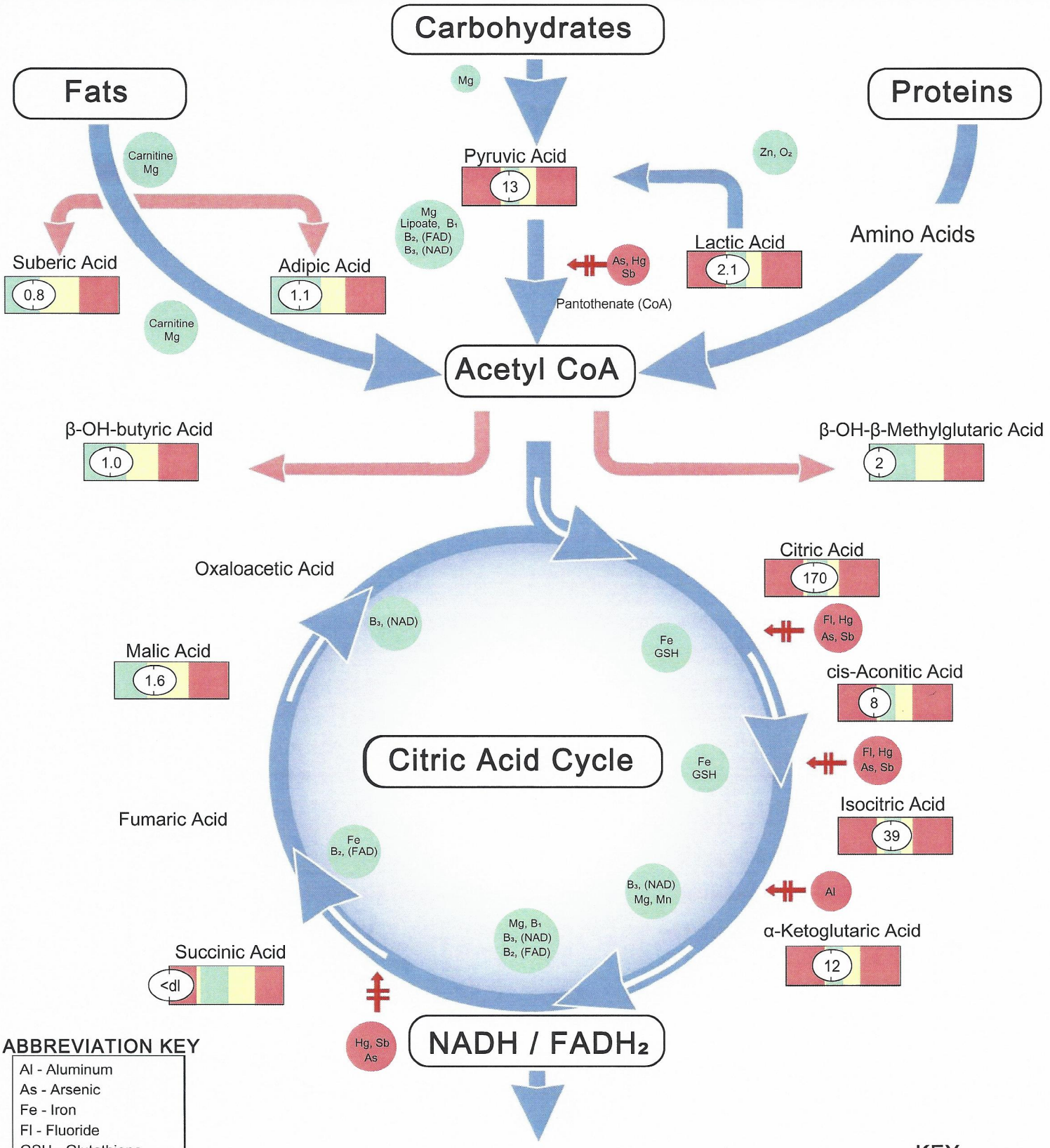
Krebs Cycle At-A-Glance



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

Metabolic Analysis Markers (Urine)

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

Malabsorption and Dysbiosis Markers

Malabsorption Markers

		Reference Range
Indoleacetic Acid (IAA)	0.9	<= 4.2
Phenylacetic Acid (PAA)	0.08	<= 0.12

Bacterial Dysbiosis Markers

		Reference Range
Dihydroxyphenylpropionic Acid (DHPPA)	2.4	<= 5.3
3-Hydroxyphenylacetic Acid	1.6	<= 8.1
4-Hydroxyphenylacetic Acid	6	<= 29
Benzoic Acid	0.08	<= 0.05
Hippuric Acid	<dl	<= 603

Yeast / Fungal Dysbiosis Markers

		Reference Range
Arabinose	39	<= 96
Citramalic Acid	6.4	<= 5.8
Tartaric Acid	<dl	<= 15

Cellular Energy & Mitochondrial Metabolites

Carbohydrate Metabolism

		Reference Range
Lactic Acid	2.1	1.9-19.8
Pyruvic Acid	13	7-32
β-OH-Butyric Acid (BHBA)	1.0	<= 2.8

Energy Metabolism

		Reference Range
Citric Acid	170	40-520
Cis-Aconitic Acid	8	10-36
Isocitric Acid	39	22-65
α-Ketoglutaric Acid (AKG)	12	4-52
Succinic Acid	<dl	0.4-4.6
Malic Acid	1.6	<= 3.0
β-OH-β-Methylglutaric Acid (HMG)	2	<= 15

Fatty Acid Metabolism

		Reference Range
Adipic Acid	1.1	<= 2.8
Suberic Acid	0.8	<= 2.1

Creatinine Concentration

		Reference Range
Creatinine ◆	13.7	3.1-19.5 mmol/L

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

Neurotransmitter Metabolites

		Reference Range
Vanilmandelic Acid	1.5	0.4-3.6
Homovanillic Acid	2.6	1.2-5.3
5-OH-indoleacetic Acid	6.4	3.8-12.1
3-Methyl-4-OH-phenylglycol	0.06	0.02-0.22
Kynurenic Acid	6.6	<= 7.1
Quinolinic Acid	1.5	<= 9.1
Kynurenic / Quinolinic Ratio	4.40	>= 0.44

Vitamin Markers

		Reference Range
α-Ketoadipic Acid	0.8	<= 1.7
α-Ketoisovaleric Acid	0.38	<= 0.97
α-Ketoisocaproic Acid	0.42	<= 0.89
α-Keto-β-Methylvaleric Acid	1.2	<= 2.1
Formiminoglutamic Acid (FIGlu)	1.2	<= 1.5
Glutaric Acid	0.33	<= 0.51
Isovalerylglycine	1.5	<= 3.7
Methylmalonic Acid	0.9	<= 1.9
Xanthurenic Acid	0.40	<= 0.96
3-Hydroxypropionic Acid	8	5-22
3-Hydroxyisovaleric Acid	3	<= 29

Toxin & Detoxification Markers

		Reference Range
α-Ketophenylacetic Acid (from Styrene)	0.19	<= 0.46
α-Hydroxyisobutyric Acid (from MTBE)	2.9	<= 6.7
Orotic Acid	0.42	0.33-1.01
Pyroglutamic Acid	21	16-34

Tyrosine Metabolism

		Reference Range
Homogentisic Acid	10	<= 19
2-Hydroxyphenylacetic Acid	0.35	<= 0.76

Metabolic Analysis Reference Ranges are Age Specific

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.

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-Aminoadipic	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

Essential and Metabolic Fatty Acids Markers (RBCs)

Omega 3 Fatty Acids

Analyte (cold water fish, flax, walnut)		Reference Range
α-Linolenic (ALA) 18:3 n3	0.12	>= 0.09 wt %
Eicosapentaenoic (EPA) 20:5 n3	1.21	>= 0.16 wt %
Docosapentaenoic (DPA) 22:5 n3	2.67	>= 1.14 wt %
Docosahexaenoic (DHA) 22:6 n3	5.8	>= 2.1 wt %
% Omega 3s	9.8	>= 3.8

Omega 9 Fatty Acids

Analyte (olive oil)		Reference Range
Oleic 18:1 n9	12	10-13 wt %
Nervonic 24:1 n9	3.5	2.1-3.5 wt %
% Omega 9s	15.3	13.3-16.6

Saturated Fatty Acids

Analyte (meat, dairy, coconuts, palm oils)		Reference Range
Palmitic C16:0	18	18-23 wt %
Stearic C18:0	17	14-17 wt %
Arachidic C20:0	0.35	0.22-0.35 wt %
Behenic C22:0	1.36	0.92-1.68 wt %
Tricosanoic C23:0	0.23	0.12-0.18 wt %
Lignoceric C24:0	3.4	2.1-3.8 wt %
Pentadecanoic C15:0	0.13	0.07-0.15 wt %
Margaric C17:0	0.34	0.22-0.37 wt %
% Saturated Fats	41.2	39.8-43.6

Methodology: GCMS

Omega 6 Fatty Acids

Analyte (vegetable oil, grains, most meats, dairy)		Reference Range
Linoleic (LA) 18:2 n6	11.4	10.5-16.9 wt %
γ-Linolenic (GLA) 18:3 n6	0.08	0.03-0.13 wt %
Dihomo-γ-linolenic (DGLA) 20:3 n6	1.30	>= 1.19 wt %
Arachidonic (AA) 20:4 n6	17	15-21 wt %
Docosatetraenoic (DTA) 22:4 n6	1.85	1.50-4.20 wt %
Eicosadienoic 20:2 n6	0.29	<= 0.26 wt %
% Omega 6s	32.1	30.5-39.7

Monounsaturated Fats

Omega 7 Fats		Reference Range
Palmitoleic 16:1 n7	0.18	<= 0.64 wt %
Vaccenic 18:1 n7	0.97	<= 1.13 wt %
Trans Fat		
Elaidic 18:1 n9t	0.32	<= 0.59 wt %

Delta - 6 Desaturase Activity

	Upregulated Functional Impaired	
Linoleic / DGLA 18:2 n6 / 20:3 n6	8.7	6.0-12.3

Cardiovascular Risk

Analyte		Reference Range
Omega 6s / Omega 3s	3.3	3.4-10.7
AA / EPA 20:4 n6 / 20:5 n3	14	12-125
Omega 3 Index	7.0	>= 4.0

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

Essential Fatty Acid Metabolism

Omega 3 Family

α-Linolenic Acid
flax, walnut, grasses
0.12

Stearidonic acid

Eicosatetraenoic acid, ETA

Eicosapentaenoic Acid
cold water fish
1.21
Anti-inflammatory Eicosanoids

Docosapentaenoic Acid
2.67

Docosahexaenoic Acid
cold water fish
5.8

Omega 6 Family

Linoleic Acid
grains, vegetable oils
11.4

γ-Linolenic Acid
evening primrose, borage, black currant
0.08

Dihomo-γ-Linolenic Acid
1.30
Series 1 Prostaglandins Anti-inflammatory

Arachidonic Acid
animal fats
17
Pro-inflammatory Eicosanoids

Docosatetraenoic Acid
1.85

Delta-6 Desaturase
Vitamin and Mineral Cofactors:
FAD (B2), Niacin (B3)
Pyridoxal-5-phosphate (B6)
Vitamin C, Insulin, Zn, Mg

Elongase
Vitamin and Mineral Cofactors:
Niacin (B3)
Pyridoxal-5-phosphate (B6)
Pantothenic Acid (B5)
Biotin, Vitamin C

Delta-5 Desaturase
Vitamin and Mineral Cofactors:
FAD (B2), Niacin (B3)
Pyridoxal-5-phosphate (B6)
Vitamin C, Insulin, Zn, Mg

Elongase
Vitamin and Mineral Cofactors:
Niacin (B3)
Pyridoxal-5-phosphate (B6), Biotin
Pantothenic Acid (B5), Vitamin C

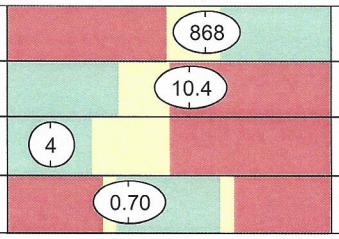
Elongase
Delta-6 Desaturase
Vitamin and Mineral Cofactors:
FAD (B2), Niacin (B3)
Pyridoxal-5-phosphate (B6), Biotin
Vitamin C, Zn, Mg, Carnitine
Pantothenic Acid (B5)

This test was developed and its performance characteristics determined by Genova Diagnostics, Inc. It has not been cleared by the U.S. Food and Drug Administration.

Oxidative Stress Markers

Oxidative Stress Markers

	Reference Range
Methodology: Colorimetric, thiobarbituric acid reactive substances (TBARS), Alkaline Picrate, Hexokinase/G-6-PDH, LC/MS/MS, HPLC	
Glutathione (whole blood)	>=669 micromol/L
Lipid Peroxides (urine)	<=10.0 micromol/g Creat.
8-OHdG (urine)	<=15 mcg/g Creat.
Coenzyme Q10, Ubiquinone (serum)	0.46-1.72 mcg/mL



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

The performance characteristics of the Oxidative Stress Markers have been verified by Genova Diagnostics, Inc. They have not been cleared by the U.S. Food and Drug Administration.

Elemental Markers

Nutrient Elements

Element	Reference Range	Reference Range
Copper *(plasma)*	98.6	75.3-192.0 mcg/dL
Magnesium *(RBC)*	47.7	30.1-56.5 mcg/g
Manganese *(whole blood)*	6.7	3.0-16.5 mcg/L
Potassium *(RBC)*	2,668	2,220-3,626 mcg/g
Selenium *(whole blood)*	141	109-330 mcg/L
Zinc *(plasma)*	104.1	64.3-159.4 mcg/dL

Toxic Elements*

Element	Reference Range	Reference Range
Lead	<DL	<= 2.81 mcg/dL
Mercury	<DL	<= 4.35 mcg/L
Arsenic	<DL	<= 13.7 mcg/L
Cadmium	0.12	<= 1.22 mcg/L
Tin	<DL	<= 0.39 mcg/L

* All toxic Elements are measured in whole blood.

Methodology: ICP-MS

The Elemental reference ranges are based on an adult population.

The performance characteristics of the Elemental Markers have been verified by Genova Diagnostics, Inc. They have not been cleared by the U.S. Food and Drug Administration.

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