

Patient: Ima Sample

Accession:

Collected:

Received:

DOB:

Completed:


External ID #:

Ordered by:

METHODOLOGY: LC-MS/MS

YOUR PERSONALIZED REPORT

SUMMARY OF FUNCTIONAL IMBALANCES



Note: The findings on this page are designed to give you a high-level overview of your current functional imbalances and help you get a general preview of the detailed report found on the following pages.

FUNCTIONAL CATEGORY

Finding

Intervention Considerations

ENERGY & MITOCHONDRIAL PROCESSING

Lactic Acid	High ▲	Elevated Lactic Acid levels are seen in anaerobic or metabolic conditions and are associated with inflammation. Reductions are seen with supplementation of B1, CoQ10, and/or LA.
D-Lactic Acid	High ▲	High D-Lactic Acid indicates glucose breakdown via the MGO pathway and is associated with oxidative stress, and inflammation. It can also be elevated due to short bowel syndrome or dietary intake. Evaluate glycolysis, microbial markers, and diet.
cis-Aconitic Acid	High ▲	Elevated levels of Aconitic Acid are associated with inflammation. Consider antioxidant support.
Isocitric Acid	Borderline High ▲	Elevated Isocitric Acid is associated with inflammation and oxidative stress. Consider support with antioxidants and cofactors B3, Mg, and Mn.
Succinic Acid	High ▲	Elevated levels of Succinic Acid are associated with mitochondrial dysfunction. Consider support with CoQ10, Mg, B6, and antioxidants.
Malic Acid	High ▲	Malic Acid is found in fruits and preservatives. High levels may indicate possible mitochondrial dysfunction. Consider CoQ10 and B3 supplementation.
Adipic Acid	Borderline High ▲	Adipic Acid levels are elevated with fatty acid oxidation disorders (MCAD). High levels are associated with starvation, ketosis, glutaric aciduria, and diabetes. Evaluate diet for high adipate foods, such as gelatin, jams/jellies, and sugar cane.
Sebacic Acid	Borderline High ▲	Elevated Sebacic Acid is associated with fatty acid oxidation disorders (MADD/MCAD). Consider support with carnitine and B2. Consider environmental sources such as plasticizers.

NUTRITION

 No Functional Imbalances Detected	Within Range ◆	No additional need for supplements (B1, B2, B3, B5, lipoic acid, B6, folate, or biotin). No elevated levels of fructose or polyphenols are noted.
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FUNCTIONAL CATEGORY

Finding

Intervention Considerations

STRESS & MOOD

Vannilylmandelic Acid

Borderline High ▲

Elevated Vannilylmandelic Acid (VMA) identifies increased epinephrine and norepinephrine turnover and is associated with higher stress, anxiety, and PTSD. Consider stress reduction and support with Mg and B2.

5-Hydroxyindoleacetic Acid

Borderline High ▲

Elevated levels of 5-Hydroxyindoleacetic Acid (5-HIAA) indicates increased serotonin turnover, which is noted with 5-HTP or SSRI intake or from food sources, such as plantains and walnuts.

Picolinic Acid

High ▲

Picolinic Acid is an immunomodulatory marker. It is neuroprotective against Quinolinic Acid activity and is increased in viral infections.

Quinolinic Acid

Borderline High ▲

Quinolinic Acid is a neuroinflammatory marker. Consider antioxidants such as vitamin D, polyphenols, EPA/DHA, and Mg. Avoid phthalates and alcohol and evaluate B6 status.

TOXIC IMPACTS

 α -Hydroxybutyric Acid

Borderline High ▲

α -Hydroxybutyric Acid levels indicate the rate of glutathione synthesis. If elevated, consider supporting with glycine, NAC, B3, or glutathione.

Orotic Acid

High ▲

Orotic Acid levels are increased in urea cycle disorders and may indicate ornithine or arginine insufficiency.

SUMMARY OF FUNCTIONAL IMBALANCES



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FUNCTIONAL CATEGORY

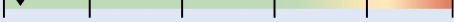
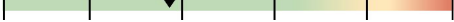
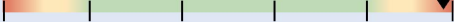

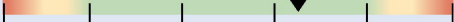

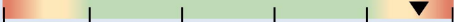
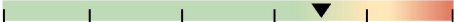


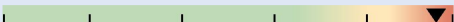
Finding

Intervention Considerations

MICROBIAL METABOLITES

Indoleacetic Acid	High ▲	Elevated Indoleacetic Acid indicates increased bacterial action on tryptophan. Check intake and digestion.
4-Hydroxyphenylacetic Acid	High ▲	If 4-Hydroxyphenylacetic Acid is elevated, evaluate tyrosine intake, total protein intake, and digestion adequacy.
Phenylacetic Acid	High ▲	If Phenylacetic Acid is high, evaluate phenylalanine intake and adequacy of digestion.
Benzoic Acid	High ▲	Benzoic Acid conjugates with glycine. If elevated, consider supplementation.
Hippuric Acid	Low ▼	Low Hippuric Acid is associated with insufficiency dysbiosis and/or the need for glycine support.
3,4-Dihydroxyhydrocinnamic Acid	Borderline High ▲	Elevated 3,4-Dihydroxyhydrocinnamic Acid is associated with increased polyphenol intake, particularly coffee. It has potent antimicrobial properties.
4-Hydroxybenzoic Acid	High ▲	4-Hydroxybenzoic Acid is associated with a higher intake of polyphenols such as anthocyanins, green tea, wine, and vanilla.
Equol	Borderline High ▲	Higher levels of equol are associated with beneficial effects.
Citramalic Acid	High ▲	Citramalic Acid can be a metabolite of gut microbes.

ENERGY & MITOCHONDRIAL PROCESSING

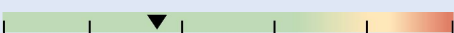

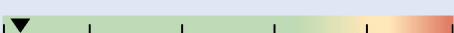

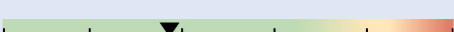
GLYCOLYSIS		Result	20% 40% 60% 80%	Reference
1	Glucose <i>Glucokinase</i>	<dl		< 15.2 mg/dL
2	Pyruvic Acid <i>Pyruvate dehydrogenase + B1, B2, B3, B5 LA</i>	11.9		< 67.4 nmol/mg Creatinine
3	Lactic Acid <i>Lactate dehydrogenase + B3</i>	861.4 H		12.2 - 458.2 nmol/mg Creatinine
4	D-Lactic Acid <i>Methylglyoxal product + glutathione</i>	>200.0		< 21.6 nmol/mg Creatinine
KREBS CYCLE		Result	20% 40% 60% 80%	Reference
5	Citric Acid <i>Citrate synthase</i>	1484.1		203.0 - 3208.6 nmol/mg Creatinine
6	cis-Aconitic Acid <i>Aconitase</i>	1031.4 H		126.3 - 668.9 nmol/mg Creatinine
7	Isocitric Acid <i>Isocitrate dehydrogenase + B3</i>	655.8		137.1 - 794.9 nmol/mg Creatinine
8	α-Ketoglutaric Acid <i>alpha-Ketoglutarate dehydrogenase + B1, B2, B3, B5, LA</i>	71.5		< 169.6 nmol/mg Creatinine
9	Succinic Acid <i>Succinic dehydrogenase + B2</i>	324.3 H		12.3 - 260.4 nmol/mg Creatinine
10	Fumaric Acid <i>Fumarase</i>	5.8		< 16.1 nmol/mg Creatinine
11	Malic Acid <i>Malate dehydrogenase + B3</i>	23.8 H		< 23.5 nmol/mg Creatinine

KEY: < dl = Results below detection limit.

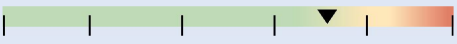
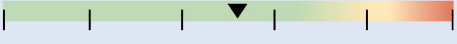
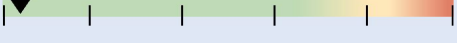


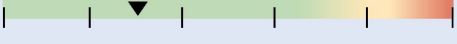

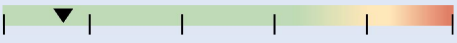
ENERGY & MITOCHONDRIAL PROCESSING

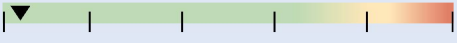

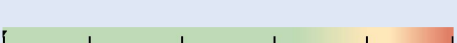
FATTY ACID OXIDATION		Result	20% 40% 60% 80%	Reference
12	Ethylmalonic Acid <i>Acyl-CoA dehydrogenase + B2</i>	37.1		< 59.6 nmol/mg Creatinine
13	2-Methylsuccinic Acid <i>Acyl-CoA dehydrogenase + B2</i>	18.3		< 33.2 nmol/mg Creatinine
14	Adipic Acid <i>Acyl-CoA dehydrogenase + B2</i>	34.8		< 48.0 nmol/mg Creatinine
15	Pimelic Acid <i>Acyl-CoA dehydrogenase + B2</i>	5.0		< 19.2 nmol/mg Creatinine
16	Suberic Acid <i>Acyl-CoA dehydrogenase + B2</i>	2.8		< 8.1 nmol/mg Creatinine
17	Sebacic Acid <i>Acyl-CoA dehydrogenase + B2</i>	14.1		< 17.2 nmol/mg Creatinine
CARNITINE USAGE		Result	20% 40% 60% 80%	Reference
18	Glutaric Acid <i>Glutaryl-CoA dehydrogenase + B2</i>	2.4		< 8.5 nmol/mg Creatinine
KETONES		Result	20% 40% 60% 80%	Reference
19	β-Hydroxybutyric Acid <i>beta-Hydroxybutyrate dehydrogenase + B3</i>	25.7		3.2 - 116.4 nmol/mg Creatinine

NUTRITION

B-COMPLEX (B1, B2, B3, B5, LA)		Result	20% 40% 60% 80%	Reference
20	α-Ketoisovaleric Acid <i>Branched-chain keto acid dehydrogenase + B1, B2, B3, B5, LA</i>	1.8		< 11.9 nmol/mg Creatinine
21	α-Keto-β-methylvaleric Acid <i>Branched-chain keto acid dehydrogenase + B1, B2, B3, B5, LA</i>	1.4		< 83.5 nmol/mg Creatinine
22	α-Ketoisocaproic Acid <i>Branched-chain keto acid dehydrogenase + B1, B2, B3, B5, LA</i>	<dl		< 17.0 nmol/mg Creatinine
23	α-Ketoglutaric Acid <i>alpha-Ketoglutarate dehydrogenase + B1, B2, B3, B5, LA</i>	71.5		< 169.6 nmol/mg Creatinine
24	Pyruvic Acid <i>Pyruvate dehydrogenase + B1, B2, B3, B5 LA</i>	11.9		< 67.4 nmol/mg Creatinine

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NUTRITION				
VITAMIN B-12		Result	20% 40% 60% 80%	Reference
25	Methylmalonic Acid <i>Methylmalonyl-CoA mutase + B12</i>	14.8		< 24.9 nmol/mg Creatinine
FOLATE		Result	20% 40% 60% 80%	Reference
26	Formiminoglutamic Acid <i>Glutamate formiminotransferase + folate</i>	1.0		< 2.7 nmol/mg Creatinine
VITAMIN B6		Result	20% 40% 60% 80%	Reference
27	Pyridoxic Acid <i>Vitamin B6 catabolite</i>	<dl		< 98.3 nmol/mg Creatinine
28	Xanthurenic Acid <i>Kynurenine transaminase + B6</i>	3.6		< 10.2 nmol/mg Creatinine
BIOTIN		Result	20% 40% 60% 80%	Reference
29	β-Hydroxyisovaleric Acid <i>Methylcrotonyl-CoA carboxylase + Biotin</i>	40.5		< 102.8 nmol/mg Creatinine
PLANT COMPONENTS		Result	20% 40% 60% 80%	Reference
30	Tartaric Acid <i>Plant component or Nocardia tartaricans/C. albicans</i>	24.9		< 335.3 nmol/mg Creatinine
31	Quercetin <i>Polyphenol: Flavonoid</i>	<dl		< 14.9 nmol/mg Creatinine
SUGAR INTAKE		Result	20% 40% 60% 80%	Reference
32	Fructose <i>Fructokinase</i>	0.4		< 4.7 nmol/mg Creatinine

STRESS & MOOD				
CATECHOLAMINE TURNOVER		Result	20% 40% 60% 80%	Reference
33	Homovanillic Acid <i>COMT + magnesium & monoamine oxidase + B2</i>	<dl		< 42.1 nmol/mg Creatinine
34	Vannilylmandelic Acid <i>Monoamine oxidase + B2</i>	34.4		5.3 - 36.1 nmol/mg Creatinine
35	Homovanillic Acid/Vannilylmandelic Acid Ratio <i>Dopamine/norepinephrine conversion balance</i>	N/A		< 2.6

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STRESS & MOOD


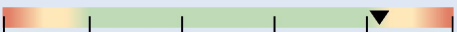

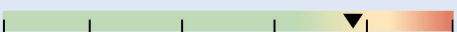

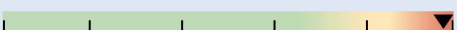

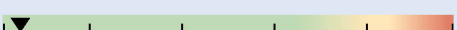

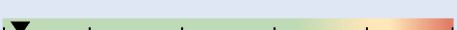


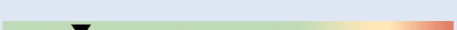


TRYPTOPHAN CATABOLISM		Result	20% 40% 60% 80%	Reference
36	5-Hydroxyindoleacetic Acid <i>Aldehyde dehydrogenase + B3</i>	18.1		6.3 - 27.6 nmol/mg Creatinine
37	Picolinic Acid <i>Non-enzymatic</i>	2.0		< 4.0 nmol/mg Creatinine
38	Kynurenic Acid <i>Kynurenine transaminase + B6</i>	19.8		7.8 - 54.0 nmol/mg Creatinine
39	Quinolinic Acid <i>Quinolinic acid phosphoribosyltransferase (QPRT)</i>	128.9		29.4 - 178.5 nmol/mg Creatinine
40	Quinolinic Acid/Kynurenic Acid Ratio <i>Neuroinflammatory/neuroprotective balance</i>	6.5		0.8 - 12.3
STRESS HORMONE		Result	20% 40% 60% 80%	Reference
41	Cortisol <i>11-beta-Hydroxysteroid dehydrogenase + B3</i>	19.6		3.8 - 113.8 mcg/g Creatinine
42	Cortisol /Cortisone Ratio <i>11-beta-Hydroxysteroid dehydrogenase + B3 activity</i>	0.659		0.1 - 0.8

TOXIC IMPACTS


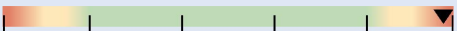
OXIDATIVE DAMAGE		Result	20% 40% 60% 80%	Reference
43	8-Hydroxy-2'-deoxyguanosine <i>DNA oxidation</i>	<dl		< 6.4 nmol/mg Creatinine
TOXIN EXPOSURE		Result	20% 40% 60% 80%	Reference
44	2-, 3-, and 4-Methylhippuric acid <i>Xylenes exposure</i>	<dl		< 0.6 nmol/mg Creatinine
45	Benzoylform <i>Styrene and ethylbenzene exposure</i>	<dl		< 3.6 nmol/mg Creatinine
46	Mandelic Acid <i>Styrene and ethylbenzene exposure</i>	<dl		< 16.9 nmol/mg Creatinine
47	Glucaric Acid <i>Glucuronic Acid Pathway</i>	11.5		< 31.5 nmol/mg Creatinine

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TOXIC IMPACTS

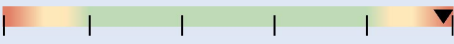
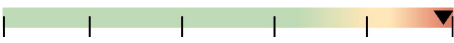
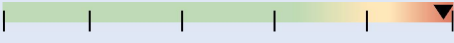
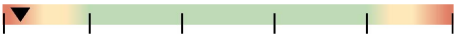
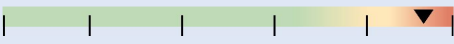

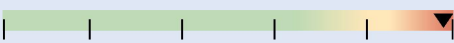
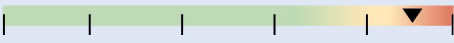
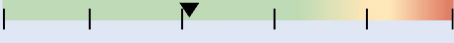
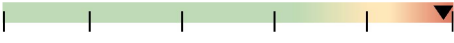
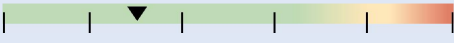

GLUTATHIONE STATUS		Result		Reference
48	α-Hydroxybutyric Acid <i>Dehydrogenase + B3</i>	64.5		15.4 - 95.6 nmol/mg Creatinine
49	α-Ketobutyric Acid <i>Lactate dehydrogenase + B3</i>	<dl		< 12.6 nmol/mg Creatinine
50	Pyroglutamic Acid <i>5-Oxoprolinase</i>	345.3		< 495.1 nmol/mg Creatinine
KIDNEY IMPACTS		Result		Reference
51	Orotic Acid <i>Uridine monophosphate synthase</i>	17.9 H		< 12.3 nmol/mg Creatinine
52	pH <i>Potential of hydrogen; >7 alkaline; <7 acidic</i>	6.1		5.0 - 8.0
53	Microalbumin <i>Blood protein</i>	<dl		< 130.4 mcg/mg Creatinine
54	Phosphate <i>Phosphate intake, absorption, metabolism</i>	74.3		11.2 - 192.4 mg/dL
55	Aldosterone <i>Regulation of sodium & potassium balance</i>	<dl		< 2.1 mcg/g Creatinine
56	Creatinine <i>Creatine breakdown</i>	87.3		29.3 - 296.8 mg/dL
OXALATE METABOLISM		Result		Reference
57	Oxalic Acid <i>Potential uremic toxin</i>	315.1		< 1498.4 nmol/mg Creatinine
58	Glyceric Acid <i>Glyoxylate reductase + B3, Mg</i>	33.6		< 72.2 nmol/mg Creatinine
59	Glycolic Acid <i>Alanine-glyoxylate transaminase + B6</i>	553.0		< 857.7 nmol/mg Creatinine

MICROBIAL METABOLITES

TRYPTOPHAN METABOLITE		Result		Reference
60	Indoleacetic Acid <i>Bifido, Bacteroides, Bacillus, Pseudomonas, E. coli</i>	114.5 H		3.0 - 55.5 nmol/mg Creatinine

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MICROBIAL METABOLITES				
PHENYLALANINE METABOLITE		Result	20% 40% 60% 80%	Reference
61	4-Hydroxyphenylacetic Acid <i>Clostridium, Klebsiella, Pseudomonas, Proteus</i>	864.1 H		43.1 - 528.1 nmol/mg Creatinine
62	Phenylacetic Acid <i>Bacteroides, Pseudomonas, E. coli, Bifido, Lactobacillus</i>	103.5 H		< 8.7 nmol/mg Creatinine
MICROBIAL METABOLITE		Result	20% 40% 60% 80%	Reference
63	Benzoic Acid <i>E. coli, Bifido, Lactobacillus, preservative</i>	2137.9 H		< 621.4 nmol/mg Creatinine
64	Hippuric Acid <i>Glycine conjugate of benzoic acid</i>	<dl		198.7 - 3104.6 nmol/mg Creatinine
65	3,4-Dihydroxyhydrocinnamic Acid <i>Clostridium, E. coli, Bifido, Lactobacillus, Eubacterium</i>	3.3		< 4.4 nmol/mg Creatinine
66	3,5-Dihydroxybenzoic Acid <i>Total microbiota</i>	148.6		< 521.8 nmol/mg Creatinine
67	4-Hydroxybenzoic Acid <i>Total microbiota, Clostridium, Eubacterium</i>	142.5 H		< 13.0 nmol/mg Creatinine
ISOFLAVONE METABOLITE		Result	20% 40% 60% 80%	Reference
68	Equol <i>A range of GI bacteria</i>	11.1		< 15.4 nmol/mg Creatinine
FUNGAL METABOLITE		Result	20% 40% 60% 80%	Reference
69	Arabinitol <i>Candida, Rhodotorula, and others</i>	2.5		< 9.0 nmol/mg Creatinine
70	Citramalic Acid <i>Aspergillus, Saccharomyces, and others</i>	3867.2 H		< 66.8 nmol/mg Creatinine
71	Tricarballic Acid <i>Fusarium, Rumen bacteria</i>	8.9		< 36.2 nmol/mg Creatinine
72	Tartaric Acid <i>Plant component or Nocardia tartaricans/C. albicans</i>	24.9		< 335.3 nmol/mg Creatinine

KEY: < dl = Results below detection limit.

PERSONALIZED METABOLOMIC RECOMMENDATIONS



NUTRIENT SUPPORT RECOMMENDATIONS KEY

Moderate Need for Nutrient Support

Significant Need for Nutrient Support

Note: Nutrient supplementation is up to the treating clinician's discretion with full understanding of the patient's medical history and current clinical condition.

Micronutrients	DRI	Recommendations	Provider Comments
Riboflavin (B2)	1.1 mg	20 mg	
Coenzyme Q10	-	≥ 100 mg	

Additional Support	Recommendations	Provider Comments
Glutathione	Glycine ≥ 500 mg, NAC ≥ 600 mg, Lipoic Acid (LA) ≥ 300 mg	
Antioxidant Need	Increase antioxidants (Vitamin C, Vitamin E, Polyphenols). Improve lifestyle.	
Glycine	500 mg Glycine	
Microbial Dysbiosis	Several microbial metabolites are elevated, evaluate dietary intake and GI health. Consider GI-MAP testing.	