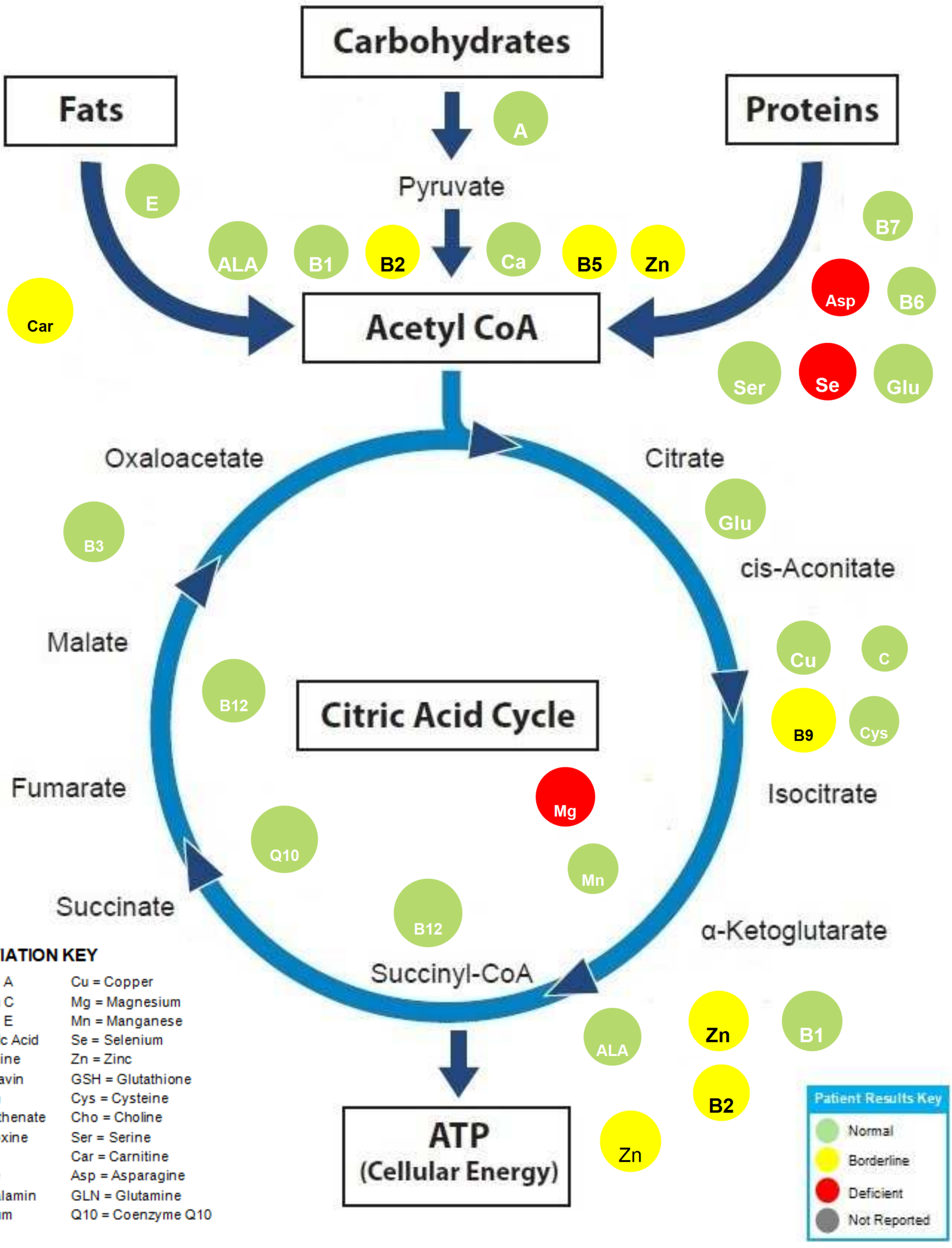
4

5 DATA PROCESSING
Data is reviewed, approved, and released to reporting.

Routine turnaround time for the Micronutrient assay is 10-14 business days.

Krebs Cycle

Energy Production



ABBREVIATION KEY

A = Vitamin A	Cu = Copper
C = Vitamin C	Mg = Magnesium
E = Vitamin E	Mn = Manganese
ALA = Lipoic Acid	Se = Selenium
B1 = Thiamine	Zn = Zinc
B2 = Riboflavin	GSH = Glutathione
B3 = Niacin	Cys = Cysteine
B5 = Pantothenate	Cho = Choline
B6 = Pyridoxine	Ser = Serine
B7 = Biotin	Car = Carnitine
B9 = Folate	Asp = Asparagine
B12 = Cobalamin	GLN = Glutamine
Ca = Calcium	Q10 = Coenzyme Q10

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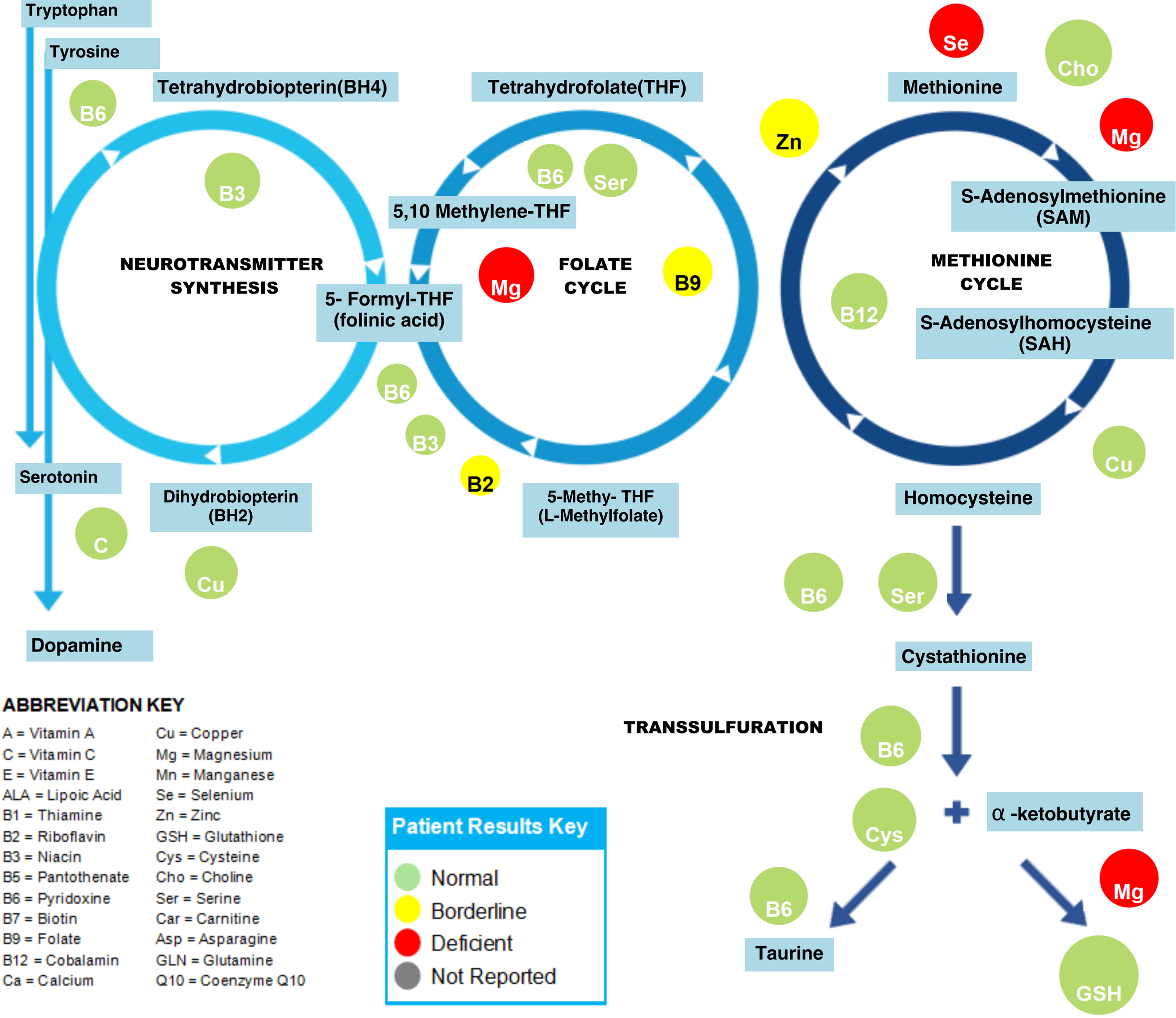
Methylation Cycle

Detoxification, Cellular Adaptability, Gene Regulation



ABBREVIATION KEY

A = Vitamin A	Cu = Copper
C = Vitamin C	Mg = Magnesium
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ALA = Lipoic Acid	Se = Selenium
B1 = Thiamine	Zn = Zinc
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B3 = Niacin	Cys = Cysteine
B5 = Pantothenate	Cho = Choline
B6 = Pyridoxine	Ser = Serine
B7 = Biotin	Car = Carnitine
B9 = Folate	Asp = Asparagine
B12 = Cobalamin	GLN = Glutamine
Ca = Calcium	Q10 = Coenzyme Q10

Patient Results Key

- Normal
- Borderline
- Deficient
- Not Reported

Supplemental Information

Cellular Function = Performance, Not Just Potential

Asparagine

PHYSIOLOGICAL FUNCTION

Asparagine is an amino acid synthesized from aspartate and glutamine. Asparagine has three major functions: 1) incorporation into amino acid sequences of proteins; 2) storage form for aspartate (is a required precursor for synthesis of DNA, RNA, and ATP); and 3) source of amino groups for production of other dispensable amino acids via transaminases. Asparagine in proteins is an attachment site for carbohydrates (N-linked oligosaccharides) to form collagen assembly, enzymes, and cell-cell recognition. Asparagine can be readily converted into aspartate, providing aspartate on demand for many cellular functions. Aspartate can increase cellular energy production by contributing carbon skeletons to the Citric Acid Cycle. Aspartate is also a component of the urea cycle, which removes excess ammonia. The conversion of asparagine to aspartate involves transfer of the extra amino group from asparagine to another keto acid, forming a dispensable amino acid. In this way, asparagine can be a precursor for many amino acids to be produced on demand to meet cell requirements.

DEFICIENCY SYMPTOMS

Data from testing over 10,000 physician office patients has found that 22.8%% have deficient asparagine function, as indicated by increased lymphocyte growth response after addition of asparagine to the lymphocyte growth media. Significantly increased prevalence of asparagine deficiencies has been detected in two clinical manifestations: 1) fatigue; and 2) immune system stress. For example, in 75 subjects with rheumatoid arthritis, 32.0% exhibited an asparagine deficiency. There are no published deficiency symptoms for asparagine in the medical literature, partly due to previous lack of adequate assessment tests. Therefore, tentative associates of asparagine deficiencies with clinical complaints of fatigue, and clinical findings of immune dysfunction (autoimmune disorders, sever allergies, infections) have been identified by the Functional Intracellular Analysis test for asparagine.

FOOD SOURCES

Although quantitative data is limited, asparagine (an amino acid) is found in many high protein animal foods. It is also found in asparagus, nuts and legumes.

REPLETION INFORMATION

Asparagine supplementation appears safe in modest doses (up to 6 grams daily).

Supplemental Information

Cellular Function = Performance, Not Just Potential

Magnesium

PHYSIOLOGICAL FUNCTION

Magnesium is predominantly found intracellularly, where it is vital for proper cell functions. Magnesium is the second most prevalent intracellular cation (after potassium). Magnesium functions are numerous and essential, including enzyme activation (over 300 types), neuromuscular activity, membrane transport and interactions, energy metabolism (carbohydrates, fats, proteins), and roles in calcium and phosphorus metabolism.

DEFICIENCY SYMPTOMS

Deficiency symptoms are both acute (Trouseau and Chvostek signs, muscle spasms, tetany, cardiac arrythmias, ataxia, vertigo, convulsions, organic brain syndrome) and chronic (thrombophlebitis, hemolytic anemia, bone loss, depressed immune function, poor wound healing, hyperirritability, burxism, hyperlipidemia, fatigue, hypertension).

Those at risk for Magnesium deficiency include: malabsorption, malnourished, alcoholics, diabetics, diuretic therapy, children, elderly, pregnant and lactating women, postmenopausal women with osteoporosis, athletes, digitalis therapy, long-term therapy with antibiotics, chemotherapeutic and immunosuppressive medications. In addition, the following diseases are associated with Magnesium deficiency: cardiovascular disease, cirrhosis, renal disease, parathyroid diseases, thyroid conditions.

FOOD SOURCES

Food	Serving	(mg)
Oat bran	1/2 cup	96
Brown rice	1 cup	86
Mackerel	3 oz.	82
Spinach, cooked	1/2 cup	78
Almonds	1 oz.	77
Swiss chard, cooked	1/2 cup	75

Food	Serving	(mg)
Lima beans	1/2 cup	63
Edamame	1/2 cup	50
Blackstrap molasses	1 tbsp	48
Potato, with skin	1 baked	43
Black eyed peas	1/2 cup	42
Banana	1 whole	34

REPLETION INFORMATION

Large oral intakes of Magnesium (400-1000 mg daily), when spread throughout the day, are not considered harmful, except for some persons with impaired renal function. Higher doses have been used as laxatives and antacids. Excessive Magnesium intake may cause diarrhea, nausea, vomiting, hypotension, bradycardia, and CNS depression. Continued excessive intakes of Magnesium may imbalance calcium and phosphorous metabolism.

Supplemental Information

Cellular Function = Performance, Not Just Potential

Oleic Acid

PHYSIOLOGICAL FUNCTION

Oleic acid is the most common monounsaturated fatty acid in human cells. Oleic acid is incorporated into cell membrane phospholipids, where it is important for important for proper membrane fluidity. Hormone responsiveness, infectivity of pathogens, mineral transport, and immune competence are affected by membrane fluidity.

Oleic acid is a major energy source for cells. Oleic acid is catabolized to acetyl groups used for energy (ATP) production and biosynthesis of many essential metabolites.

Oleic acid is obtained by cells from endogenous biosynthesis or from serum triglycerides. Biosynthesis of fatty acids (like oleic acid) utilizes the same enzymes responsible for elongation of other fatty acids which are precursors for eicosanoids (prostaglandins). Thus, deficient oleic acid status may also indicate deficient eicosanoid production, signifying a need for essential fatty acids.

DEFICIENCY SYMPTOMS

No deficiency symptoms are clearly defined for oleic acid since a dietary intake is not absolutely essential. Monounsaturated fat intake may be beneficial for reducing high blood cholesterol levels. A need for oleic acid may possibly reflect a need for essential fatty acids (linoleic acid, linolenic acid), or omega-3 fatty acids (alpha linolenic acid, EPA, and DHA).

FOOD SOURCES*

Source	**Oleic acid composition
High oleic safflower oil	84%
Peanut oil	71%
Avocado oil	70%
Almond oil	67%

Source	Oleic acid composition
Olive oil	66%
Canola oil	63%
Rice bran oil	43%
Sesame oil	42%

*The corresponding foods to the oils listed above (e.g. olives, avocados, almonds) are also good sources oleic acid.
** Despite the high content of oleic acid in listed oils, some also ocntain high levels of polysaturated fatty acids which may become pro-inflammatory due to oxidation that occurs during processing and/or cooking.

REPLETION INFORMATION

Although some margarines and shortenings are high in monounsaturated fats, a considerable amount is in the form of trans-monosaturated isomers (elaidic acid). Reductions in these foods are recommended to improve oleic acid status. No overt toxicity for fats rich in oleic acid is known, except for a laxative effect when consumed in large amounts (>50-100 grams per serving). Daily doses of 1-2 tablespoons of oleic-rich oils (olive, canola, avocado) are usually adequate to add significant dietary amounts of oleic acid. Although flaxseed oil (edible linseed oil) contains little oleic acid, it is an excellent source of the essential fatty acids, linoleic acid and linolenic (omega-3) acid. Daily doses of 1-2 tablespoons per day will provide sufficient essential fatty acids to prevent essential fatty acid deficiencies.

Supplemental Information

Cellular Function = Performance, Not Just Potential

Selenium

PHYSIOLOGICAL FUNCTION

The trace mineral selenium functions primarily as a component of the antioxidant enzyme, glutathione peroxidase. Glutathione peroxidase activity, which requires selenium for activity, facilitates the recycling of vitamins C and E, in optimizing the performance of the antioxidant system. Low levels of selenium have been linked to a higher risk for cancer, cardiovascular disease, inflammatory diseases, and other conditions associated with free radical damage, including aging and cataract formation. Selenium is also essential for healthy cell-mediated immune function, stimulating immune prope1iies of lymphocytes. Selenium is also needed for the activation of thyroid hormones.

DEFICIENCY SYMPTOMS

Chronic low selenium intake is associated with an increased risk for heart disease, cancer and depressed immune function. Selenium appears to provide protection against heart disease and stroke. Selenium supplementation (100 mcg/day) increases the ratio ofHDL to LDL and inhibits platelet aggregation.

Selenium and glutathione peroxidase activity are low in patients with rheumatoid arthritis, eczema, psoriasis and most inflammatory conditions. This is related to the increased synthesis of proinflammatory prostaglandins and leukotrienes. Immune system function is enhanced by selenium, by contributing to higher natural killer cell (NKC) activity. Natural killer cells have the ability to destroy cancer cells and bacterial and viral agents. Heavy metal toxicity symptoms may be alleviated by selenium, acting as an antagonist. Selenium deficiency may also contribute to male infertility.

FOOD SOURCES

Food	Serving	(μg)
Brazil nuts	1 oz.	839
Tuna	3 oz.	92
Oysters	3 oz.	65
Clams	3 oz.	54
Halibut	3 oz.	47
Shrimp	3 oz.	42

Food	Serving	(μg)
Salmon	3 oz.	40
Crab	3 oz.	38
Brown rice	1 cup	19
Sunflower seeds	1/4 cup	18
Beef	3 oz.	17
Walnuts	1 oz.	5

Some plants including garlic, Brazil nuts and plants in the Brassica family (cruciferous vegetables such as cabbage and broccoli) tend to accumulate selenium if they are grown in selenium-rich soil, making them a potentially rich plant-based source of this mineral.

REPLETION INFORMATION

Selenium is safe at the level generally used for supplementation (100-200 mcg/day). However, taking more than 750 mcg of selenium per day may cause toxicity Reactions such as loss of fingernails, skin rash, and neurological aberrations. In the presence of iodine deficiency goiter, selenium supplementation has been reported to exacerbate low thyroid function.

Selenium is available in several different forms. Studies indicate that inorganic salts like sodium selenite are less effectively absorbed and not as biologically active as organic forms of selenium, such as selenomethionine or high-selenium content yeast.

OPTION 2:

METABOLOMIX

MICRONUTRIENTS, FATTY ACIDS,
AND HEAVY METALS VIA URINE

GENOVA DIAGNOSTICS
63 Zillicoa Street
Asheville, NC 28801

Metabolomix+

3200 Metabolomix+ - FMV Urine

Results Overview

Functional Imbalance Scores

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

Need for Antioxidant Support

Oxidative Stress

5

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

Need for Mitochondrial Support

Mitochondrial Dysfunction

0

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

Need for Inflammation Support

Omega Imbalance

8

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

Need for Reduced Exposure

Toxic Exposure

7

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

Need for Methylation Support

Methylation Imbalance

7

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

Nutrient Need Overview

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

Amino Acids (mg/day)

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

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

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

Interpretation At-A-Glance

Antioxidant Needs

Vitamin A

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

Vitamin C

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

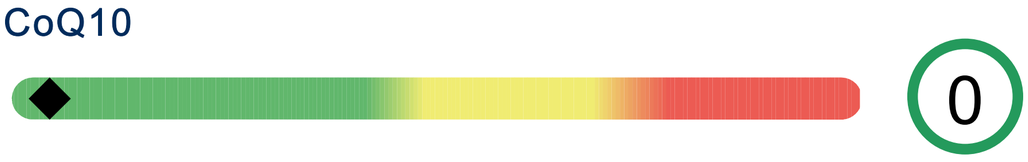
Vitamin E / Tocopherols

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

α-Lipoic Acid

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

CoQ10

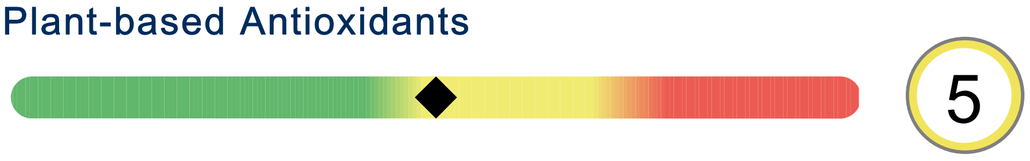


- CoQ10 is a powerful antioxidant that is synthesized in the body and contained in cell membranes. CoQ10 is also essential for energy production & pH regulation.
- CoQ10 deficiency may occur with HMG-CoA reductase inhibitors (statins), several anti-diabetic medication classes (biguanides, sulfonylureas)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

Glutathione

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

Plant-based Antioxidants



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

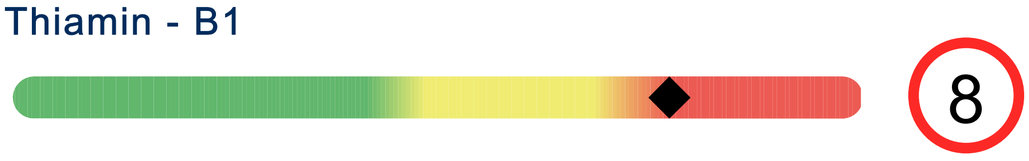
KEY

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

Interpretation At-A-Glance

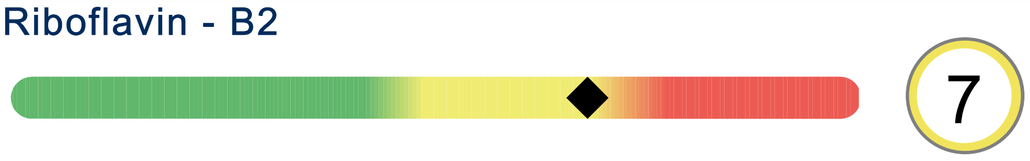
B-Vitamin Needs

Thiamin - B1



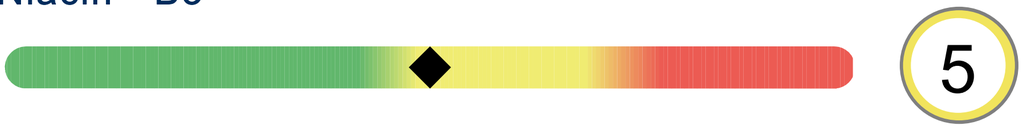
- B1 is a required cofactor for enzymes involved in energy production from food, and for the synthesis of ATP, GTP, DNA, RNA and NADPH.
- Low B1 can result from chronic alcoholism, diuretics, digoxin, oral contraceptives and HRT, or large amounts of tea & coffee (contain anti-B1 factors).
- B1 deficiency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

Riboflavin - B2



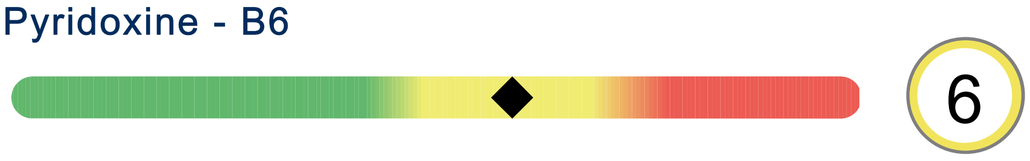
- B2 is a key component of enzymes involved in antioxidant function, energy production, detoxification, methionine metabolism and vitamin activation.
- Low B2 may result from chronic alcoholism, some anti-psychotic medications, oral contraceptives, tricyclic antidepressants, quinacrine or adriamycin.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

Niacin - B3



- B3 is used to form NAD and NADP, involved in energy production from food, fatty acid & cholesterol synthesis, cell signaling, DNA repair & cell differentiation.
- Low B3 may result from 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

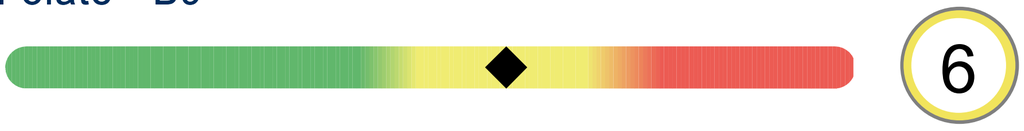


- B6 (as P5P) is a cofactor for enzymes involved in glycogenolysis & gluconeogenesis, and synthesis of neurotransmitters, heme, B3, RBCs and nucleic acids.
- Low B6 may result from chronic alcoholism, long-term diuretics, estrogens (oral contraceptives and HRT), anti-TB meds, penicillamine, L-DOPA or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

Folate - B9



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

Cobalamin - B12

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

KEY

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

Interpretation At-A-Glance

Mineral Needs

Magnesium

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

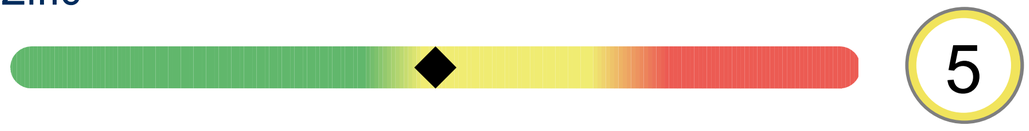
Manganese

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

Molybdenum

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

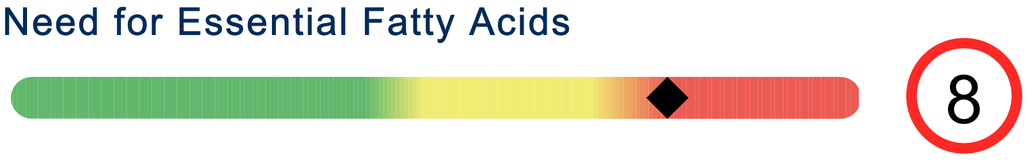
Zinc



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

Essential Fatty Acid Needs

Need for Essential Fatty Acids



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

KEY

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Interpretation At-A-Glance

Microbiome & Digestive Support

Need for Probiotics

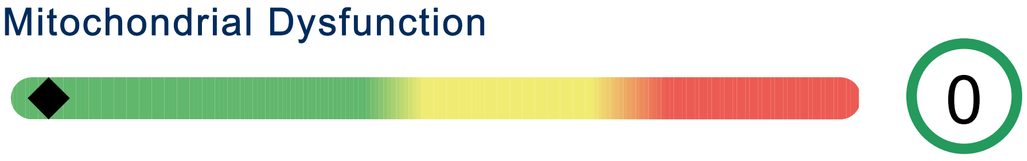
- Probiotics have many functions. These include: production of some B vitamins and vitamin K; enhance digestion & absorption; decrease severity of diarrheal illness; modulate of immune function & intestinal permeability.
- Alterations of gastrointestinal microflora may result from C-section delivery,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

Need for Pancreatic Enzymes

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

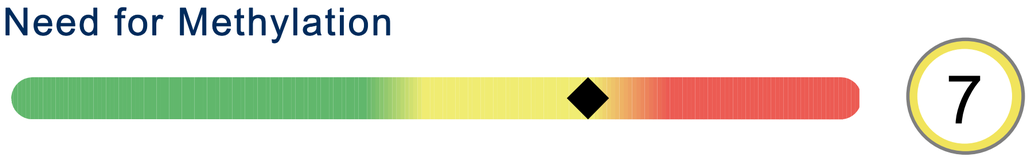
Functional Imbalances

Mitochondrial Dysfunction



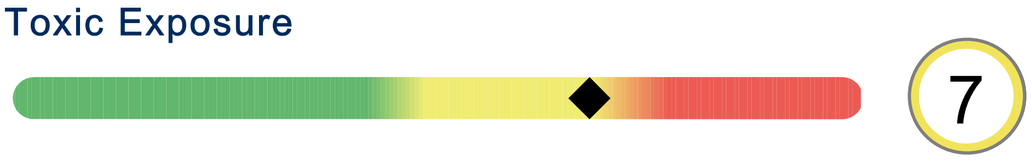
- Mitochondria are a primary site of generation of reactive oxygen species. Oxidative damage is considered an important factor in decline of physiologic function that occurs with aging and stress.
- Mitochondrial defects have been identified in cardiovascular disease, fatigue syndromes, neurologic disorders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

Need for Methylation



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

Toxic Exposure

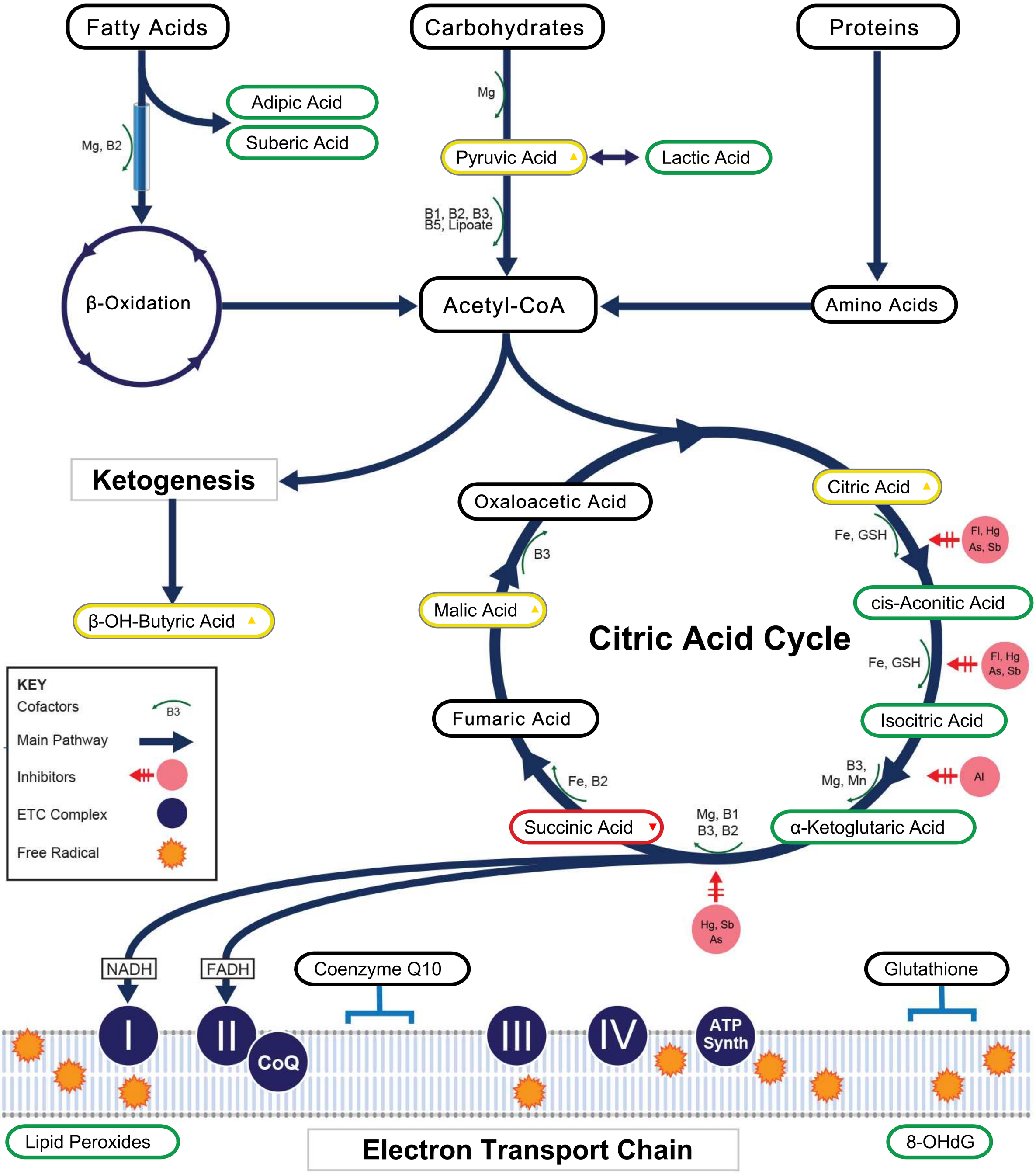


- Methyl tert-Butyl Ether (MTBE) is a common gasoline additive used to increase octane ratings, and has been found to contaminate ground water supplies where gasoline is stored. Inhalation of MTBE may cause nose and throat irritation, as well as headaches, nausea, dizziness and mental confusion. Animal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

KEY

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

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	3.1	<= 4.2
Phenylacetic Acid	0.16	<= 0.12

Dysbiosis Markers

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

Yeast / Fungal Dysbiosis Markers

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

Cellular Energy & Mitochondrial Markers

Fatty Acid Metabolism

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

Carbohydrate Metabolism

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

Energy Metabolism

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

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

Vitamin Markers

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

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

Methylation Markers (Folate, B12)

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

Biotin Markers

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

Neurotransmitter Metabolites

Kynurenine Markers (Vitamin B6)

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

Catecholamine Markers

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

Serotonin Markers

5-OH-indoleacetic Acid	11.2	3.8-12.1

Toxin & Detoxification Markers

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

Organic Acid 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	23.7	3.5-16.4
Glycolic Acid	59	<= 67
Oxalic Acid	66	<= 78

All biomarkers reported in mmol/mol creatinine.

Creatinine Concentration

		Reference Range
Creatinine ◆	1.8	3.1-19.5 mmol/L

Oxidative Stress Markers

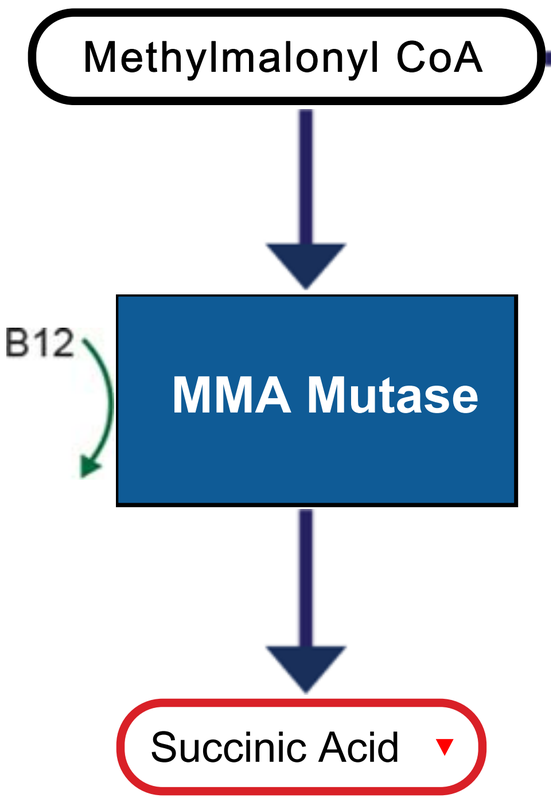
Oxidative Damage

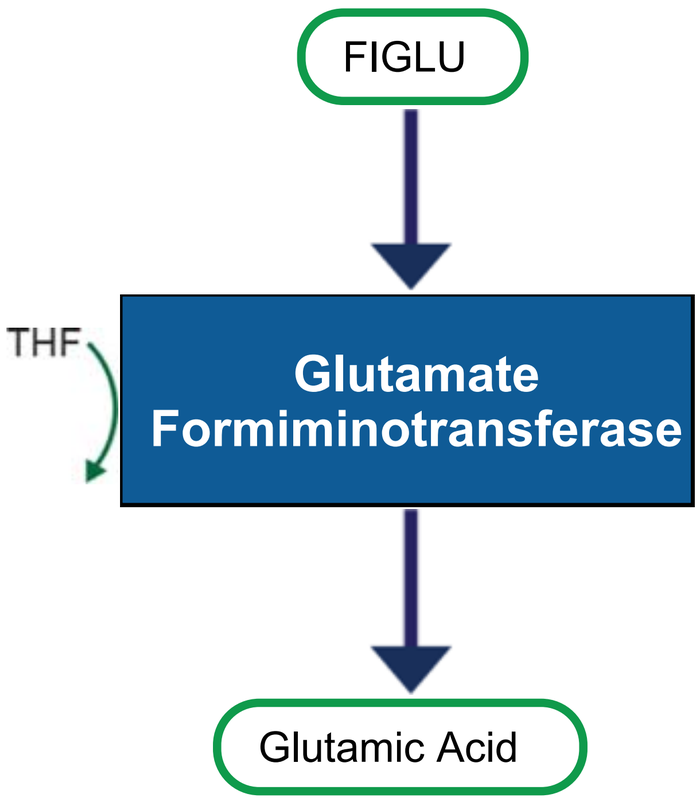
		Reference Range
Lipid Peroxides (urine)	5.9	<= 10.0 micromol/g Creat.
8-OHdG (urine)	<DL	<= 15 mcg/g Creat.

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

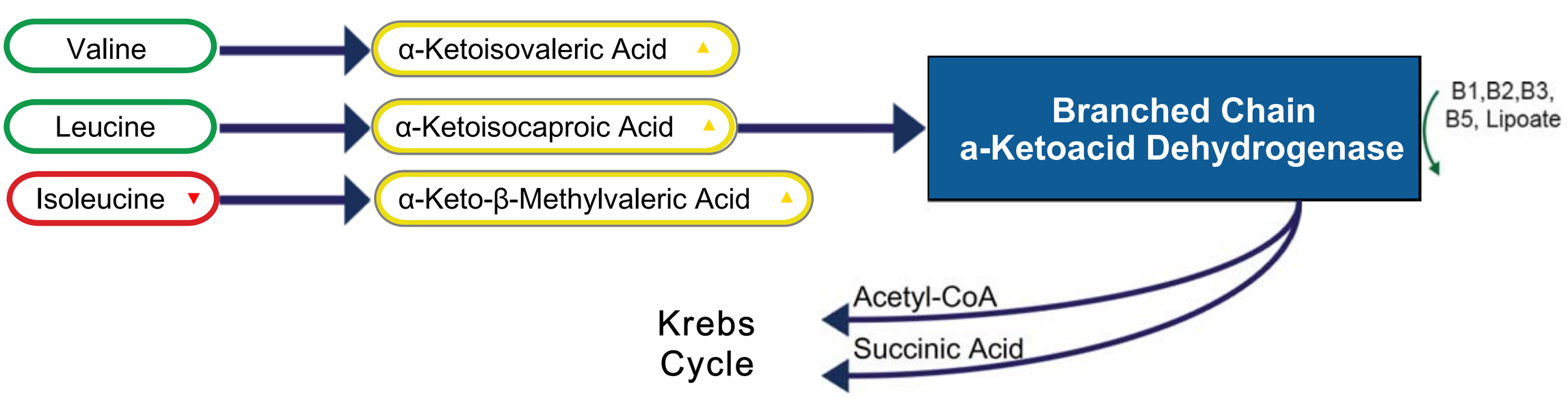
Pathways

Methylation Markers





Branch-Chain Amino Acid Metabolism



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

Amino Acids (FMV)

Nutritionally Essential Amino Acids

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

Nonessential Protein Amino Acids

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

Creatinine Concentration

		Reference Range
Creatinine◆	1.9	3.1-19.5 mmol/L

Intermediary Metabolites

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

Urea Cycle Markers

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

Glycine/Serine Metabolites

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

Dietary Peptide Related Markers

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

Amino Acid reference ranges are age specific.

Methodology: LC/MS/MS, Alkaline Picrate

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

Methodology: GCMS

Essential & Metabolic Fatty Acids Markers (RBCs)

Omega-3 Fatty Acids

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

Omega-9 Fatty Acids

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

Saturated Fatty Acids

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

Omega-6 Fatty Acids

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

Monounsaturated Fatty Acids

Omega-7 Fatty Acids

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

Trans Fats

Analyte		Reference Range
Elaidic 18:1 n9t	0.15	<= 0.59 wt %

Delta-6-Desaturase Activity

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

Cardiovascular Risk

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

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

* The patient results for the Omega 3 Index have been converted to red blood cell equivalence in order to maintain applicability to the literature-based reference ranges for this marker.

Fatty Acid Metabolism

Omega-3 Metabolism

Enzyme

Omega-6 Metabolism

α-Linolenic Acid ▼

Delta-6-Desaturase
Important Regulators:
B2, B3, B6, Vitamin C, Insulin, Zn, Mg

Linoleic Acid ▼

Stearidonic Acid

γ-Linolenic Acid ▼

Elongase
Important Regulators:
B3, B5, B6, Biotin, Vitamin C

Eicosatetraenoic Acid

Dihomo-γ-Linolenic Acid ▼

Anti-Inflammatory
Series 1 Prostaglandins

Delta-5-Desaturase
Important Regulators:
B2, B3, B6, Vitamin C, Insulin, Zn, Mg

Eicosapentaenoic Acid

Anti-Inflammatory
Eicosanoids

Arachidonic Acid ▲

Pro-Inflammatory
Eicosanoids

Elongase
Important Regulators:
B3, B5, B6, Biotin, Vitamin C

Docosapentaenoic Acid

Docosatetraenoic Acid ▲

Elongase

Delta-6-Desaturase

Docosahexaenoic Acid

3204 Add - on Comprehensive Urine Elements - FMV Urine

Methodology: ICP-MS and Alkaline Picrate

Elemental Markers

Toxic Elements

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

Nutrient Elements

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

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

Creatinine Concentration

	Reference Range
Urine Creatinine ◆	mmol/L

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.