

Urine Metabolomix Profile

Your Personalized Wellness Fingerprint



Metabolomix Profile

Yeast & Dysbiosis Bacterial Overgrowth Clostridia Markers Oxalate Pathway
 Krebs Cycle Neurotransmitters Fatty Acids Nutritional & Amino Acids

This report: Urine Metabolites & Nutritional Analysis

✓ ISO 15189:2022 ✓ NABL Accredited ✓ LC-MS/MS

PATIENT INFORMATION			
Name:	Lab ID:	Collection:	Reported:
Age:	Gender:	Received:	Methodology: LC-MS/MS
Sample: Urine	Facility: metaomics	Ref. Dr.: —	Directly Measured Analytes: 140 (+ 21 derived functional ratio indices, Section 7A)

Clinical Significance: This Metabolomix Profile provides a comprehensive functional assessment across multiple biological domains — including plasma amino acids, hormones, fatty acids, urine metabolites, neurotransmitters, trace elements, and toxic elements — using LC-MS/MS quantitative analysis. Abnormal findings reflect functional imbalances that may contribute to underlying health issues and guide targeted nutritional and clinical interventions.

FUNCTIONAL IMBALANCE OVERVIEW

Scoring Method — Pathway-Weighted Concordance Score (PWCS v2): Each domain is scored from 0 to 9.9 using an asymptotic saturation model ($\tau = 6.0$). Tier weights: Core = 2.0 | Supportive = 0.8 | Exploratory = 0.3. Deviation multipliers: $\leq 25\% = 0.4$ | $25\text{--}200\% = 1.0$ | $200\text{--}500\% = 1.5$ | $500\text{--}1000\% = 2.0$ | $>1000\% = 2.5$. Concordance bonuses (capped at 2.0): awarded when multiple markers confirm the same pathway disruption. Shared markers across domains receive a 50% discount to prevent double-counting. Risk tiers: 0–2.9 = Minimal | 3.0–5.4 = Moderate | 5.5–7.4 = High | 7.5–9.9 = Elevated

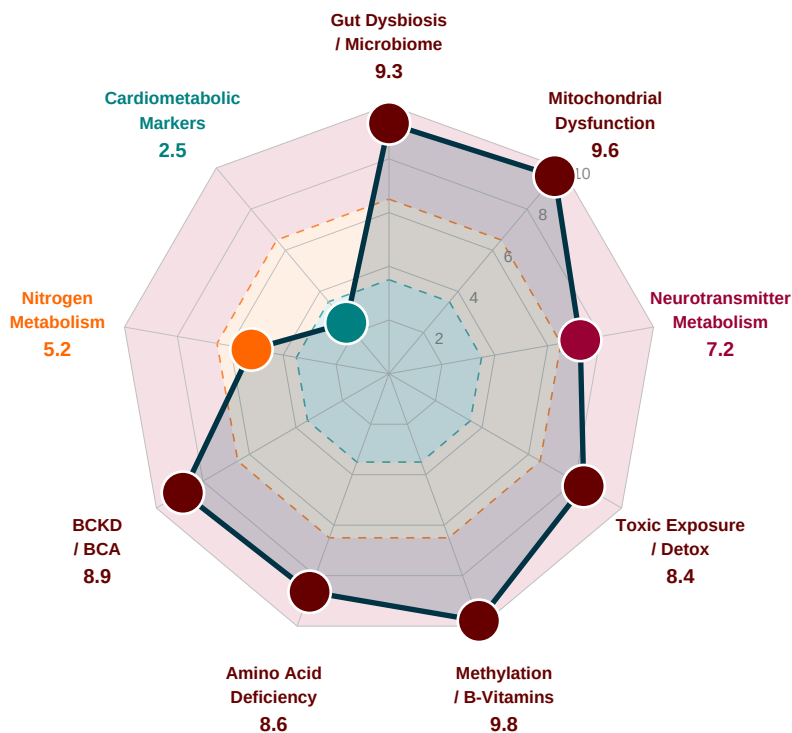
COMPOSITE BURDEN	CRITICAL MULTISYSTEM Domains ≥ 7.5 (Elevated): 6 Avg score: 7.72/10 Domains ≥ 7.5 (Elevated): 6 Avg: 7.72/9.9 PWCS v2 $\tau=6.0$ shared-marker discount applied
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GUT DYSBIOSIS / MICROBIOME ELEVATED	▲ Tartaric acid (4.86× ULN) ▲ Arabinose (1.67× ULN) ▲ DHPPA (2.00× ULN) ▲ 4-Hydroxyhippuric acid (2.13× ULN) ▲ Phenylacetic acid (1.63× ULN) ▲ 2-Hydroxyphenylacetic acid (1.59× ULN) ▼ Hippuric acid (0.26× LLN) ● Within range: HPPHA, p-Cresyl sulfate, 4-Hydroxybenzoic acid, 3-Indoleacetic acid, Benzoic acid PWCS v2 testable=19 markers=14.92 shared_disc=0.80 bonus=2.00 penalty=0.00 raw=16.12
MITOCHONDRIAL DYSFUNCTION / KREBS CYCLE ELEVATED	▲ Pyruvic acid (1.51× ULN) ▲ Cis-aconitic acid (89.89× ULN) ▲ α-Ketoglutaric acid (2.27× ULN) ▲ Lactic acid (1.10× ULN) ▲ Succinic acid (4.77× ULN) ▲ Isocitric acid (2.52× ULN) ▼ Fumaric acid (0.10× LLN) ▼ NAD+ (0.00× LLN) ● Within range: Citric acid, Malic acid PWCS v2 testable=13 markers=17.70 shared_disc=0.00 bonus=2.00 penalty=0.40 raw=19.30
NEUROTRANSMITTER METABOLISM HIGH	▲ Homovanillic acid (HVA) (1.64× ULN) ▲ Vanilmandelic acid (VMA) (1.15× ULN) ▲ 5-HIAA (1.23× ULN) ▲ 2,3-Pyridinedicarboxylic acid (2.59× ULN) ▲ Uracil (1.29× ULN) ▲ Thymine (1.32× ULN) ● Within range: DOPAC, Kynurenic acid, Picolinic acid PWCS v2 testable=9 markers=6.00 shared_disc=0.00 bonus=2.00 penalty=0.30 raw=7.70
TOXIC EXPOSURE / DETOXIFICATION / REDOX ELEVATED	▲ Glucaric acid (1.73× ULN) ▲ Pyroglutamic acid (1.32× ULN) ▲ Orotic acid (7.76× ULN) ▲ 2-Hydroxyhippuric acid (4.58× ULN) ▲ 8-OHdG (2.50× ULN) ● Within range: Bisphenol A, Bisphenol B, 3-/4-Methylhippuric ac, 2-Methylhippuric acid, 3-Nitrotyrosine PWCS v2 testable=12 markers=11.80 shared_disc=2.00 bonus=2.00 penalty=0.90 raw=10.90
METHYLATION / B-VITAMIN FUNCTION ELEVATED	▲ FIGLU (11.85× ULN) ▲ Methylmalonic acid (MMA) (6.67× ULN) ▲ Pyridoxic acid (B6) (1.52× ULN) ▲ Pantothenic acid (B5) (9.19× ULN) ▲ N-Acetylcysteine (NAC) (1.43× ULN) ▲ Glutaric acid (B2) (14.60× ULN) ▼ Ascorbic acid (Vit C) (0.40× LLN) ● Within range: Methionine, Mevalonic acid, 3-Hydroxy-3-methylglut PWCS v2 testable=11 markers=22.20 shared_disc=0.00 bonus=2.00 penalty=0.90 raw=23.30

 AMINO ACID DEFICIENCY / SUBSTRATE INSUFFICIENCY 8.64 ELEVATED	▲ Tyrosine (2.88× ULN) ▲ Phenylalanine (1.94× ULN) ▲ Histidine (1.46× ULN) ▲ Aspartic acid (1.49× ULN) ▲ Creatine (1.49× ULN) ▼ Serine (0.57× LLN) ▼ Lysine (0.21× LLN) ▼ Alanine (0.46× LLN) ▼ Cystine (0.34× LLN) ▼ Glycine (0.63× LLN) ● Within range: Methionine, Isoleucine, Valine, Arginine, Threonine, Glutamic acid, Leucine PWCS v2 testable=19 markers=11.40 shared_disc=0.95 bonus=1.80 penalty=0.30 raw=11.95
 BCKD / BRANCHED-CHAIN AXIS 8.86 ELEVATED	▲ 3-Methyl-2-oxovaleric acid (21.98× ULN) ▲ α-Ketoisocaproic acid (28.59× ULN) ▲ Valerylglycine (1.08× ULN) ▲ Ethylmalonic+Methylsuccinic acid (5.50× ULN) ● Within range: α-Ketoisovaleric acid, Leucine, Isoleucine, Valine, Butyrylglycine, Isovalerylglycine, 3-Hydroxyisovaleric ac PWCS v2 testable=11 markers=11.52 shared_disc=0.00 bonus=1.50 penalty=0.00 raw=13.02
 NITROGEN METABOLISM / UREA CYCLE 5.2 MODERATE	▲ Orotic acid (7.76× ULN) ▲ Creatine (1.49× ULN) ▲ Aspartic acid (1.49× ULN) ▼ Glycine (0.63× LLN) ● Within range: Arginine, Argininosuccinic acid, Phosphoric acid PWCS v2 testable=7 markers=6.40 shared_disc=3.20 bonus=1.20 penalty=0.00 raw=4.40
 GUT-DERIVED / CARDIOMETABOLIC MARKERS 2.47 MINIMAL	▲ TMAO (2.41× ULN) ▼ Hippuric acid (0.26× LLN) ● Within range: p-Cresyl sulfate, HPPHA PWCS v2 testable=4 markers=2.80 shared_disc=1.40 bonus=0.30 penalty=0.00 raw=1.70

● Result Key:	▲ HIGH — above reference range	▼ LOW — below reference range	● Normal — within reference range	N/AP — not applicable / not available
● Abbreviations:	ULN — Upper Limit of Normal	LLN — Lower Limit of Normal	× ULN / × LLN — fold above/below limit	mmol/mol creat. — creatinine-corrected

Functional Domain Profile



9.3 Elevated	9.6 Elevated	7.2 High	8.4 Elevated	9.8 Elevated	8.6 Elevated	8.9 Elevated	5.2 Moderate	2.5 Minimal
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Minimal 0–2.9

Moderate 3.0–5.4

High 5.5–7.4

Elevated 7.5–10

Baby Twisha Acharya

SECTION 1 — INTESTINAL MICROBIAL OVERGROWTH

Yeast & Fungal Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol creat.)
1	Citramalic acid	17.88	1.79×	▲ M	≤ 10.00
2	5-Hydroxymethyl-2-Furoic acid (Aspergillus)	5.5	1.00×	● N	≤ 14.00
3	3-Oxoglutaric acid	0.25	1.00×	● N	≤ 35.00
4	Furan-2,5-dicarboxylic acid (Aspergillus)	4.84	1.00×	● N	≤ 16.00
5	Furancarboxylglycine (Aspergillus)	1.97	1.04×	▲ M	≤ 1.90
6	Tartaric acid (Aspergillus)	21.85	4.86×	▲ H	≤ 4.50
7	Arabinose	8.33	1.67×	▲ M	≤ 5.00
9	Tricarballic acid (Fusarium)	0.65	1.48×	▲ M	≤ 0.44

Bacterial Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol creat.)
10	Hippuric acid	25.96	0.26×	▼ L	100 – 613.00
11	Phenylacetic acid	1.79	1.63×	▲ M	≤ 1.10
12	2-Hydroxyphenylacetic acid	3.19	1.59×	▲ M	0.06 – 2.00
13	4-Hydroxybenzoic acid	1.11	1.00×	● N	≤ 1.30
14	4-Hydroxyhippuric acid	36.19	2.13×	▲ M	0.79 – 17.00
15	Benzoic acid	2.23	1.00×	● N	≤ 3.00
16	Benzoylformic acid	0.29	1.00×	● N	≤ 3.00
17	DHPPA	0.76	2.00×	▲ M	≤ 0.38
18	Trimethylamine-N-Oxide (TMAO)	12.06	2.41×	▲ M	≤ 5.00

Clostridia Bacterial Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol creat.)
19	4-Hydroxyphenylacetic acid (C. difficile)	43.86	2.31×	▲ M	≤ 19.00
20	HPHPA (C. sporogenes, C. botulinum)	4.35	1.00×	● N	≤ 208.00
21	p-Cresyl sulfate (C. difficile)	9.35	1.00×	● N	≤ 75.00
22	3-Indoleacetic acid (Clostridia spp.)	3.8	1.00×	● N	≤ 11.00
23	3-Hydroxypropionic acid	9.05	1.00×	● N	1.00 – 36.00

SECTION 2 — OXALATE METABOLITES & GLYCOLYTIC CYCLE

Oxalate Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
24	Glyceric acid	3.53	1.00×	● N	0.77 – 7.00
25	Glycolic acid	72.69	1.00×	● N	≤ 117.00
26	Oxalic acid	99.91	2.22×	▲ M	≤ 45.00

Glycolytic Cycle Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
27	Lactic acid	66.02	1.10×	▲ M	5 – 60.00
28	Pyruvic acid	13.76	1.51×	▲ M	2 – 9.10

SECTION 3 — MITOCHONDRIAL MARKERS

Krebs Cycle Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
29	Succinic acid	44.4	4.77×	▲ H	0.5 – 9.30
30	Fumaric acid	0.96	0.10×	▼ L	10 – 36
31	Malic acid	0.72	1.00×	● N	0.06 – 1.80
32	α-Ketoglutaric acid	79.28	2.27×	▲ M	5 – 35.00
33	Cis-aconitic acid	2516.82	89.89×	▲ H	6.8 – 28.00
34	Citric acid	226.56	1.00×	● N	150 – 507.00
35	Isocitric acid	193.78	2.52×	▲ M	20 – 77.00

Amino Acid Metabolites (Mitochondrial) & Cofactor/Redox

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
36	3-Methylglutaric acid	5.84	7.68×	▲ H	≤ 0.76
37	3-Methylglutaconic acid	26.85	5.97×	▲ H	≤ 4.50
38	2-Hydroxyglutaric acid	44.91	2.99×	▲ M	≤ 15.00
39	2-Methylglutaric acid	1.43	2.86×	▲ M	≤ 0.50
40	3-Hydroxyglutaric acid	2.92	1.00×	● N	≤ 6.20
41	Succinylacetone	0.53	1.00×	● N	≤ 2.00
42	NAD+ (Nicotinamide adenine dinucleotide)				0.80 – 1.20

SECTION 4 — NEUROTRANSMITTER METABOLITES

Phenylalanine & Tyrosine Metabolites (Catecholamines)					
Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
43	Vanilmandelic acid (norepinephrine, epinephrine)	4.24	1.15×	▲ M	0.46 – 3.70
44	Homovanillic acid / HVA (dopamine)	16.39	4.55×	▲ H	0.80 – 3.60
46	Dihydroxyphenylacetic acid (DOPAC)	0.14	1.00×	● N	0.08 – 3.50

Tryptophan Metabolites (Serotonin & Kynurenine Pathway)					
Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
48	5-Hydroxyindole-3-acetic acid (serotonin)	18.46	1.53×	▲ M	3.8 – 12.10
49	2,3-Pyridinedicarboxylic acid	10.1	2.59×	▲ M	0.85 – 3.90
50	Kynurenic acid	2.11	1.00×	● N	1.00 – 2.20
51	Picolinic acid	0.44	1.00×	● N	≤ 12.39

Pyrimidine Metabolites — Folate Metabolism					
Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
52	Uracil	12.48	1.29×	▲ M	≤ 9.70
53	Thymine	0.74	1.32×	▲ M	≤ 0.56

SECTION 5 — KETONE & FATTY ACID OXIDATION

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
54	3-Hydroxybutyric acid	2.32	1.00×	● N	≤ 3.10
55	Acetoacetic acid	0.18	1.00×	● N	≤ 10.00
56	Adipic acid	6.3	1.66×	▲ M	0.04 – 3.80
57	Suberic acid	0.52	1.00×	● N	0.18 – 2.20
58	Sebacic acid	0.03	1.00×	● N	≤ 0.24
59	Ethylmalonic acid + Methylsuccinic acid	27.49	5.50×	▲ H	0.54 – 5.00
60	Malonic acid	2.41	1.00×	● N	≤ 9.70
61	Tiglylglycine	0.02	1.00×	● N	≤ 2.00
62	Pimelic acid	1.29	1.00×	● N	≤ 2.0

SECTION 6 — NUTRITIONAL MARKERS

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
63	Methylmalonic acid (Vitamin B12 marker)	15.34	6.67×	▲ H	≤ 2.30

64	Formiminoglutamic acid / FIGLU (Folate marker)	37.91	11.85×	▲ H	≤ 3.20
65	Pyridoxic acid (Vitamin B6)	51.75	1.52×	▲ M	5.00 – 34.00
66	Pantothenic acid (Vitamin B5)	91.89	9.19×	▲ H	2.00 – 10.00
67	Glutaric acid (Vitamin B2 / Riboflavin marker)	7.3	14.60×	▲ H	0.04 – 0.50
68	Ascorbic acid (Vitamin C)	15.92	0.40×	▼ L	≥ 40.00
69	3-Hydroxy-3-methylglutaric acid (CoQ10 marker)	25.64	1.00×	● N	0.17 – 39.00
70	Mevalonic acid (Cholesterol biosynthesis)	0.26	1.00×	● N	≤ 0.60
71	N-Acetylcysteine (Glutathione precursor)	0.4	1.43×	▲ M	0.15 – 0.28
72	2-Methylcitric acid (Biotin / Vitamin H)	10.44	3.87×	▲ H	0.19 – 2.70

SECTION 7 — INDICATORS OF DETOXIFICATION

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
73	Pyroglutamic acid (Glutathione / Redox)	44.97	1.32×	▲ M	16 – 34
74	Glutathione Reduced (GSH)	0.06	1.00×	● N	≤ 0.50
75	Glutathione Disulfide (GSSG)	0.01	1.00×	● N	≤ 0.10
77	2-Hydroxybutyric acid (Methylation / Toxic)	9.94	5.52×	▲ H	0.03 – 1.80
78	Orotic acid (Ammonia excess)	5.43	7.76×	▲ H	0.06 – 0.70
79	2-Hydroxyhippuric acid (Salicylates / GI)	5.96	4.58×	▲ H	≤ 1.30
80	2-Methylhippuric acid (Xylene exposure)	0.15	1.00×	● N	≤ 0.28
81	3-/4-Methylhippuric acid (Xylene)	0.62	1.00×	● N	≤ 3.50
82	8-Hydroxydeoxyguanosine (8-OHdG)	0.05	2.50×	▲ M	≤ 0.02
84	Bisphenol A (BPA)	0.01	1.00×	● N	≤ 1.00
85	Bisphenol B (BPB)	0.04	1.00×	● N	≤ 0.20
87	3-Nitrotyrosine (Peroxyne/nitrite / NO stress)	0.05	1.00×	● N	≤ 1.00

SECTION 7A — FUNCTIONAL RATIO INDICES

Derived metabolic ratios provide functional context beyond individual marker levels. These indices reflect enzymatic efficiency, cofactor balance, and pathway flux across key metabolic domains. Values outside reference ranges should be interpreted alongside the individual marker data and the clinical interpretation section.

Sl. No.	Ratio / Index	Calculated Value	Reference Range	Status	Clinical Significance
Mitochondrial Function					

91	Lactate / Pyruvate	4.80	10 – 25	▼ LOW	Cytosolic NADH:NAD ⁺ redox balance; elevated L/P reflects impaired pyruvate entry into mitochondria or excess cytosolic lactate production — indicates cytosolic redox imbalance, not direct electron transport chain failure.
92	Citrate / cis-Aconitate	0.090	2 – 15	▼ LOW	Aconitase enzyme activity; influenced by oxidative stress and iron-dependent mitochondrial function.
93	cis-Aconitate / Isocitrate	12.99	0.1 – 1.5	▲ HIGH	Balance between proximal Krebs cycle intermediates and metabolic flow.
94	α-KG / Succinate	1.79	10 – 80	▼ LOW	Krebs cycle flux efficiency; reflects B-complex and lipoic acid-dependent metabolism.
95	Succinate / Fumarate	46.25	1 – 10	▲ HIGH	May reflect riboflavin (B2)-dependent enzyme activity and mitochondrial efficiency.
96	Fumarate / Malate	1.33	0.1 – 1.5	● NORMAL	Distal Krebs cycle flux and overall mitochondrial energy efficiency.
Neurotransmitter Balance					
97	HVA / VMA	3.87	0.2 – 2.0	▲ HIGH	Balance between dopamine and catecholamine metabolism.
98	HVA / DOPAC	117.1	0.1 – 2.0	▲ HIGH	May reflect COMT enzyme activity and methylation efficiency.
99	Kynurenic / Xanthurenic	11.11	1 – 5	▲ HIGH	Balance of B6-dependent tryptophan metabolism pathways.
100	Kynurenic / Picolinic	4.79	0.5 – 2.5	▲ HIGH	Balance between neuroprotective and immune-regulatory tryptophan pathways.
101	Quinolinic / Kynurenate	4.79	0.5 – 3.0	▲ HIGH	Neurotoxic vs neuroprotective tryptophan balance.
102	Pyridoxic / Serotonin	2.80	5 – 20	▼ LOW	Adequacy of vitamin B6 for serotonin synthesis.
103	Pyridoxic / Kynurenic	24.53	5 – 25	● NORMAL	B6 availability in neuroprotective pathways.
Methylation & B-Vitamin Function					
104	Pyridoxic / Xanthurenic	272.4	5 – 30	▲ HIGH	Functional sufficiency of vitamin B6 in metabolic pathways.
105	MMA / FIGlu	0.405	0.1 – 3.0	● NORMAL	Relative functional status of vitamin B12 versus folate metabolism.
106	Methionine / 2-Hydroxybutyric	0.151	0.5 – 3.5	▼ LOW	Balance between methylation capacity and oxidative stress demand.
Redox, Detoxification & Nitrogen Balance					
107	Ascorbate / Pyroglutamate	0.354	2 – 10	▼ LOW	Vitamin C status relative to glutathione demand.
108	Glycine / Pyroglutamate	2.09	2 – 8	● NORMAL	Phase II detoxification capacity relative to glutathione stress.
109	Serine / Pyroglutamate	0.382	2 – 10	▼ LOW	Balance between neuronal repair substrates and detoxification demand.
110	Pantothenic / Pyroglutamate	2.04	0.1 – 1.5	▲ HIGH	CoA-dependent metabolism (B5) relative to glutathione turnover.
Nitrogen Balance					
111	Orotate / Arginine	5.84	≤ 0.7	▲ HIGH	Urea cycle efficiency and ammonia handling capacity.

sl 112 — Section boundary index (reserved; not reported). Amino acid panel serial numbers commence at sl 113 (Section 8).

SECTION 8 — AMINO ACIDS

Essential Amino Acids

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol)
113	Histidine	437.89	1.46×	▲ M	30 – 300
114	Isoleucine	0.38	1.00×	● N	≤ 2.90
115	Leucine	3.9	1.00×	● N	3.5 – 7.2
116	Lysine	1.05	0.21×	▼ L	5 – 33.4
117	Methionine	1.5	1.00×	● N	1.0 – 1.7
118	Phenylalanine	21.58	1.94×	▲ M	5 – 11.1
119	Threonine	21.24	1.00×	● N	≤ 43.40
120	Valine	1.54	1.00×	● N	≤ 8.30

Non-Essential Amino Acids

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol)
121	Alanine	11.43	0.46×	▼ L	25 – 55.0
122	Arginine	0.93	1.00×	● N	≤ 7.40
123	Aspartic acid	2.09	1.49×	▲ M	0.4 – 1.4
124	Cystine	1.68	0.34×	▼ L	5 – 16.1
125	Glutamic acid	6.83	1.00×	● N	2 – 7.0
126	Glycine	93.85	0.63×	▼ L	150 – 460.2
127	Proline	0.59	1.00×	● N	≤ 9.0
128	Tyrosine	50.33	2.88×	▲ M	8 – 17.5
129	Serine	17.18	0.57×	▼ L	30 – 74.4

SECTION 9 — AMINO ACID METABOLITES

Branched-Chain Ketoacids & Other Catabolism Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol)
130	2-Hydroxyisovaleric acid	0.62	1.00×	● N	≤ 2.00
131	α-Ketoisovaleric acid	0.58	1.00×	● N	≤ 2.10
132	3-Methyl-2-oxovaleric acid	43.97	21.98×	▲ H	≤ 2.00
133	2-Hydroxyisocaproic acid	1.18	1.00×	● N	≤ 2.00
134	α-Ketoisocaproic acid	57.17	28.59×	▲ H	≤ 2.00

136	Mandelic acid	1.2	1.00×	● N	≤ 2.00
137	3-Phenyllactic acid	0.58	1.00×	● N	≤ 2.00
138	Phenylpyruvic acid	0.2	1.00×	● N	≤ 2.00
139	Homogentisic acid	0.12	1.00×	● N	≤ 2.00
140	4-Hydroxyphenyllactic acid	1.06	1.00×	● N	≤ 10.00
141	4-Hydroxyphenylpyruvic acid	1.32	1.00×	● N	≤ 5.00
142	Xanthurenic acid (Kynurenine / Tryptophan)	0.19	1.00×	● N	≤ 0.46
143	3-Hydroxyisovaleric acid	6.25	1.00×	● N	≤ 40.00
144	N-Acetyl-L-aspartic acid	32.05	1.00×	● N	10 – 38.00
145	α-Ketobutyric acid	0.31	1.00×	● N	≤ 3.00
146	4-Hydroxybutyric acid	2.67	1.00×	● N	≤ 4.80
147	O-Phosphorylethanolamine	1.31	0.66×	▼ L	2 – 51.00
148	Creatine	2.98	1.49×	▲ M	0.50 – 2.00
149	Argininosuccinic acid	0.18	1.00×	● N	≤ 5.00

Acylglycines

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
150	Propionylglycine	0.07	1.00×	● N	≤ 0.30
151	Butyrylglycine	0.6	1.00×	● N	0.10 – 2.00
152	Isobutyrylglycine	1.51	1.00×	● N	≤ 9.00
153	3-Methylcrotonylglycine	0.23	1.00×	● N	≤ 1.50
154	2-Methylbutyrylglycine	5.0	5.81×	▲ H	0.01 – 0.86
155	Isovalerylglycine	0.58	1.00×	● N	≤ 10.00
156	Valerylglycine	0.13	1.08×	▲ M	≤ 0.12
157	Hexanoylglycine	0.49	1.00×	● N	≤ 0.80
158	3-Phenylpropionylglycine	ND	ND	ND	≤ 0.60
159	Suberylglycine	0.09	1.00×	● N	≤ 5.40

Other Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Range (mmol/mol)
160	Glucaric acid (Oxidized Sugar)	8.5	1.73×	▲ M	0.10 – 4.90

161	Phosphoric acid (Inorganic Phosphate)	4273.91	1.00×	● N	1000 – 5000
162	*Creatinine (Fluid intake indicator)	1.00 mmol/L	0.91×	▼ L	1.10 – 20.00 mmol/L

INTEGRATED CLINICAL INTERPRETATION & NUTRIENT RECOMMENDATIONS

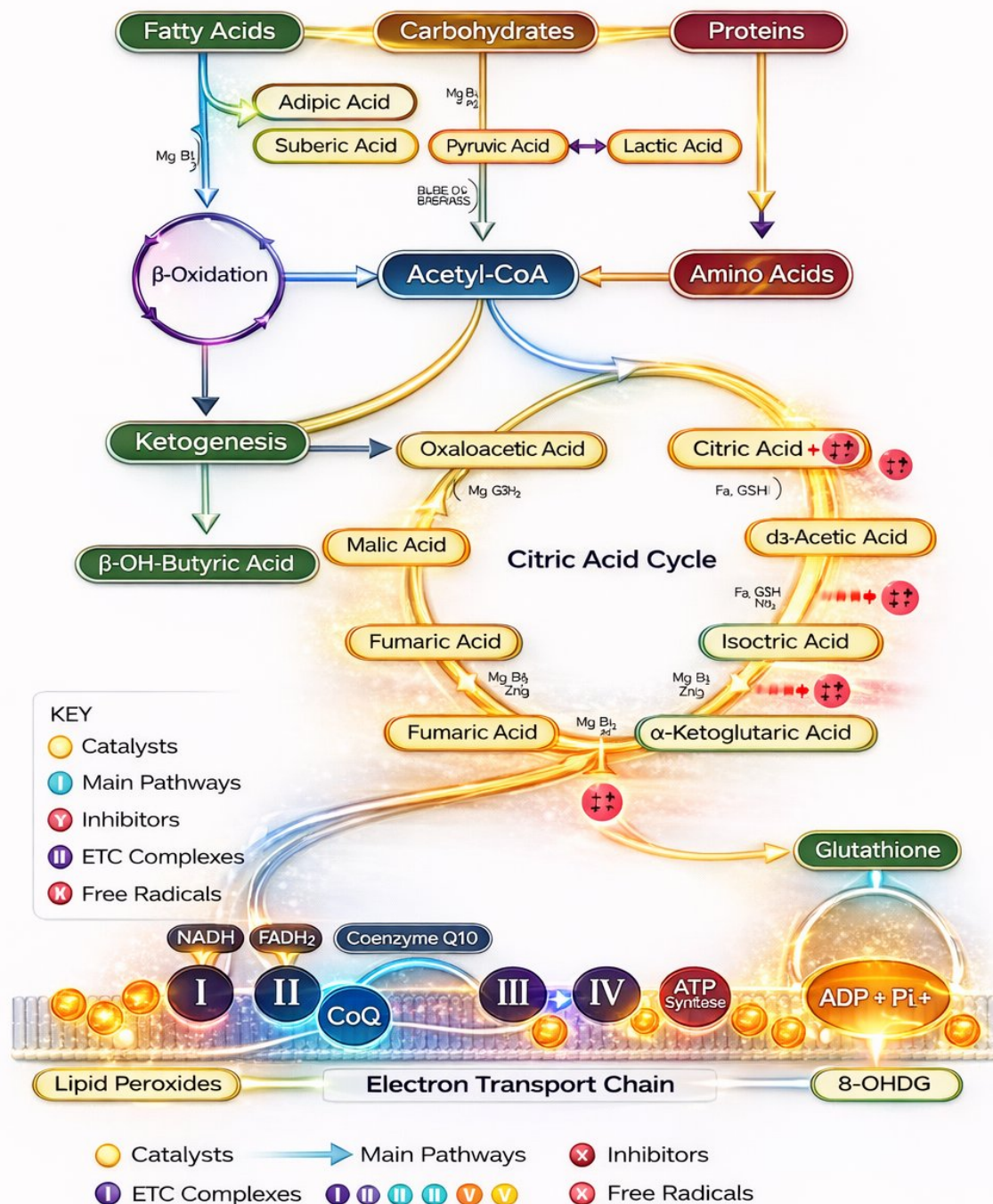
Domain · Clinical priority	Abnormal findings (key markers)	Clinical significance (bullet points)
Gut Dysbiosis / Microbiome ELEVATED Domain score: 9.32 / 10	▲ Tartaric acid — 21.85 (ref ≤ 4.50; 4.86× ULN) ▲ Arabinose — 8.33 (ref ≤ 5.00; 1.67× ULN) ▲ DHPPA — 0.76 (ref ≤ 0.38; 2.00× ULN) ▲ 4-Hydroxyhippuric acid — 36.19 (ref 0.79 – 17.00; 2.13× ULN) ▲ Phenylacetic acid — 1.79 (ref ≤ 1.10; 1.63× ULN) ▲ 2-Hydroxyphenylacetic acid — 3.19 (ref 0.06 – 2.00; 1.59× ULN) ▼ Hippuric acid — 25.96 (ref 100 – 613.00; 0.26× LLN)	■ Paediatric patient: paediatric refs applied for HVA, 5-HIAA (age-appropriate) and Orotic. - Tartaric elevated at 4.86× ULN (21.85) — dietary/grape. - Arabinose elevated at 1.67× ULN (8.33) — yeast/Candida. - DHPPA elevated at 2.00× ULN (0.76) — dysbiotic. - Tricarballic elevated at 1.48× ULN (0.65) — Fusarium.
Mitochondrial Dysfunction / Krebs Cycle ELEVATED Domain score: 9.60 / 10	▲ Pyruvic acid — 13.76 (ref 2 – 9.10; 1.51× ULN) ▲ Cis-aconitic acid — 2516.82 (ref 6.8 – 28.00; 89.89× ULN) ▲ α-Ketoglutaric acid — 79.28 (ref 5 – 35.00; 2.27× ULN) ▲ Lactic acid — 66.02 (ref 5 – 60.00; 1.10× ULN) ▲ Succinic acid — 44.4 (ref 0.5 – 9.30; 4.77× ULN) ▲ Isocitric acid — 193.78 (ref 20 – 77.00; 2.52× ULN) ▼ Fumaric acid — 0.96 (ref 10 – 36; 0.10× LLN) ▼ NAD+ (0.00× LLN)	- Cis-aconitic elevated at 89.89× ULN (2516.82). - Isocitric elevated at 2.52× ULN (193.78). - Pyruvic elevated at 1.51× ULN (13.76). - EM+MS elevated at 5.50× ULN (27.49). - α-KG elevated at 2.27× ULN (79.28).
Neurotransmitter Metabolism HIGH Domain score: 7.23 / 10	▲ Homovanillic acid / HVA — 16.39 (ref 0.80 – 3.60; 4.55× ULN) ▲ Vanilmandelic acid — 4.24 (ref 0.46 – 3.70; 1.15× ULN) ▲ 5-HIAA (1.23× ULN) ▲ 2,3-Pyridinedicarboxylic acid — 10.1 (ref 0.85 – 3.90; 2.59× ULN) ▲ Uracil — 12.48 (ref ≤ 9.70; 1.29× ULN) ▲ Thymine — 0.74 (ref ≤ 0.56; 1.32× ULN)	- Neurotransmitter markers evaluated against paediatric refs (HVA ≤10.00, 5-HIAA ≤15.00) appropriate for age 10y. - HVA elevated at 1.64× ULN (16.39) — increased dopamine turnover. 5-HIAA elevated at 1.23× ULN (18.46) — increased serotonin turnover. - Quinolinic elevated at 2.59× ULN (10.10) — tryptophan diversion. - Address tryptophan/tyrosine availability before initiating direct neurotransmitter support.
Toxic Exposure / Detoxification / Redox ELEVATED Domain score: 8.37 / 10	▲ Glucaric acid — 8.5 (ref 0.10 – 4.90; 1.73× ULN) ▲ Pyroglutamic acid — 44.97 (ref 16 – 34; 1.32× ULN) ▲ Orotic acid — 5.43 (ref 0.06 – 0.70; 7.76× ULN) ▲ 2-Hydroxyhippuric acid — 5.96 (ref ≤ 1.30; 4.58× ULN) ▲ 8-Hydroxydeoxyguanosine — 0.05 (ref ≤ 0.02; 2.50× ULN)	- Glucaric elevated at 1.73× ULN (8.50) — elevated Phase II demand. - Oxalic elevated at 2.22× ULN (99.91). - NAC elevated at 1.43× ULN (0.40) — may reflect NAC supplementation. 8-OHdG elevated at 2.50× ULN (0.05) — oxidative DNA damage. - Vitamin C balance, glutathione precursor support, and exposure reduction recommended.

Domain · Clinical priority	Abnormal findings (key markers)	Clinical significance (bullet points)
Methylation / B-Vitamin Function ELEVATED Domain score: 9.79 / 10	▲ Formiminoglutamic acid / FIGLU — 37.91 (ref ≤ 3.20; 11.85× ULN) ▲ Methylmalonic acid — 15.34 (ref ≤ 2.30; 6.67× ULN) ▲ Pyridoxic acid — 51.75 (ref 5.00 – 34.00; 1.52× ULN) ▲ Pantothenic acid — 91.89 (ref 2.00 – 10.00; 9.19× ULN) ▲ N-Acetylcysteine — 0.4 (ref 0.15 – 0.28; 1.43× ULN) ▲ 3-Oxoglutaric acid — 0.25 (ref ≤ 35.00;) ▼ Ascorbic acid — 15.92 (ref ≥ 40.00; 0.40× LLN)	- MMA elevated at 6.67× ULN (15.34) with concurrent FIGLU elevation — combined B12/folate insufficiency. 2-Methylcitric elevated at 3.87× ULN (10.44). - Pantothenic elevated at 9.19× ULN (91.89) — may reflect B5 supplementation. 5-MTHF, methylcobalamin, P5P supplementation as indicated; reassess at 3 months.
Amino Acid Deficiency / Substrate Insufficiency ELEVATED Domain score: 8.64 / 10	▲ 3-Nitrotyrosine — 0.05 (ref ≤ 1.00;) ▲ Phenylalanine — 21.58 (ref 5 – 11.1; 1.94× ULN) ▲ Histidine — 437.89 (ref 30 – 300; 1.46× ULN) ▲ Aspartic acid — 2.09 (ref 0.4 – 1.4; 1.49× ULN) ▲ Creatine — 2.98 (ref 0.50 – 2.00; 1.49× ULN) ▼ Serine — 17.18 (ref 30 – 74.4; 0.57× LLN) ▼ Lysine — 1.05 (ref 5 – 33.4; 0.21× LLN) ▼ Cystine — 1.68 (ref 5 – 16.1; 0.34× LLN) ▼ Furancarboxylglycine — 1.97 (ref ≤ 1.90; 0.96× LLN)	- Multiple urinary amino acids substantially reduced (Alanine, Lysine); reduced protein availability or absorption issues. - Dietary protein adequacy assessment recommended.
BCKD / Branched-Chain Axis ELEVATED Domain score: 8.86 / 10	▲ 3-Methyl-2-oxovaleric acid — 43.97 (ref ≤ 2.00; 21.98× ULN) ▲ α-Ketoglutaric acid — 57.17 (ref ≤ 2.00; 28.59× ULN) ▲ Isovalerylglycine — 0.58 (ref ≤ 10.00;) ▲ Ethylmalonic+Methylsuccinic acid (5.50× ULN)	- AKBM elevated at 21.98× ULN (43.97). - AKIC elevated at 28.59× ULN (57.17). - BCKD elevation consistent with acquired B1/B2/lipoic acid cofactor insufficiency. - Do NOT initiate BCAA supplementation without first addressing cofactor status.
Nitrogen Metabolism / Urea Cycle MODERATE Domain score: 5.20 / 10	▲ Orotic acid — 5.43 (ref 0.06 – 0.70; 7.76× ULN) ▲ Creatine — 2.98 (ref 0.50 – 2.00; 1.49× ULN) ▲ Aspartic acid — 2.09 (ref 0.4 – 1.4; 1.49× ULN) ▼ Furancarboxylglycine — 1.97 (ref ≤ 1.90; 0.96× LLN)	- Orotic elevated at 7.76× ULN (5.43) — increased urea cycle demand. - Creatine elevated at 1.49× ULN (2.98) — may reflect creatine supplementation. - Urea cycle structural integrity should be evaluated alongside protein intake.
Gut-Derived / Cardiometabolic Markers MINIMAL Domain score: 2.47 / 10	▲ Trimethylamine-N-Oxide — 12.06 (ref ≤ 5.00; 2.41× ULN) ▼ Hippuric acid — 25.96 (ref 100 – 613.00; 0.26× LLN)	- TMAO elevated at 2.41× ULN (12.06). - Dietary and microbiome intervention recommended.
Clinical Priority	Result Symbols	Abbreviations

ELEVATED	Strong multi-marker concordance; warrants immediate clinical attention	▲ Above reference range	ULN	Upper Limit of Normal
HIGH	Important finding; warrants clinical attention	▼ Below reference range	LLN	Lower Limit of Normal
MODERATE	Worth monitoring; secondary to priority domains	● Within range / note	× ULN / × LLN	Fold above / below the reference limit
MINIMAL	No current concern; review at follow-up		mmol/mol creat.	Creatinine-corrected concentration
			N/AP	Not applicable / ratio not calculable
			N/AV	Not available / not detected
			LC-MS/MS	Liquid chromatography–tandem mass spectrometry

PATHWAY REFERENCE — MITOCHONDRIAL HEALTH & ENERGY PRODUCTION

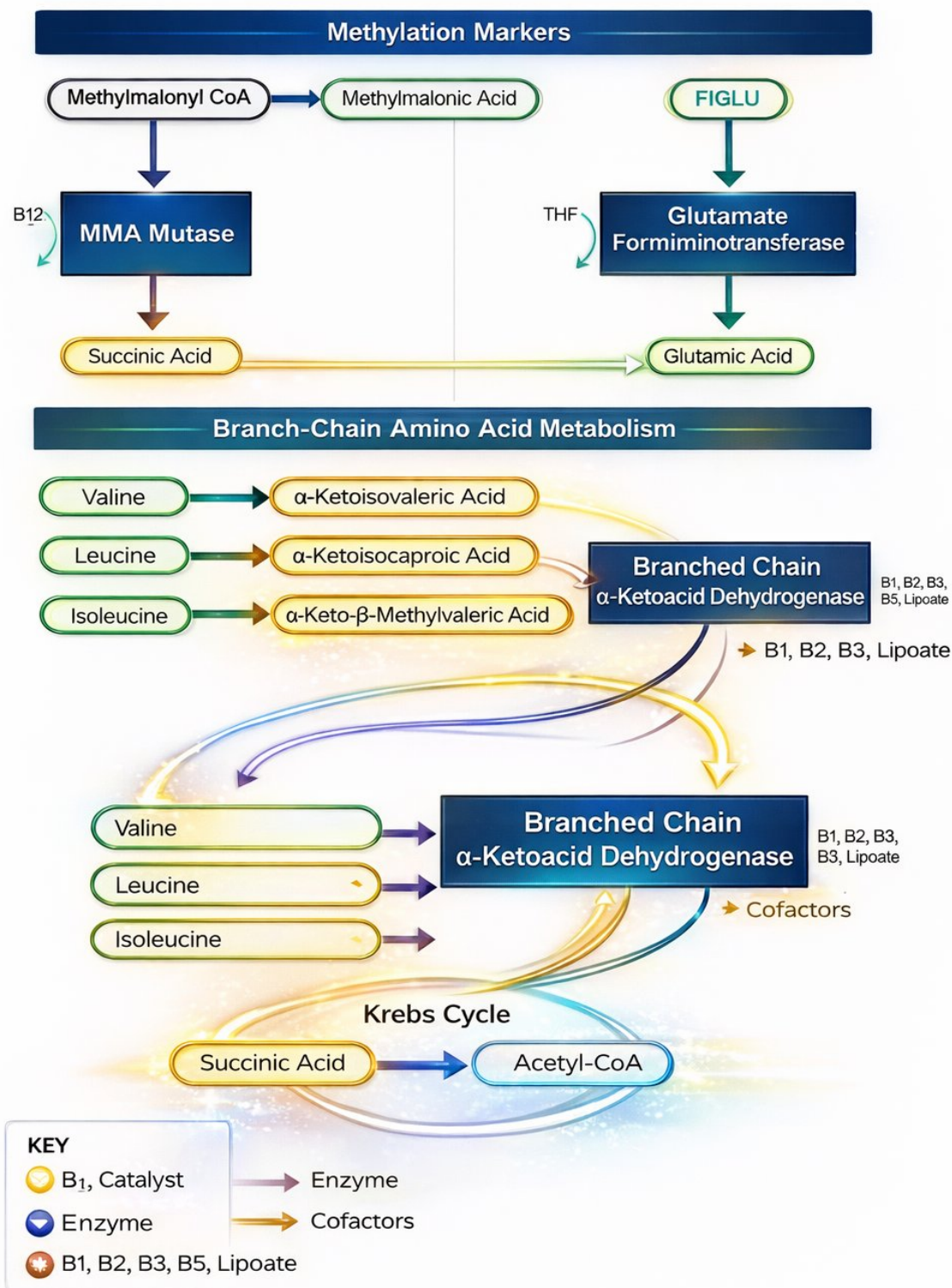
Mitochondrial Health & Energy Production



Citric acid cycle, beta-oxidation, electron transport chain, and key cofactor dependencies.

PATHWAY REFERENCE — METHYLATION MARKERS & BRANCHED-CHAIN AMINO ACID METABOLISM

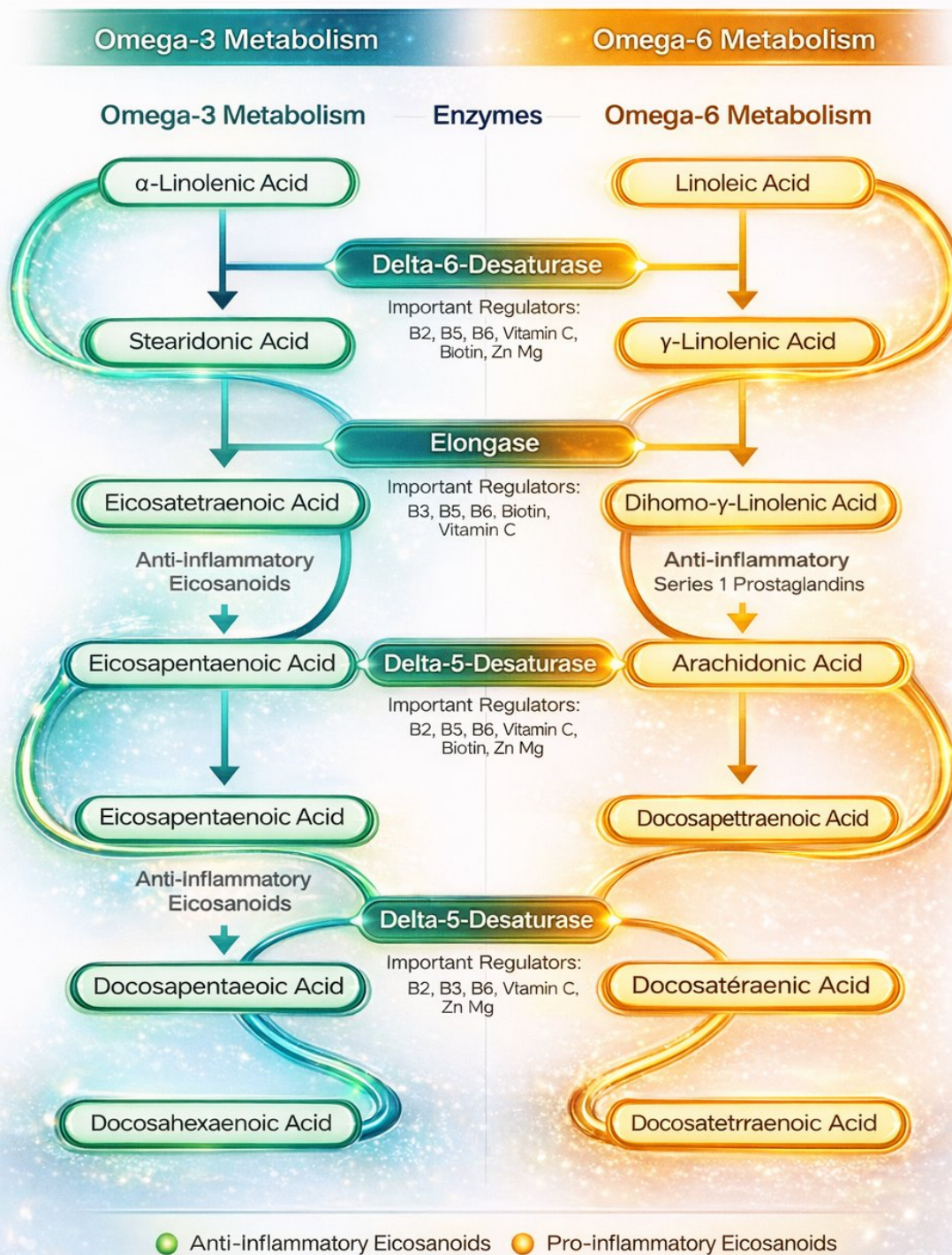
Methylation Markers



FIGLU / folate cycle, MMA / B₁₂ pathway, and BCAA catabolism via BCKD complex.

PATHWAY REFERENCE — FATTY ACID METABOLISM

Fatty Acid Metabolism



Omega-3 and Omega-6 desaturation and elongation pathways with enzyme regulators.

ABBREVIATIONS & GLOSSARY

Analytical & Laboratory			
LC-MS/MS	Liquid Chromatography–Tandem Mass Spectrometry — analytical method used for quantitative metabolite measurement	ISO 15189	International standard for quality and competence in medical laboratories
NABL	National Accreditation Board for Testing and Calibration Laboratories (India)	mmol/mol creat.	Millimoles per mole of creatinine — creatinine-corrected urine concentration unit
N/AP	Not Applicable — result or ratio not calculable for this sample	N/AV	Not Available — marker not detected or below quantification limit
Biomarkers & Metabolites			
5-HIAA	5-Hydroxyindole-3-acetic acid — principal urinary serotonin metabolite	5-MTHF	5-Methyltetrahydrofolate — active, methylated form of dietary folate
8-OHdG	8-Hydroxydeoxyguanosine — oxidative DNA damage marker	AKBM	3-Methyl-2-oxovaleric acid — isoleucine catabolism intermediate; BCKD complex marker
AKIC	α -Ketoisocaproic acid — leucine catabolism intermediate; BCKD complex marker	BPA	Bisphenol A — endocrine-disrupting plasticiser compound
BPB	Bisphenol B — endocrine-disrupting plasticiser compound	DHPPA	3-(3-Hydroxyphenyl)-3-hydroxypropionic acid — marker of dysbiotic polyphenol-metabolising bacteria
DOPAC	Dihydroxyphenylacetic acid — intermediate dopamine metabolite	FIGLU	Formiminoglutamic acid — histidine catabolite; elevated when folate cycle is functionally impaired
GSH	Glutathione (reduced form) — principal intracellular antioxidant tripeptide	GSSG	Glutathione disulfide (oxidised form) — produced during oxidative stress; recycled to GSH by glutathione reductase
HPHPA	3-Hydroxyphenylhydracrylic acid — Clostridium sporogenes / botulinum bacterial marker	HVA	Homovanillic acid — principal urinary dopamine metabolite
MMA	Methylmalonic acid — functional marker of vitamin B12 status	TMAO	Trimethylamine N-oxide — gut-derived metabolite of choline and carnitine; cardiometabolic marker
VMA	Vanilmandelic acid — urinary metabolite of norepinephrine and epinephrine	α -KG	α -Ketoglutaric acid — Krebs cycle intermediate; also called 2-oxoglutaric acid
Enzymes & Pathways			
AADC	Aromatic Amino Acid Decarboxylase — P5P-dependent enzyme converting 5-HTP→serotonin and L-DOPA→dopamine	BCKD	Branched-Chain α -Ketoacid Dehydrogenase — multienzyme complex requiring B1, B2, B3, lipoate cofactors
CoA	Coenzyme A — central metabolic cofactor for acetyl group transfer; synthesised from pantothenic acid (B5)	CoQ10	Coenzyme Q10 (Ubiquinol) — lipid-soluble electron carrier in mitochondrial respiratory chain
FTCD	Formiminotransferase-Cyclodeaminase — folate-dependent enzyme catalysing histidine catabolism; elevated FIGLU indicates reduced FTCD activity	SCAD	Short-Chain Acyl-CoA Dehydrogenase — mitochondrial enzyme for short-chain fatty acid β -oxidation
SHMT	Serine Hydroxymethyltransferase — transfers one-carbon units from serine to the folate cycle		
Nutrients & Cofactors			
B1	Thiamine — cofactor for pyruvate dehydrogenase, α -KG dehydrogenase, and BCKD complex	B2	Riboflavin — cofactor for flavoenzymes including succinate dehydrogenase and BCKD; measured indirectly via glutaric acid
B3	Niacin (Nicotinamide) — precursor to NAD ⁺ ; essential for redox metabolism	B5	Pantothenic acid — precursor to CoA; measured directly in urine as pantothenic acid
B6 / P5P	Pyridoxine / Pyridoxal-5-Phosphate — active B6 cofactor for AADC, transaminases, and transsulfuration; measured as pyridoxic acid	B12	Cobalamin — cofactor for MMA mutase; functional status measured via MMA

Folate	Vitamin B9 — functional status assessed via FIGLU elevation and MMA/FIGLU ratio	NAC	N-Acetylcysteine — cysteine precursor; supports glutathione synthesis via transsulfuration
NAD⁺	Nicotinamide Adenine Dinucleotide — essential redox cofactor for Krebs cycle dehydrogenases, Complex I, PARP, and sirtuins	SAM	S-Adenosylmethionine — universal methyl donor; synthesised from methionine and ATP
Reference Ranges & Report Terms			
LLN	Lower Limit of Normal — the lower boundary of the reference range; values below = Low (▼)	ULN	Upper Limit of Normal — the upper boundary of the reference range; values above = High (▲)
× ULN	Fold above the Upper Limit of Normal (e.g. 2.3× ULN = 2.3 times the upper limit)	× LLN	Fold below the Lower Limit of Normal (e.g. 0.16× LLN = 16% of the lower limit)
BCAA	Branched-Chain Amino Acids — leucine, isoleucine, valine	NMDA	N-Methyl-D-Aspartate — glutamate receptor subtype; kynurenic acid is an endogenous NMDA antagonist
O-PEA	O-Phosphorylethanolamine — precursor to membrane phospholipids; low levels suggest impaired phospholipid synthesis	PHI	Protected Health Information — individually identifiable health data governed by applicable privacy regulations
SAMe	S-Adenosylmethionine (abbreviated SAMe in clinical context) — see SAM		

Disclaimer

This report is intended for informational and supportive clinical use only. It must be interpreted by a qualified healthcare professional in conjunction with the patient's complete clinical history, presenting symptoms, medications, dietary status, and other relevant laboratory investigations.

The findings presented are suggestive and indicative of metabolic patterns and should not be considered as standalone diagnostic evidence for any specific inborn error of metabolism, infection, microbial colonisation, or nutrient deficiency without appropriate clinical correlation and confirmatory testing.

Any recommendations, including nutritional or biochemical considerations, are provided as general guidance or starting points and must be validated and tailored by the treating physician based on the patient's clinical condition.

Report Authentication

Prepared by:

Reviewed by:

Authorised by: