NutriPATH
INTEGRATIVE PATHOLOGY SERVICES
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PATRICIA JEFFERS
04-Feb-1969 Female

16 TAMARIND STREET
KIRWAN QLD 4817

-.VERA DAHLSTROM
RESTORING VITALITY NATUROPATHIC CLINIC
2 TOROKINA STREET

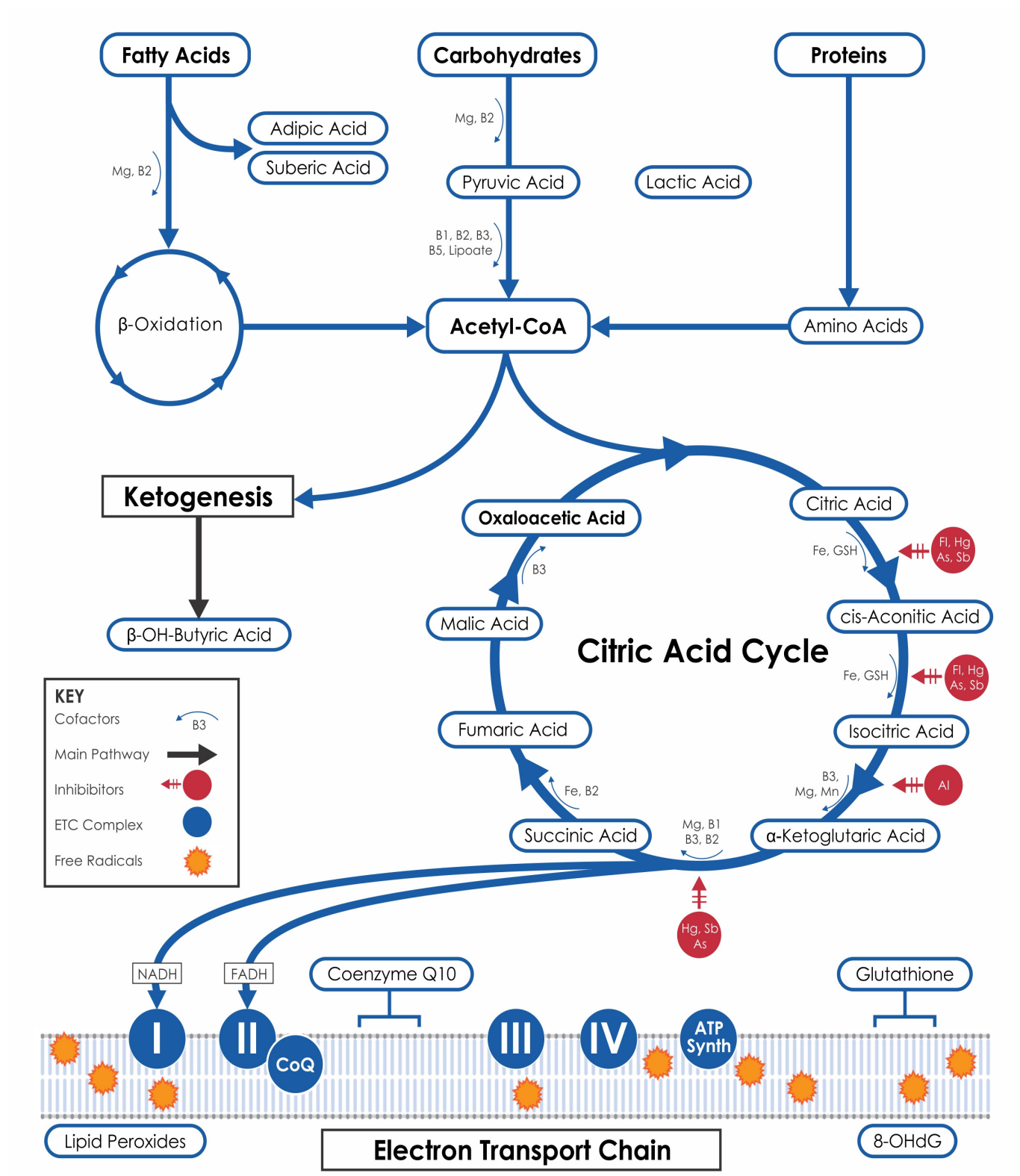
LAB ID : 3881792
UR NO. : 6185907
Collection Date : 03-Apr-2023
Received Date:06-Apr-2023

3881792

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.	8.34	0.00 - 11.10	ug/mgCR
2.	Suberic Acid.	1.21	0.00 - 4.60	ug/mgCR
3.	Ethylmalonic Acid	2.86	0.00 - 6.30	ug/mgCR
4.	Pimelic Acid	22.9	5.9 - 31.8	nmol/mg Cr
5.	Methyl-Succinic Acid	18.50	3.20 - 21.10	nmol/mg Cr

CARBOHYDRATE Metabolism/Glycolysis
(B1, B3, Cr, Lipoic Acid, CoQ10)

6.	Pyruvic Acid.	*7.41* *H	0.00 - 6.40	ug/mgCR
7.	Lactic Acid.	*18.55* *H	0.00 - 16.40	ug/mgCR
8.	b-OH-Butyric Acid	*15.20* *H	0.00 - 9.90	ug/mgCR
9.	Glucose (OA)	0.1	0.1 - 1.1	mmol/L

CITRIC ACID CYCLE Metabolites.
(B Comp., CoQ10, Amino Acids, Mg)

10.	Citric Acid.	585.0	56.0 - 987.0	ug/mgCR
11.	cis-Aconitic Acid.	21.2	18.0 - 78.0	ug/mgCR
12.	Isocitric Acid.	44.4	35.0 - 143.0	ug/mgCR
13.	a-Ketoglutaric Acid.	8.94	0.00 - 35.00	ug/mgCR
14.	Succinic Acid	8.87	1.10 - 20.90	ug/gCR
15.	Fumaric Acid.	1.22	1.10 - 1.35	ug/mgCR
16.	Malic Acid.	0.48	0.00 - 3.10	ug/mgCR
17.	b-OH-b-Methylglutaric Acid	2.10	0.00 - 5.10	ug/mgCR

B-Complex Vitamins & Amino Acid Markers
(B1, B2, B3, B5, B6, Biotin)

18.	a-Ketoisovaleric Acid	0.37	0.00 - 0.49	ug/mgCR
19.	a-Ketoisocaproic Acid	0.40	0.00 - 0.52	ug/mgCR
20.	a-Keto-b-Methylvaleric Acid	0.96	0.00 - 1.10	ug/mgCR
21.	Xanthurenic Acid	0.40	0.0 - 0.5	ug/mgCR
22.	beta-Hydroxyisovaleric Acid	3.82	0.00 - 11.50	ug/mgCR

METHYLATION COFACTORS
(B12, Folate)

23.	Methylmalonic Acid.	<dl	0.00 - 2.30	ug/mgCR
24.	Formiminoglutamic Acid **	0.3	0.0 - 2.2	ug/mgCR

Cell Regulation Markers

NEUROTRANSMITTER METABOLISM
(Tyrosine, Tryptophan, B6, Antioxidants)

25.	Homovanillic Acid (HVA)	6.96	1.40 - 7.60	ug/mgCR
26.	Vanillylmandelic Acid (VMA)	1.59	1.20 - 5.30	mmol/molCr
27.	5-Hydroxyindoleacetic Acid (5HIAA)	2.30	1.60 - 9.80	ug/mgCR
28.	Kynurenic Acid.	0.93	0.0 - 1.5	ug/mgCR
29.	Quinolinic Acid (OA)	0.87	0.00 - 5.80	ug/mgCR
30.	Picolinic Acid	4.2	2.8 - 13.5	ug/mgCR
31.	Cortisol (OA)	361	166 - 507	nmol/L

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

32.	ParaHydroxyphenyllactate	<dl	0.00 - 0.66	ug/mgCR
33.	8 OH-deoxyguanosine	4.0	0.0 - 7.6	ug/mgCR

Toxicants and Detoxification

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

34.	2-Methylhippuric Acid	<dl	0.00 - 0.19	ug/mgCR
35.	Orotic Acid.	0.35	0.00 - 1.01	ug/mgCR
36.	Glucaric Acid.	1.87	0.00 - 10.70	ug/mgCR
37.	a-OH-Butyric Acid	0.32	0.10 - 0.90	ug/mgCR
38.	Pyroglutamic Acid.	35.2	28.0 - 88.0	ug/mgCR

Compounds of Bacterial or Yeast/Fungal Origin

BACTERIAL DYSBIOSIS MARKERS.

39.	Benzoate (OA)	4.11	0.00 - 9.30	ug/mgCR
40.	Hippurate (OA)	816	0.0 - 1070	ug/mgCR
41.	Phenylacetate	<dl	0.0 - 0.2	ug/mgCR
42.	Phenylpropionate	<dl	0.0 - 0.1	ug/mgCR
43.	ParaHydroxyBenzoate	0.3	0.0 - 1.8	ug/mgCR
44.	p-HydroxyPhenylacetate	2.2	0.0 - 34.0	ug/mgCR
45.	Indoleacetic Acid	53.3	0.00 - 90.00	ug/mgCR
46.	Tricarballylate	*1.76* *H	0.00 - 1.41	ug/mgCR

L. acidophilus/General Bacteria

47.	D-Lactate	3.4	0.0 - 4.1	ug/mgCR

CLOSTRIDIAL SPECIES

48.	Dihydroxyphenylpropionic Acid	<dl	0.00 - 0.05	ug/mgCR
49.	4-Cresol	2.0	0.0 - 75.0	mmol/molCr
50.	3-OH-Proprionic Acid	7.3	0.0 - 208.0	mmol/molCr

YEAST/FUNGAL DYSBIOSIS MARKERS.

51.	Arabinitol	16.5	0.0 - 73.0	ug/mgCR
52.	Citramalic Acid	1.1	0.0 - 3.6	mmol/molCr
53.	Tartaric Acid.	0.1	0.0 - 7.0	ug/mgCR

Oxalate Metabolites

54.	Oxalic Acid	2.65	0.77 - 7.00	ug/mgCR
55.	Glyceric Acid	18.5	16.0 - 117.0	mmol/molCr
56.	Glycolic Acid	10.6	6.8 - 101.0	mmol/molCr

Nutritional Markers

57.	Pyridoxic Acid (Vit B6)	9.5	5.0 - 34.0	mmol/molCr
58.	Pantothenic Acid (Vit B5)	3.3	2.0 - 10.0	mmol/molCr
59.	Glutaric Acid (Vit B2) **	0.3	0.0 - 0.4	mmol/molCr
60.	Ascorbic Acid (Vit C)	133	10.0 - 200	mmol/molCr
61.	CoEnzyme-Q10 (CoQ10) **	8.41	0.17 - 39.00	mmol/molCr
62.	N-Acetylcysteine (NAC)	0.15	0.10 - 0.28	mmol/molCr
63.	Biotin (Vit H)	0.22	0.19 - 2.70	mmol/molCr

	Creatinine, Urine Spot.	*17.5* *H	5.0 - 11.0	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	400.0	mg	
Vitamin-B1	20.0	mg	
Vitamin-B2	60.0	mg	
Vitamin-B3	500.0	mg	
Vitamin-B5	200.0	mg	
Vitamin-B6	40.0	mg	
Biotin.	300.0	ug	
Chromium .	200.0	ug	
Vanadium.	100.0	ug	
Magnesium .	600.0	mg	
Coenzyme Q10.	300.0	mg	
alpha Lipoic Acid.	600.0	mg	
Acetyl-L-Carnitine.	600.0	mg	
Lysine.	450.0	mg	
Glycine .	1000.0	mg	
Probiotics (Multistain)	15.0	billion CFU	
D-Lactate-free probiotics	5.0	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.

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.

PYRUVATE ELEVATED:
Elevated levels of pyruvate may reflect failure of pyruvate dehydrogenase due to a functional need for increased B vitamins, particularly thiamin and pantothenic acid.

Pyruvate is the anaerobic breakdown product of glucose. Its further conversion to acetyl-CoA requires the pyruvate dehydrogenase enzyme complex. Pyruvate dehydrogenase requires cofactors derived from thiamin, riboflavin, niacin, lipoic acid, and pantothenic acid for optimal function.

Levels of pyruvate in the tissues are further controlled by the biotin-containing protein, pyruvate carboxylase, which controls the first step in the reformation of glucose from pyruvate. Multiple forms of pyruvate carboxylase deficiency, some of which are biotin responsive, have been reported.
Supplementation Recommendations:
B Vitamins (B1, B2, B3, B5), Biotin, CoQ10, alpha Lipoic Acid, Magnesium, Manganese.

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.

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Supplementation Recommendations:
B Vitamins (B1, B2, B3, B5), lipoic acid, and CoQ10.

b-HYDROXYBUTYRATE ELEVATED:
Beta-Hydroxy Butyrate is a primary ketone body produced in proportion to dependence on fatty acid oxidation for ATP, most often due to restricted carbohydrate oxidation. It is a functional marker of ketosis.
An increase in the level of this organic acid may be indicative of poor carbohydrate intake (fasting, low CHO diet), poor metabolism, poor glucose utilization, impaired insulin function or excessive oxidation of free fatty acids. Another possibility is a defect in cytochrome oxidase enzyme.
Supplementation Recommendations:
Chromium, Vanadium, B Vitamins (B1, B3, B5, B12), Biotin, Carnitine, Lipoic Acid.

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.

B-Vitamins/Amino Acids Comment

B-COMPLEX VITAMIN MARKERS:
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

5HIAA IS WITHIN RANGE:
5HIAA is the major metabolite of Serotonin.

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.

Bacterial Dysbiosis Comment

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TRICARBALLYLATE ELEVATED:
- Tricarballylate has an extremely high affinity for magnesium, preventing its absorption.
- Elevations caused by high-carbohydrate dietary intake.

Causes:
Intestinal bacterial overgrowth, associated with high dietary carbohydrate, Probably due to microaerophilic bacteria.
Obesity, hyperinsulinaemia also contribute to elevations.

Symptoms/Conditions
Elements tightly bound by tricarballylate causing decreased intestinal absorption (Magnesium, Calcium, Zinc)

Supplementation Recommendations:
Magnesium, Calcium, Zinc, Restricted carbohydrate diet