US BioTek LABORATORIES
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1620 Linden Av N
Shoreline WA, 98133
Dr.- US BIOTEK

SAMPLE REPORT

09-May-1990 Female

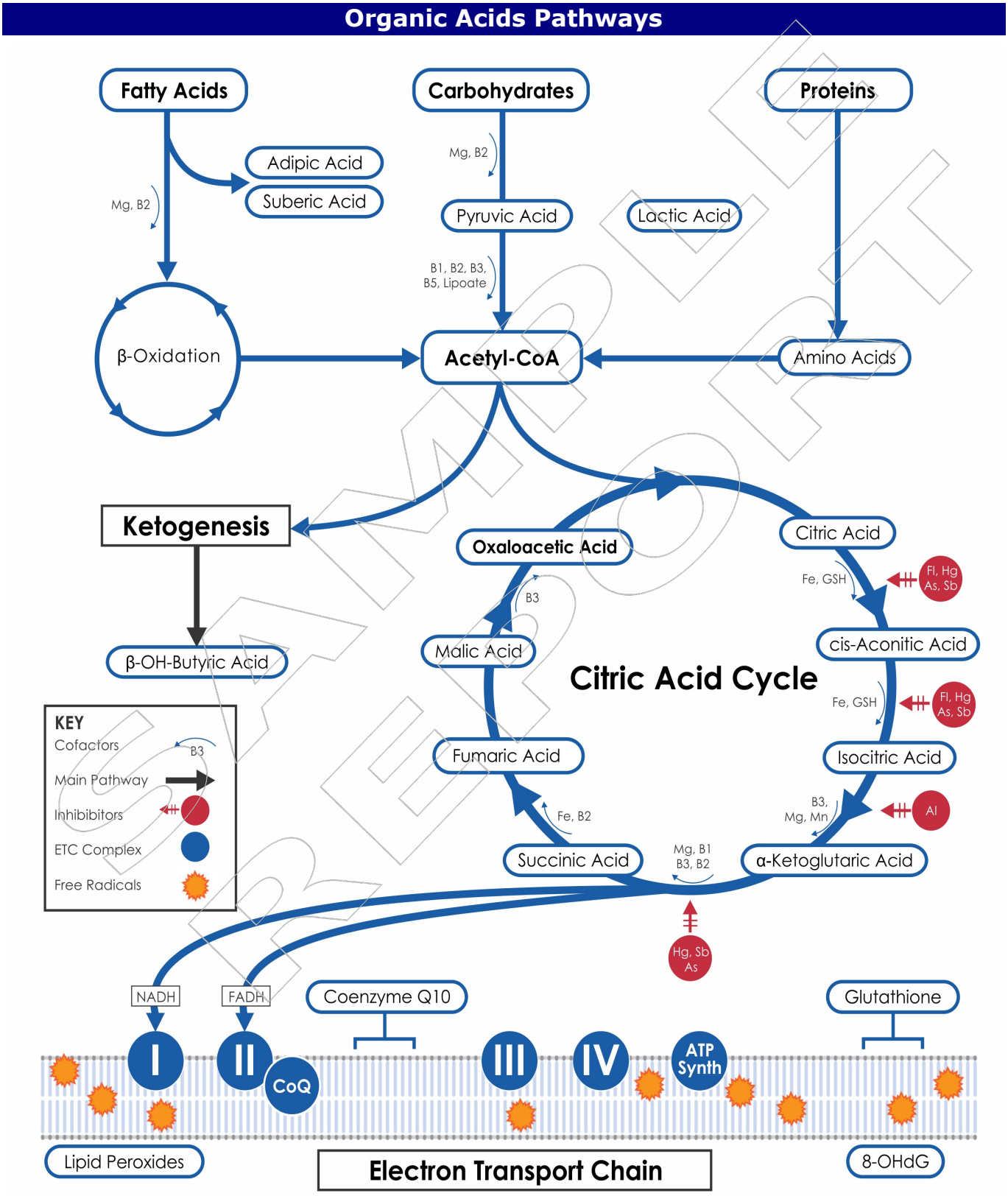
LAB ID : 00000000
Collection Date : dd/mm/yyyy
Received Date: dd/mm/yyyy

Accession #: 0000000000

ORGANIC ACIDS METABOLOMIC MAPPING

Method: LCMS/MS/MS

Organic Acids Pathways



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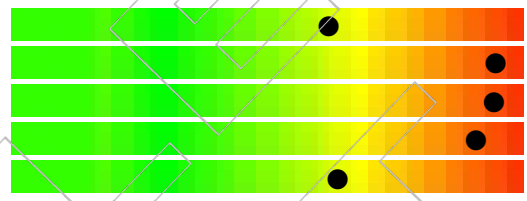
Nutrient Markers

URINE, SPOT

KETONE/FATTY ACID Metabolites

(Carnitine & B2)

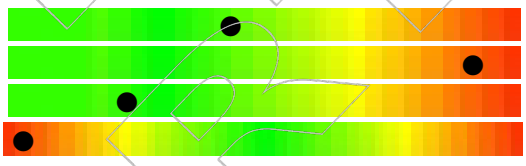
1.	Adipic Acid.	2.55		0.04 - 3.80	mmol/mol
2.	Suberic Acid.	*6.18*	*H	0.18 - 2.20	mmol/mol
3.	Ethylmalonic Acid	*4.65*	*H	0.0 - 2.80	mmol/mol
4.	Pimelic Acid	*5.00*	*H	0.0 - 4.0	mmol/mol
5.	Methyl-Succinic Acid	1.88		0.1 - 2.2	mmol/mol



CARBOHYDRATE Metabolism/Glycolysis

(B1, B3, Cr, Lipoic Acid, CoQ10)

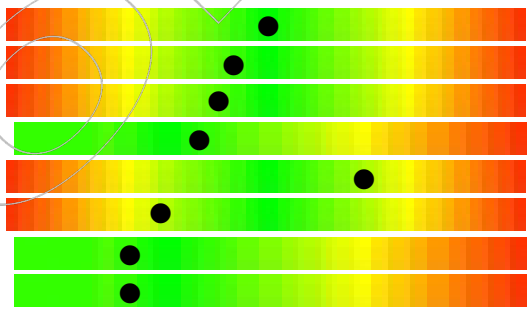
6.	Pyruvic Acid.	4.20		0.00 - 9.11	mmol/mol
7.	Lactic Acid.	*55.09*	*H	0.00 -48.00	mmol/mol
8.	b-OH-Butyric Acid	0.72		0.00 - 3.10	mmol/mol
9.	Glucose (OA)	0.1		0.1 - 1.1	mmol/L



CITRIC ACID CYCLE Metabolites.

(B Comp., CoQ10, Amino Acids, Mg)

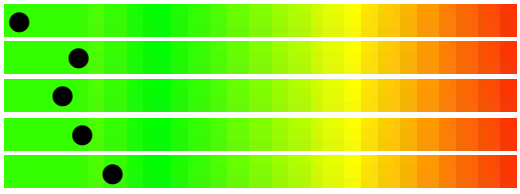
10.	Citric Acid.	345.4		132.5-507.0	mmol/mol
11.	cis-Aconitic Acid.	19.8		10.0-36.0	mmol/mol
12.	Isocitric Acid.	66.6		19.0-260.0	mmol/mol
13.	a-Ketoglutaric Acid.	11.57		4.00-52.00	mmol/mol
14.	Succinic Acid	8.71		0.00-9.30	mmol/mol
15.	Fumaric Acid.	0.11		0.00 - 0.94	mmol/mol
16.	Malic Acid.	0.88		0.06 - 1.80	mmol/mol
17.	b-OH-b-Methylglutaric Acid	1.21		0.00 - 8.50	mmol/mol



B-Complex Vitamins & Amino Acid Markers

(B1, B2, B3, B5, B6, Biotin)

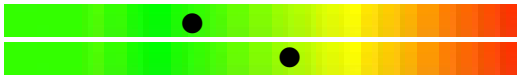
18.	a-Ketoisovaleric Acid	<dl		0.00 - 0.97	mmol/mol
19.	a-Ketoisocaproic Acid	0.12		0.00 - 0.89	mmol/mol
20.	a-Keto-b-Methylvaleric Acid	0.23		0.00 - 2.00	mmol/mol
21.	Xanthurenic Acid	0.17		0.00 - 0.96	mmol/mol
22.	beta-Hydroxyisovaleric Acid	0.38		0.00 -1.00	mmol/mol



METHYLATION COFACTORS

(B12, Folate)

23.	Methylmalonic Acid.	0.97		0.00 - 2.30	mmol/mol
24.	Formiminoglutamic Acid **	0.33		0.0 - 0.506	mmol/mol

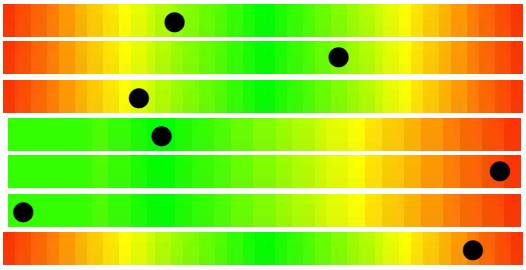


Cell Regulation Markers

NEUROTRANSMITTER METABOLISM

(Tyrosine, Tryptophan, B6, Antioxidants)

25.	Homovanillic Acid (HVA)	1.66		0.8-3.60	mmol/mol
26.	Vanillylmandelic Acid (VMA)	0.22		2.00-0.387	mmol/mol
27.	5HIAA	0.34		0.34-0.450	mmol/mol
28.	Kynurenic Acid.	0.38		0.00 - 2.20	mmol/mol
29.	Quinolinic Acid (OA)	*15.67*	*H	0.00 - 3.90	mmol/mol
30.	Picolinic Acid	<dl		0.0 - 2.9	mmol/mol
31.	Cortisol (OA)	*242*	*H	5.0 - 65.0	ng/mL



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Oxidative Damage/AntiOxidant Markers
(Vitamin C and Other Antioxidants)

32.	ParaHydroxyphenyllactate	0.45	0.00 - 1.47	mmol/mol
33.	8 OH-deoxyguanosine	9.2	0.0 - 12.0	mmol/mol

Toxicants and Detoxification

DETOXIFICATION INDICATORS
(Arg, NAC, Met, Mg, Antioxidants)

34.	2-Methylhippuric Acid	<dl	0.00 - 7.71	mmol/mol
35.	Orotic Acid.	0.28	0.00 - 0.54	mmol/mol
36.	Glucaric Acid.	9.37	0.00-12.3	mmol/mol
37.	a-OH-Butyric Acid	0.25	0.00 - 0.83	mmol/mol
38.	Pyroglutamic Acid.	13.2	10.0-33.00	mmol/mol

Compounds of Bacterial or Yeast/Fungal Origin

BACTERIAL DYSBIOSIS MARKERS.

39.	Benzoate (OA)	2.85	0.00 - 5.0	mmol/mol
40.	Hippurate (OA)	125	0.0 - 603	mmol/mol
41.	Phenylacetate	<dl	0.0 - 0.4	mmol/mol
42.	Phenylpropionate	<dl	0.0 - 5.0	mmol/mol
43.	ParaHydroxyBenzoate	1.1	0.0 - 2.0	mmol/mol
44.	p-HydroxyPhenylacetate	0.4	0.0 - 1.5	mmol/mol
45.	Indoleacetic Acid	<dl	0.0 - 6.8	mmol/mol
46.	Tricarballylate	0.93	0.00 -43.0	mmol/mol

CLOSTRIDIAL SPECIES

47.	Dihydroxyphenylpropionic Acid	<dl	0.00 -5.3	mmol/mol
48.	4-Cresol	0.3	0.0 - 1.7	mmol/mol
49.	3-OH-Proprionic Acid	1.9	0.0 - 22.0	mmol/mol

YEAST/FUNGAL DYSBIOSIS MARKERS.

50.	Arabinitol	10.0	0.0 -36.0	mmol/mol
51.	Citramalic Acid	3.0	0.0 - 3.6	mmol/mol
52.	Tartaric Acid.	1.7	0.0 - 16.5	mmol/mol

Oxalate Metabolites

53.	Oxalic Acid	8.85	3.15 - 41.69	mmol/mol
54.	Glyceric Acid	0.6	0.2 - 7.0	mmol/mol
55.	Glycolic Acid	18.3	13.5 - 85.9	mmol/mol

Nutritional Markers

56.	Pyridoxic Acid (Vit B6)	1.3	0.7 - 20.3	mmol/mol
57.	Pantothenic Acid (Vit B5)	1.5	0.5 - 7.4	mmol/mol
58.	Glutaric Acid (Vit B2) **	0.2	0.1 - 1.2	mmol/mol
59.	Ascorbic Acid (Vit C)	0.2	0.1 - 135	mmol/mol
60.	CoEnzyme-Q10 (CoQ10) **	3.63	1.27 - 4.29	mmol/mol
61.	N-Acetylcysteine (NAC)	0.21	0.15 - 0.83	mmol/mol
62.	Biotin (Vit H)	2.49	1.06 - 6.66	mmol/mol

	Creatinine, Urine Spot.	8.4	3.5 - 22.9	mmol/L

Results reported as <dl = Less than detectable limit

*** A high value for this marker may indicate a deficiency of this vitamin*

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Nutritional Guide

Nutrient	Adult Dose Range	Units	Clinician Notes
Vitamin-C	1500.0	mg	
Vitamin-E	500.0	IU	
Vitamin-B1	150.0	mg	
Vitamin-B2	200.0	mg	
Vitamin-B3	500.0	mg	
Vitamin-B5	200.0	mg	
Vitamin-B6	150.0	mg	
Biotin.	300.0	ug	
Folinic Acid.	700.0	ug	
Chromium .	200.0	ug	
Magnesium .	600.0	mg	
Coenzyme Q10.	300.0	mg	
alpha Lipoic Acid.	600.0	mg	
Calcium-D-glucurate.	500.0	mg	
Acetyl-L-Carnitine.	600.0	mg	
N-Acetylcysteine.	600.0	mg	
Glutathione.	500.0	mg	
5-hydroxyTryptophan (5-HTP).	87.5	mg	
Lysine.	1000.0	mg	
L-Arginine.	2000.0	mg	
Glycine .	1000.0	mg	
Methionine.	800.0	mg	
Ornithine.	750.0	mg	
Serine.	1500.0	mg	
Tryptophan.	525.0	mg	
Probiotics (Multistain)	15.0	billion CFU	

Disclaimer:

Supplement recommendations are based on the Organic Acid test results. The prescribing health practitioner must take into consideration the age, weight, sex, and pregnancy or lactation state. In addition, consider clinical state, medication regime, associated drug-nutrient depletion and allergies. The doses listed above are considered optimal, based on lab results and do not apply to specific disease conditions where doses may need to be altered. The vitamins, minerals or amino acids listed are elemental quantities. Use clinical discretion when choosing the right salt with the guidance of your compounding health professional. For example, Magnesium may be prescribed as a glycinate for its calming effect or threonate may be used for a Magnesium that crosses the blood-brain-barrier.

References:
Laboratory Evaluations for Integrative and Functional Medicine by Richard Lord.
J.Alexander Bralley; Textbook of Nutritional Medicine by Alan Gaby.

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Laboratory Comments

Ketone/FA Metabolites Comment

Organic acids provide functional markers for the metabolic effects of micronutrient adequacy, toxic exposure, neuroendocrine activity, intestinal bacterial and fungal overgrowth. Organic acid testing indicates the need for nutrients, diet modification, detoxification, antioxidant protection or further testing.

In a healthy state, organic acids are excreted in the urine at low concentrations. Low range results may be associated with hypometabolic compensatory states. Compensatory responses include hormonal secretions and cytokine responses that can slow or reverse deviations from median or normal physiologic states.

The Krebs cycle is a process of conversion of fats, carbohydrates and protein to mitochondrial energy, ATP.

Metabolic blocks in the Krebs cycle due to insufficient enzymes or cofactors will result in the elevation of organic acids that accumulate and spill into urine.

FATTY ACID METABOLISM:
Adipate, suberate, pimelate, Ethylmalonate and 2-methylsuccinate are organic compounds from fatty acid metabolism. Long chain fatty acids (LCFAs) undergo beta-oxidation in the mitochondria which is carnitine dependant. Dietary fat is broken down to produce free fatty acids, energy substrates using pathways that require carnitine and vitamin B2 (Riboflavin).
Low levels of Ethylmalonate with high adipate and suberate may be associated with carnitine deficient hypometabolic states where multiple amino acid catabolic pathways are restricted due to mitochondrial retraction.

SUBERIC ACID (SUBERATE) ELEVATED:
Adipate and suberate are short chain dicarboxylic fatty acids. Low levels of carnitine cause inadequate transfer of fatty acids into the cell's energy production processes in the mitochondria, producing excess amounts of adipate, suberate, and ethylmalonate. A deficiency of B2 (riboflavin) and to a lesser extent B5 (pantothenic acid) may also be found with elevations of Suberate. Also oxidation of oleic acid (olive oil, seed oils, cod/krill oil) produces suberic acid.
Supplementation Recommendations:
B complex (B2, B5), CoQ10, L-Carnitine (may be contraindicatedin patients on thyroid medications), L-Lysine (precursor to L-Carnitine), Other nutrients involved in Carnitine synthesis (Mg, SAMe, Vit B6, ascorbic acid, iron, niacin). Reduce polyunsaturated fatty acid intake.

ETHYLMALONATE ELEVATED:
Ethylmalonic Acid is a functional marker of carnitine insufficiency. It may be formed when short chain fatty acid oxidation is compromised, which causes an elevation of butyrate, some of which is converted to ethylmalonate.
This oxidation is dependent on formation of acylcarnitine.
Causes:
Carnitine deficiency, Riboflavin deficiency, failure in formation or oxidation of butyrylacrnitine, genetic mutations (short chain acyl-CoA dehydrogenase, multiple acyl-CoA dehyrdrogenase), Isoleucine loading, Toxicant exposures.
Symptoms/conditions:
Periodic mild weakness, Mitochondrial dysfunction, Nausea, Fatigue, Hypoglycemia, Recurrent infections, Attention defici in children, Metabolilc acidosis, Reye syndrome (inhibition of fatty acid oxidation likely caused by aspirin in presence of a genetic mutation given for viral infection-viral toxins also implicated).
Supplementation Recommendations:
B complex (B2, B5), CoQ10, L-Carnitine (may be contraindicatedin patients on thyroid medications), L-Lysine (precursor to L-Carnitine), Other nutrients involved in Carnitine synthesis (Mg, SAMe, Vit B6, ascorbic acid, iron, niacin)
Also: Glycine, 250mg/kg/day, Avoid medium chain fatty acids such as coconut oil.

PIMELIC ACID ELEVATED:
Pimelate is a precursor of the Bacillus subtilis biotin synthesis pathway and is synthesized from

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cyclohexanone and from salicylic acid.
Supplementation Recommendations:
Consider Biotin to reduce elevated levels.

Carbohydrate Metabolism Comment

CARBOHYDRATE METABOLISM/GLYCOLYSIS:
Dietary carbohydrates are broken down into Glucose and other sugars where carbohydrate breakdown products, pyruvate and lactate are formed. Pyruvate enters the Krebs cycle via dehydrogenase enzymes which require vitamin B1 (thiamine), vitamin B2 (riboflavin), vitamin B3 (niacin), vitamin B5 (pantothenic acid), and lipoic Acid to function correctly. Review Vitamin B Levels in conjunction with Pyruvate and Lactate levels.

In the absence of these nutrients, lactate builds up leading to lactic acidosis. Elevated pyruvate and lactate can indicate a need for lipoic acid.

LACTATE ELEVATED:
This metabolic precursor to the Citric Acid Cycle, may indicate a block in the production of energy due to mitochondrial disorders, an on-going infectious state, use of some recreational and/or pharmaceutical drugs, alcohol over-consumption, poor blood sugar control (especially with diabetics), and a number of inborn errors of metabolism.
Supplementation Recommendations:
B Vitamins (B1, B2, B3, B5), lipoic acid, and CoQ10.

GLUCOSE LOW:
Glycolysis of carbohydrates provide glucose as a fuel source for cellular function.
Pancreatic Insulin regulates Glucose transport into cells.
Low blood glucose, also known as low blood sugar or hypoglycaemia results when blood glucose drops which is common in type 1 diabetes and among people with type 2 diabetes who take insulin or some other diabetes medicines below 70mg/dl.
Supplementation Recommendations:
Glucose, glucagon.

Cit Acid Cycle Metabs Comment

The Citric Acid Cycle is the pathway for energy released from food components and the source of anabolic molecules to support organ maintenance and neurological function. Therefore, the citric acid cycle serves both anabolic and catabolic functions representing the crossroads of food conversion and utilisation.

FUMARATE LOW:
Indicative of poor functioning or overstress on the citric acid cycle, a low reading of this organic acid may be suggestive of low tyrosine and phenylalanine.
Drugs which may have an adverse affect: Methotrexate.
Supplementation Recommendations:
Aspartic Acid, tyrosine and phenylalanine, L-arginine, a B-complex, manganese, and magnesium.

B-Vitamins/Amino Acids Comment

B-COMPLEX VITAMIN MARKERS:

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B-Complex Vitamin Markers are metabolic intermediates in the degradation of amino acids. When hepatic enzymes remove branched-chain amino acids, they form keto acids.
B-complex vitamins are essential for many in metabolic functions in the body used to extract energy from cellular health, remove toxins, and maintain the immune system.
B-Complex vitamin deficiencies produce symptoms associated with homocysteinemia effects or mitochondriopathy-associated symptoms which include periodic weakness, nausea, fatigue, attention deficit or Reye syndrome.

Neurotransmitter Metabolism Comment

QUINOLINOLATE ELEVATED:
- Produced from L-tryptophan in interferon gamma (IFN-g)-stimulated macrophages via the kynurenine pathway.
- Functions in immune system modulation of brain activity
- Quinolinate is a powerful agonist of the NMDA receptors, ultimately leading to glutamate toxicity
- In inflammatory diseases, a high Quinolinate:Kynurenate (QUIN/KYNA) ratio increases risk of neurotoxicity
- May be elevated by L-tryptophan, but not by 5-hydroxytryptophan loading.

Causes:
- Disordered tryptophan metabolism
- Chronic stimulation of the immune response: causes release of INF-g by macrolphages
- Results in tryptophan conversion to quinolinate by astrocytes and microglia in CNS
- HIV -related neurological dysfunction: Due to overstimulation by quinolinate of the NMDA receptors. Causes subsequent neurological degeneration with permanent loss of brain function.
- Microbial Infections: Bacterial infection (recent or chronic), Fungal and parasitic infections, Viral infection, recent or chronic
- Gastrointestinal infections (recent or chronic) leading to Auotimmune disease, Inflammatory bowel diseases
- Meningitis
- Septicemia
- Chronic hyperammonemia
- Symptoms/Conditions:

Viral infection, Irritable bowel disease, Neurodegenerative conditions, Memory deficits, Insomnia, Chronic fatigue syndrome

Supplementation Recommendations:
Antioxidants (Vitamin C, Vitamin E, lipoic acid), Magnesium, Glycine, 50, Resolve inflammatory stimulation.

CORTISOL ELEVATED:
Cortisol is the primary glucocorticoid involved in the regulation of glucose metabolism and the body's response to stress. During times of stress, cortisol levels increase and accelerate the breakdown of proteins to provide the fuel to maintain body functions.
Elevations in Cortisol is directly associated with adrenal dysfunction and may be implicated in the ultimate deficiency of nutrients and antioxidants required for ATP production.
Treat for cortisol excess following adrenal dysfunction protocols.

Detoxification/Toxicants Comment

OXIDATIVE DAMAGE AND ANTIOXIDANT MARKERS:
The assessment of protection from oxidant and ammonia challenge should be of priority when detoxification requirement is suspected. Oxidative stress has been associated with a variety of diseases like diabetes, cancer, neurodegenerative disorders and aging.

DETOXIFICATION INDICATORS:
The organic acids of this group serve as biomarkers of detoxification status or biotransformation capacities, distinct parts of the detoxification system, providing insight about both exogenous toxin accumulation and endogenous detoxification responses.
Elevations in toxicant and detoxification markers reveal aspects of xenobiotic exposure, endogenous toxins and detoxification functions.