METAOMICS

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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

Sample Patient

Lab ID: MO-FMD-SAMPLE • Age: 45 years • Male • Collection: 28-Oct-2026 • FM Diagnostics

Health First. It Matters.

PATIENT INFORMATION

Name: Sample Patient	**Lab ID: MO-FMD-SAMPLE**	**Collection: 28-Oct-2026**	**Reported: 30-Oct-2026**
Age: 45 years	**Gender: Male**	**Received: 29-Oct-2026**	**Methodology: LC-MS/MS**
Sample: Urine	**Facility: FM Diagnostics**	**Ref. Dr.: Treating Physician**	**Directly Measured Analytes: 130** *(+ 20 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.

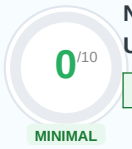
FUNCTIONAL IMBALANCE OVERVIEW

Risk tiers: 0–2.9 = Minimal | 3.0–5.4 = Moderate | 5.5–7.4 = High | 7.5–9.9 = Elevated

■ COMPOSITE BURDEN	**MINIMAL** | **Domains ≥7.5 (Elevated):** 0 | **Avg score:** 1.41/10

GUT DYSBIOSIS / MICROBIOME 2.19/10 MINIMAL	▲ Phenylacetic acid (1.68× ULN) ▲ Trimethylamine-N-Oxide (1.36× ULN)
MITOCHONDRIAL DYSFUNCTION / KREBS CYCLE 2.06/10 MINIMAL	▲ Succinic acid (1.53× ULN) ▲ 3-Methylglutaconic acid (1.16× ULN)
NEUROTRANSMITTER METABOLISM 0/10 MINIMAL	
TOXIC EXPOSURE / DETOXIFICATION / REDOX 0/10 MINIMAL	
METHYLATION / B-VITAMIN FUNCTION 4.19/10 MODERATE	▲ Formiminoglutamic acid / FIG (2.14× ULN) ▼ Pyridoxic acid (0.64× LLN) ▼ Ascorbic acid (0.31× LLN)
AMINO ACID DEFICIENCY / SUBSTRATE INSUFFICIENCY 0.64/10 MINIMAL	▼ Serine (0.95× LLN)
BCKD / BRANCHED-CHAIN AXIS 4.19/10 MODERATE	▲ 3-Methyl-2-oxovaleric acid (1.60× ULN) ▲ α-Ketoisocaproic acid (1.43× ULN) ▼ N-Acetyl-L-aspartic acid (0.21× LLN)

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NITROGEN METABOLISM / UREA CYCLE

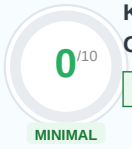
MINIMAL



GUT-DERIVED / CARDIOMETABOLIC MARKERS

MINIMAL

▲ Trimethylamine-N-Oxide (1.36× ULN)

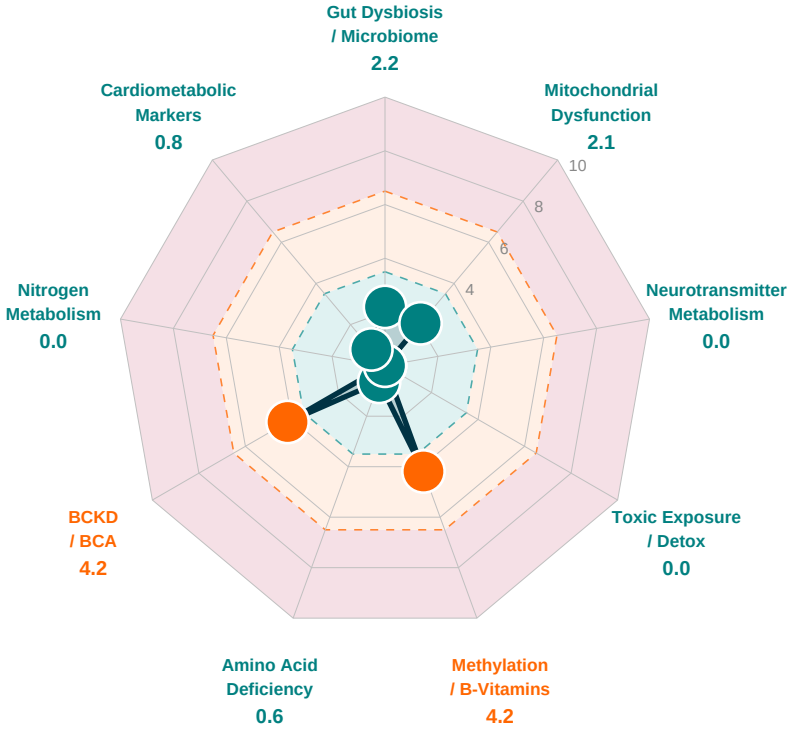


KETONE & FATTY-ACID OXIDATION

MINIMAL

● **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



Gut Dysbiosis / Microbiome	Mitochondrial Dysfunction	Neurotransmitter Metabolism	Toxic Exposure / Detox	Methylation / B-Vitamins	Amino Acid Deficiency	BCKD / BCA	Nitrogen Metabolism	Cardiometabolic Markers
2.2	2.1	0.0	0.0	4.2	0.6	4.2	0.0	0.8
Minimal	Minimal	Minimal	Minimal	Moderate	Minimal	Moderate	Minimal	Minimal

Sample Patient

Minimal 0–2.9 | Moderate 3.0–5.4 | High 5.5–7.4 | Elevated 7.5–10

SECTION 1 — INTESTINAL MICROBIAL OVERGROWTH

Yeast & Fungal Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
1	Citramalic acid	1.85	1.00×	N	≤ 10.00
2	5-Hydroxymethyl-2-Furoic acid (Aspergillus)	3.2	1.00×	N	≤ 14.00
3	3-Oxoglutaric acid	0.08	1.00×	N	≤ 35.00
4	Furan-2,5-dicarboxylic acid (Aspergillus)	2.1	1.00×	N	≤ 16.00
5	Furancarbonylglycine (Aspergillus)	0.85	1.00×	N	≤ 1.90
6	Tartaric acid (Aspergillus)	2.4	1.00×	N	≤ 4.50
7	Arabinose	2.1	1.00×	N	≤ 5.00
8	Tricarballylic acid (Fusarium)	0.18	1.00×	N	≤ 0.44

Bacterial Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
9	Hippuric acid	120.4	1.00×	N	100 – 613.00
10	Phenylacetic acid	1.85	1.68×	▲ M	≤ 1.10
11	2-Hydroxyphenylacetic acid	0.75	1.00×	N	0.06 – 2.00
12	4-Hydroxybenzoic acid	0.42	1.00×	N	≤ 1.30
13	4-Hydroxyhippuric acid	8.2	1.00×	N	0.79 – 17.00
14	Benzoic acid	1.1	1.00×	N	≤ 3.00
15	Benzoylformic acid	0.08	1.00×	N	≤ 3.00
16	DHPPA	0.38	1.00×	N	≤ 0.38
17	Trimethylamine-N-Oxide (TMAO)	6.8	1.36×	▲ M	≤ 5.00

Clostridia Bacterial Markers

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
18	4-Hydroxyphenylacetic acid (C. difficile)	8.5	1.00×	N	≤ 19.00
19	HPHPA (C. sporogenes, C. botulinum)	1.62	1.00×	N	≤ 208.00
20	p-Cresyl sulfate (C. difficile)	1.9	1.00×	N	≤ 75.00
21	3-Indoleacetic acid (Clostridia spp.)	3.4	1.00×	N	≤ 11.00
22	3-Hydroxypropionic acid	2.1	1.00×	N	1.00 – 36.00

SECTION 2 — OXALATE METABOLITES & GLYCOLYTIC CYCLE

Oxalate Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
23	Glyceric acid	1.42	1.00×	● N	0.77 – 7.00
24	Glycolic acid	18.5	1.00×	● N	≤ 117.00
25	Oxalic acid	12.8	1.00×	● N	≤ 45.00

Glycolytic Cycle Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
26	Lactic acid	38.2	1.00×	● N	5 – 60.00
27	Pyruvic acid	6.8	1.00×	● N	2 – 9.10

SECTION 3 — MITOCHONDRIAL MARKERS

Krebs Cycle Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
28	Succinic acid	14.2	1.53×	▲ M	0.5 – 9.30
29	Fumaric acid	22.4	1.00×	● N	10 – 36
30	Malic acid	0.95	1.00×	● N	0.06 – 1.80
31	α-Ketoglutaric acid	12.4	1.00×	● N	5 – 35.00
32	Cis-aconitic acid	18.6	1.00×	● N	6.8 – 28.00
33	Citric acid	210.4	1.00×	● N	150 – 507.00
34	Isocitric acid	38.2	1.00×	● N	20 – 77.00

Amino Acid Metabolites (Mitochondrial) & Cofactor/Redox

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
35	3-Methylglutaric acid	0.62	1.00×	● N	≤ 0.76
36	3-Methylglutaconic acid	5.2	1.16×	▲ M	≤ 4.50
37	2-Hydroxyglutaric acid	1.85	1.00×	● N	≤ 15.00
38	2-Methylglutaric acid	0.12	1.00×	● N	≤ 0.50
39	3-Hydroxyglutaric acid	0.62	1.00×	● N	≤ 6.20
40	Succinylacetone	0.18	1.00×	● N	≤ 2.00
41	NAD+ (Nicotinamide adenine dinucleotide)	1.05	1.00×	● N	0.80 – 1.20

SECTION 4 — NEUROTRANSMITTER METABOLITES

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Phenylalanine & Tyrosine Metabolites (Catecholamines)

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
42	Vanilmandelic acid (norepinephrine, epinephrine)	**1.85**	1.00×	● N	0.46 – 3.70
43	Homovanillic acid / HVA (dopamine)	**1.2**	1.00×	● N	0.80 – 3.60
44	Dihydroxyphenylacetic acid (DOPAC)	**0.48**	1.00×	● N	0.08 – 3.50

Tryptophan Metabolites (Serotonin & Kynurenine Pathway)

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
45	5-Hydroxyindole-3-acetic acid (serotonin)	**5.8**	1.00×	● N	3.8 – 12.10
46	2,3-Pyridinedicarboxylic acid	**1.2**	1.00×	● N	0.85 – 3.90
47	Kynurenic acid	**1.1**	1.00×	● N	1.00 – 2.20
48	Picolinic acid	**4.2**	1.00×	● N	≤ 12.39

Pyrimidine Metabolites — Folate Metabolism

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
49	Uracil	**3.8**	1.00×	● N	≤ 9.70
50	Thymine	**0.12**	1.00×	● N	≤ 0.56

SECTION 5 — KETONE & FATTY ACID OXIDATION

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
51	3-Hydroxybutyric acid	**1.85**	1.00×	● N	≤ 3.10
52	Acetoacetic acid	**2.4**	1.00×	● N	≤ 10.00
53	Adipic acid	**1.62**	1.00×	● N	0.04 – 3.80
54	Suberic acid	**0.45**	1.00×	● N	0.18 – 2.20
55	Sebacic acid	**0.08**	1.00×	● N	≤ 0.24
56	Ethylmalonic acid + Methylsuccinic acid	**3.2**	1.00×	● N	0.54 – 5.00
57	Malonic acid	**2.8**	1.00×	● N	≤ 9.70
58	Tiglylglycine	**0.62**	1.00×	● N	≤ 2.00
59	Pimelic acid	**0.85**	1.00×	● N	≤ 2.0

SECTION 6 — NUTRITIONAL MARKERS

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
60	Methylmalonic acid (Vitamin B12 marker)	**1.42**	1.00×	● N	≤ 2.30

61	Formiminoglutamic acid / FIGLU (Folate marker)	6.85	2.14×	▲ M	≤ 3.20
62	Pyridoxic acid (Vitamin B6)	3.2	0.64×	▼ L	5.00 – 34.00
63	Pantothenic acid (Vitamin B5)	5.8	1.00×	● N	2.00 – 10.00
64	Glutaric acid (Vitamin B2 / Riboflavin marker)	0.28	1.00×	● N	0.04 – 0.50
65	Ascorbic acid (Vitamin C)	12.4	0.31×	▼ L	≥ 40.00
66	3-Hydroxy-3-methylglutaric acid (CoQ10 marker)	8.5	1.00×	● N	0.17 – 39.00
67	Mevalonic acid (Cholesterol biosynthesis)	0.18	1.00×	● N	≤ 0.60
68	N-Acetylcysteine (Glutathione precursor)	0.18	1.00×	● N	0.15 – 0.28
69	2-Methylcitric acid (Biotin / Vitamin H)	1.85	1.00×	● N	0.19 – 2.70

SECTION 7 — INDICATORS OF DETOXIFICATION

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
70	Pyroglutamic acid (Glutathione / Redox)	22.4	1.00×	● N	16 – 34
71	Glutathione Reduced (GSH)	0.18	1.00×	● N	≤ 0.50
72	Glutathione Disulfide (GSSG)	0.04	1.00×	● N	≤ 0.10
73	2-Hydroxybutyric acid (Methylation / Toxic)	0.85	1.00×	● N	0.03 – 1.80
74	Orotic acid (Ammonia excess)	0.42	1.00×	● N	0.06 – 0.70
75	2-Hydroxyhippuric acid (Salicylates / GI)	0.62	1.00×	● N	≤ 1.30
76	2-Methylhippuric acid (Xylene exposure)	0.08	1.00×	● N	≤ 0.28
77	3-/4-Methylhippuric acid (Xylene)	0.95	1.00×	● N	≤ 3.50
78	8-Hydroxydeoxyguanosine (8-OHdG)	0.01	1.00×	● N	≤ 0.02
79	Bisphenol A (BPA)	0.32	1.00×	● N	≤ 1.00
80	Bisphenol B (BPB)	0.08	1.00×	● N	≤ 0.20
81	3-Nitrotyrosine (Peroxynitrite / NO stress)	0.42	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				
82	**Citrate / cis-Aconitate**	**11.31**	2 – 15	● NORMAL	Aconitase enzyme activity; influenced by oxidative stress and iron-dependent mitochondrial function.

83	**cis-Aconitate / Isocitrate**	**0.487**	0.1 – 1.5	● NORMAL	Balance between proximal Krebs cycle intermediates and metabolic flow.
84	**α-KG / Succinate**	**0.873**	10 – 80	▼ LOW	Krebs cycle flux efficiency; reflects B-complex and lipoic acid–dependent metabolism.
85	**Succinate / Fumarate**	**0.634**	1 – 10	▼ LOW	May reflect riboflavin (B2)-dependent enzyme activity and mitochondrial efficiency.
86	**Fumarate / Malate**	**23.58**	0.1 – 1.5	▲ HIGH	Distal Krebs cycle flux and overall mitochondrial energy efficiency.
Neurotransmitter Balance					
87	**HVA / VMA**	**0.649**	0.2 – 2.0	● NORMAL	Balance between dopamine and catecholamine metabolism.
88	**HVA / DOPAC**	**2.50**	0.1 – 2.0	▲ HIGH	May reflect COMT enzyme activity and methylation efficiency.
89	**Kynurenic / Xanthurenic**	**9.17**	1 – 5	▲ HIGH	Balance of B6-dependent tryptophan metabolism pathways.
90	**Kynurenic / Picolinic**	**0.262**	0.5 – 2.5	▼ LOW	Balance between neuroprotective and immune-regulatory tryptophan pathways.
91	**Quinolinate / Kynurenate**	**1.09**	0.5 – 3.0	● NORMAL	Neurotoxic vs neuroprotective tryptophan balance.
92	**Pyridoxic / Serotonin**	**0.552**	5 – 20	▼ LOW	Adequacy of vitamin B6 for serotonin synthesis.
93	**Pyridoxic / Kynurenic**	**2.91**	5 – 25	▼ LOW	B6 availability in neuroprotective pathways.
Methylation & B-Vitamin Function					
94	**Pyridoxic / Xanthurenic**	**26.67**	5 – 30	● NORMAL	Functional sufficiency of vitamin B6 in metabolic pathways.
95	**MMA / FIGlu**	**0.207**	0.1 – 3.0	● NORMAL	Relative functional status of vitamin B12 versus folate metabolism.
96	**Methionine / 2-Hydroxybutyric**	**1.41**	0.5 – 3.5	● NORMAL	Balance between methylation capacity and oxidative stress demand.
Redox, Detoxification & Nitrogen Balance					
97	**Ascorbate / Pyroglutamate**	**0.554**	2 – 10	▼ LOW	Vitamin C status relative to glutathione demand.
98	**Glycine / Pyroglutamate**	**8.28**	2 – 8	▲ HIGH	Phase II detoxification capacity relative to glutathione stress.
99	**Serine / Pyroglutamate**	**1.27**	2 – 10	▼ LOW	Balance between neuronal repair substrates and detoxification demand.
100	**Pantothenic / Pyroglutamate**	**0.259**	0.1 – 1.5	● NORMAL	CoA-dependent metabolism (B5) relative to glutathione turnover.
Nitrogen Balance					
101	**Orotate / Arginine**	**0.200**	≤ 0.7	● NORMAL	Urea cycle efficiency and ammonia handling capacity.

SECTION 8 — AMINO ACIDS

Essential Amino Acids

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
102	Histidine	**148.2**	1.00×	● N	30 – 300

103	Isoleucine	1.85	1.00×	● N	≤ 2.90
104	Leucine	4.2	1.00×	● N	3.5 – 7.2
105	Lysine	18.4	1.00×	● N	5 – 33.4
106	Methionine	1.2	1.00×	● N	1.0 – 1.7
107	Phenylalanine	8.5	1.00×	● N	5 – 11.1
108	Threonine	22.4	1.00×	● N	≤ 43.40
109	Valine	4.8	1.00×	● N	≤ 8.30

Non-Essential Amino Acids

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
110	Alanine	32.4	1.00×	● N	25 – 55.0
111	Arginine	2.1	1.00×	● N	≤ 7.40
112	Aspartic acid	0.62	1.00×	● N	0.4 – 1.4
113	Cystine	8.2	1.00×	● N	5 – 16.1
114	Glutamic acid	2.85	1.00×	● N	2 – 7.0
115	Glycine	185.4	1.00×	● N	150 – 460.2
116	Proline	4.2	1.00×	● N	≤ 9.0
117	Tyrosine	12.4	1.00×	● N	8 – 17.5
118	Serine	28.5	0.95×	▼ 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
119	2-Hydroxyisovaleric acid	0.38	1.00×	● N	≤ 2.00
120	α-Ketoisovaleric acid	0.18	1.00×	● N	≤ 2.10
121	3-Methyl-2-oxovaleric acid	3.2	1.60×	▲ M	≤ 2.00
122	2-Hydroxyisocaproic acid	0.12	1.00×	● N	≤ 2.00
123	α-Ketoisocaproic acid	2.85	1.43×	▲ M	≤ 2.00
124	Mandelic acid	0.85	1.00×	● N	≤ 2.00
125	3-Phenyllactic acid	0.62	1.00×	● N	≤ 2.00
126	Phenylpyruvic acid	0.08	1.00×	● N	≤ 2.00

127	Homogentisic acid	**0.01**	1.00×	● N	≤ 2.00
128	4-Hydroxyphenyllactic acid	**4.2**	1.00×	● N	≤ 10.00
129	4-Hydroxyphenylpyruvic acid	**0.42**	1.00×	● N	≤ 5.00
130	Xanthurenic acid (Kynurenine / Tryptophan)	**0.12**	1.00×	● N	≤ 0.46
131	3-Hydroxyisovaleric acid	**2.4**	1.00×	● N	≤ 40.00
132	N-Acetyl-L-aspartic acid	**2.1**	0.21×	● N	10 – 38.00
133	α-Ketobutyric acid	**0.38**	1.00×	● N	≤ 3.00
134	4-Hydroxybutyric acid	**1.85**	1.00×	● N	≤ 4.80
135	O-Phosphorylethanolamine	**12.4**	1.00×	● N	2 – 51.00
136	Creatine	**0.62**	1.00×	● N	0.50 – 2.00
137	Argininosuccinic acid	**2.8**	1.00×	● N	≤ 5.00

Acylglycines

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
138	Propionylglycine	**0.02**	1.00×	● N	≤ 0.30
139	Butyrylglycine	**0.18**	1.00×	● N	0.10 – 2.00
140	Isobutyrylglycine	**0.18**	1.00×	● N	≤ 9.00
141	3-Methylcrotonylglycine	**0.12**	1.00×	● N	≤ 1.50
142	2-Methylbutyrylglycine	**0.22**	1.00×	● N	0.01 – 0.86
143	Isovalerylglycine	**0.28**	1.00×	● N	≤ 10.00
144	Valerylglycine	**0.01**	1.00×	● N	≤ 0.12
145	Hexanoylglycine	**0.28**	1.00×	● N	≤ 0.80
146	3-Phenylpropionylglycine	**0.01**	1.00×	● N	≤ 0.60
147	Suberylglycine	**0.04**	1.00×	● N	≤ 5.40

Other Metabolites

Sl.	Metabolic Marker	Observed Value (mmol/mol creat.)	×	Result	Reference Range (mmol/mol
148	Glucaric acid (Oxidized Sugar)	**2.85**	1.00×	● N	0.10 – 4.90
149	Phosphoric acid (Inorganic Phosphate)	**1850.4**	1.00×	● N	1000 – 5000
150	*Creatinine (Fluid intake indicator)	**8.20 mmol/L**	1.00×	● N	1.10 – 20.00 mmol/L

INTEGRATED CLINICAL INTERPRETATION & NUTRIENT RECOMMENDATIONS

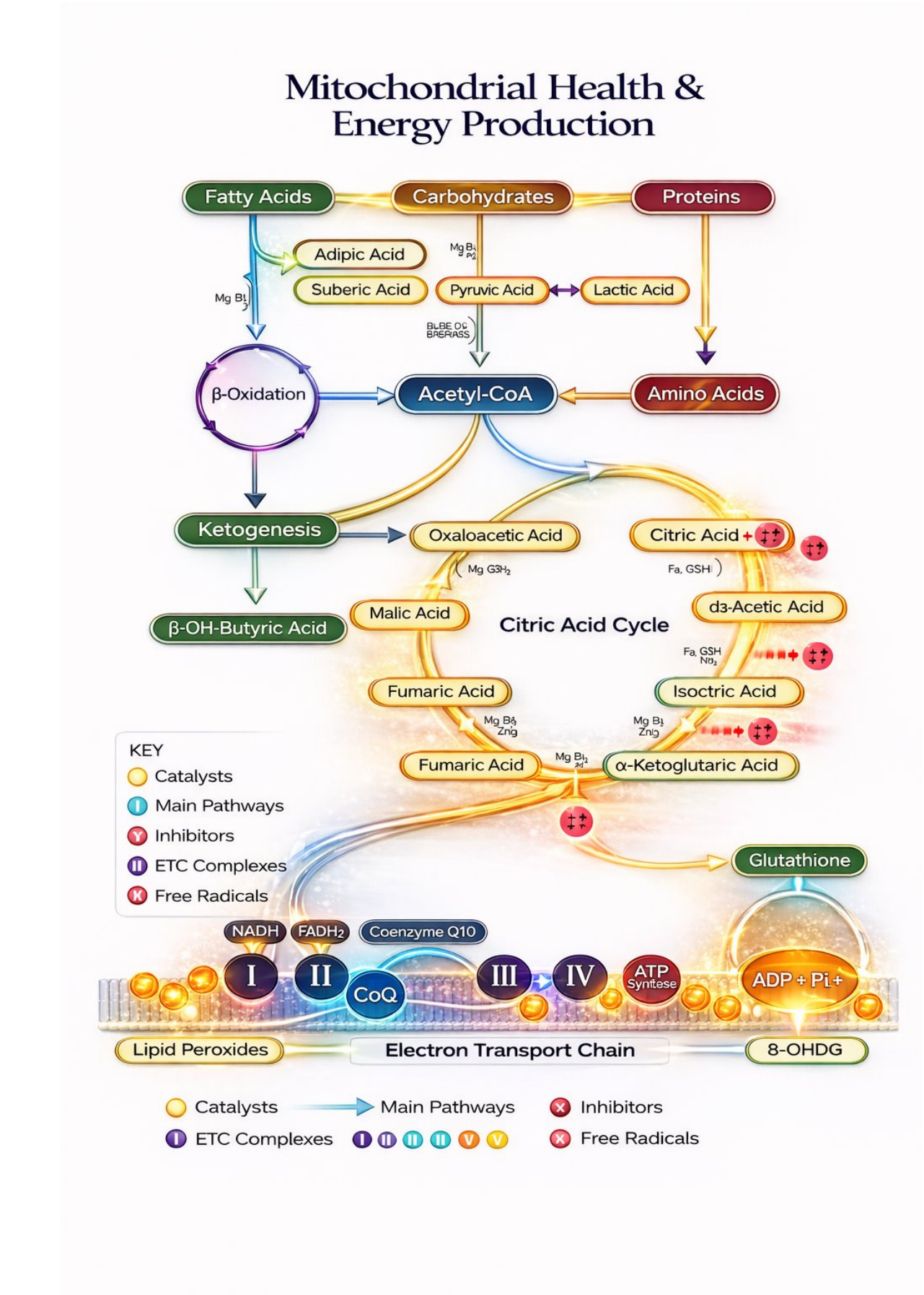
Domain · Clinical priority	Abnormal findings (key markers)	Clinical significance (bullet points)
Gut Dysbiosis / Microbiome MINIMAL Domain score: 2.19 / 10	▲ Phenylacetic acid — 1.85 (ref ≤ 1.10; 1.68× ULN) ▲ Trimethylamine-N-Oxide — 6.8 (ref ≤ 5.00; 1.36× ULN)	• Aromatic bacterial fermentation elevated (1 marker(s)) — reflects phenolic dysbiosis or altered colonic metabolism. • TMAO elevated — gut-derived cardiometabolic risk marker. Reduce dietary phosphatidylcholine (red meat, egg yolk, full-fat dairy) and consider L. reuteri / A. muciniphila probiotic support.
Mitochondrial Dysfunction / Krebs Cycle MINIMAL Domain score: 2.06 / 10	▲ Succinic acid — 14.2 (ref 0.5 – 9.30; 1.53× ULN) ▲ 3-Methylglutaconic acid — 5.2 (ref ≤ 4.50; 1.16× ULN)	• Mitochondrial inner-membrane / CoA-pathway stress indicated by elevated 3-methylglutaconic / HMG markers. B2 (riboflavin), lipoic acid, and CoQ10 repletion supports mitochondrial function.
Neurotransmitter Metabolism MINIMAL Domain score: 0.00 / 10	● All measured markers within reference range	• Neurotransmitter markers within reference range; no catecholamine or tryptophan-pathway disruption pattern detected.
Toxic Exposure / Detoxification / Redox MINIMAL Domain score: 0.00 / 10	● All measured markers within reference range	• Redox and toxic-exposure markers within reference range; no significant xenobiotic burden or oxidative-stress pattern detected.
Methylation / B-Vitamin Function MODERATE Domain score: 4.19 / 10	▲ Formiminoglutamic acid / FIGLU — 6.85 (ref ≤ 3.20; 2.14× ULN) ▼ Pyridoxic acid — 3.2 (ref 5.00 – 34.00; 0.64× LLN) ▼ Ascorbic acid — 12.4 (ref ≥ 40.00; 0.31× LLN)	• Functional folate insufficiency at the FTCD step — FIGLU elevated with intact B12 handling. 5-MTHF (1–5 mg/day) supplementation preferred over folic acid. • Low Pyridoxic acid indicates functional B6 insufficiency affecting aminotransferase and neurotransmitter synthesis — P5P 25–50 mg/day recommended. • Vitamin C depleted — impairs methylation support, collagen synthesis, and antioxidant capacity. Liposomal Vitamin C 500–1000 mg/day recommended.
Amino Acid Deficiency / Substrate Insufficiency MINIMAL Domain score: 0.64 / 10	▼ Serine — 28.5 (ref 30 – 74.4; 0.95× LLN)	• Amino acid profile broadly within reference; no substrate insufficiency pattern detected.
BCKD / Branched-Chain Axis MODERATE Domain score: 4.19 / 10	▲ 3-Methyl-2-oxovaleric acid — 3.2 (ref ≤ 2.00; 1.60× ULN) ▲ α-Ketoisocaproic acid — 2.85 (ref ≤ 2.00; 1.43× ULN) ▼ N-Acetyl-L-aspartic acid — 2.1 (ref 10 – 38.00; 0.21× LLN)	• Branched-chain α-keto acid elevation (2 marker(s)) — indicates BCKD complex cofactor stress. B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic), and lipoic acid repletion advised. • Do NOT initiate BCAA supplementation before cofactor status is corrected — this would deepen the metabolic block.
Nitrogen Metabolism / Urea Cycle MINIMAL Domain score: 0.00 / 10	● All measured markers within reference range	• Urea cycle markers within reference range; ammonia handling appears adequate.

Domain · Clinical priority	Abnormal findings (key markers)	Clinical significance (bullet points)
Gut-Derived / Cardiometabolic Markers MINIMAL Domain score: 0.79 / 10	▲ Trimethylamine-N-Oxide — 6.8 (ref ≤ 5.00; 1.36× ULN)	• TMAO elevated — gut-derived cardiometabolic risk marker. Reduce dietary phosphatidylcholine (red meat, egg yolk, full-fat dairy) and consider L. reuteri / A. muciniphila probiotic support.
Ketone & Fatty-Acid Oxidation MINIMAL Domain score: 0.00 / 10	● All measured markers within reference range	• Fatty acid oxidation and ketone markers within reference range; mitochondrial β-oxidation unremarkable.

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

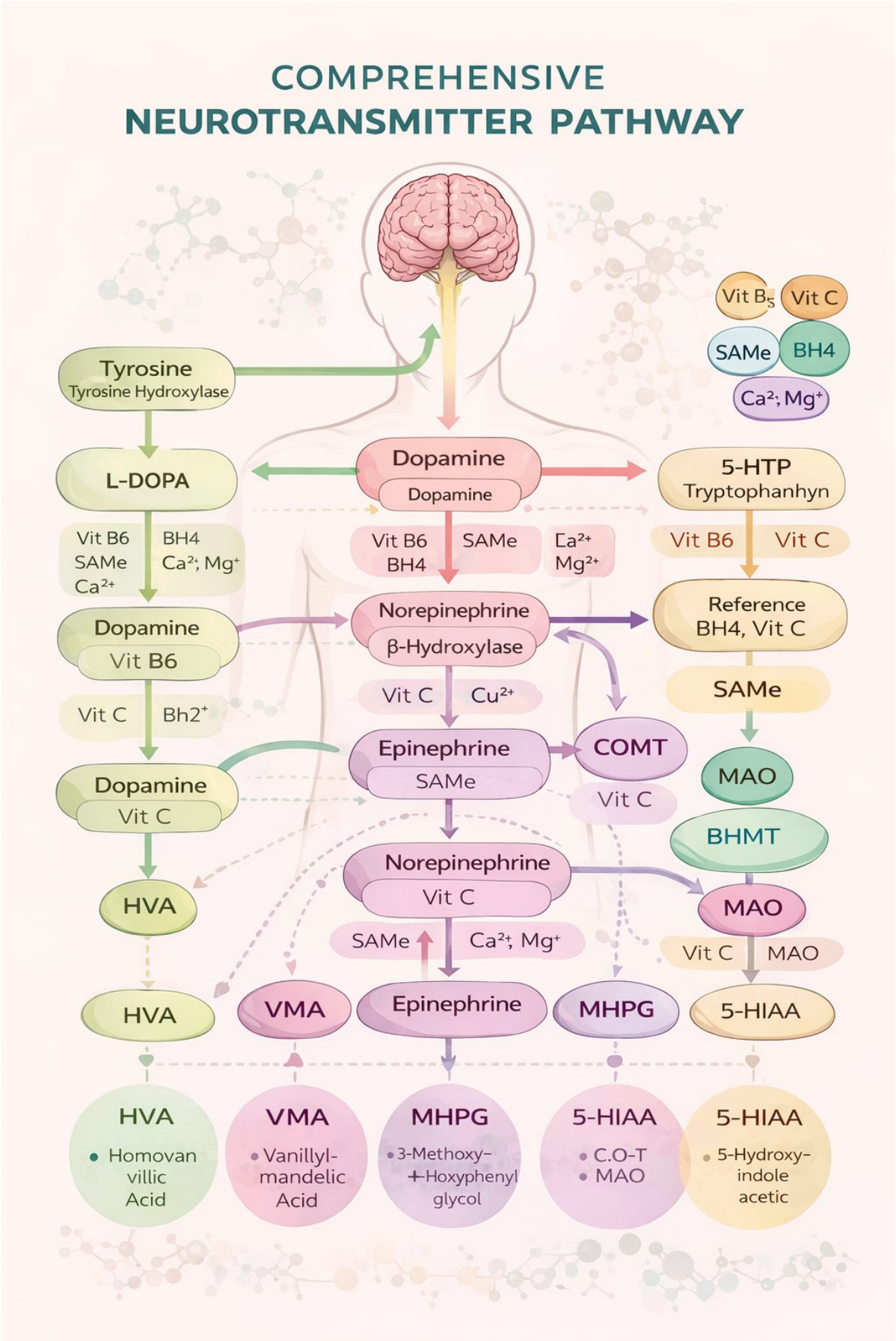
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PATHWAY REFERENCE — MITOCHONDRIAL HEALTH & ENERGY PRODUCTION



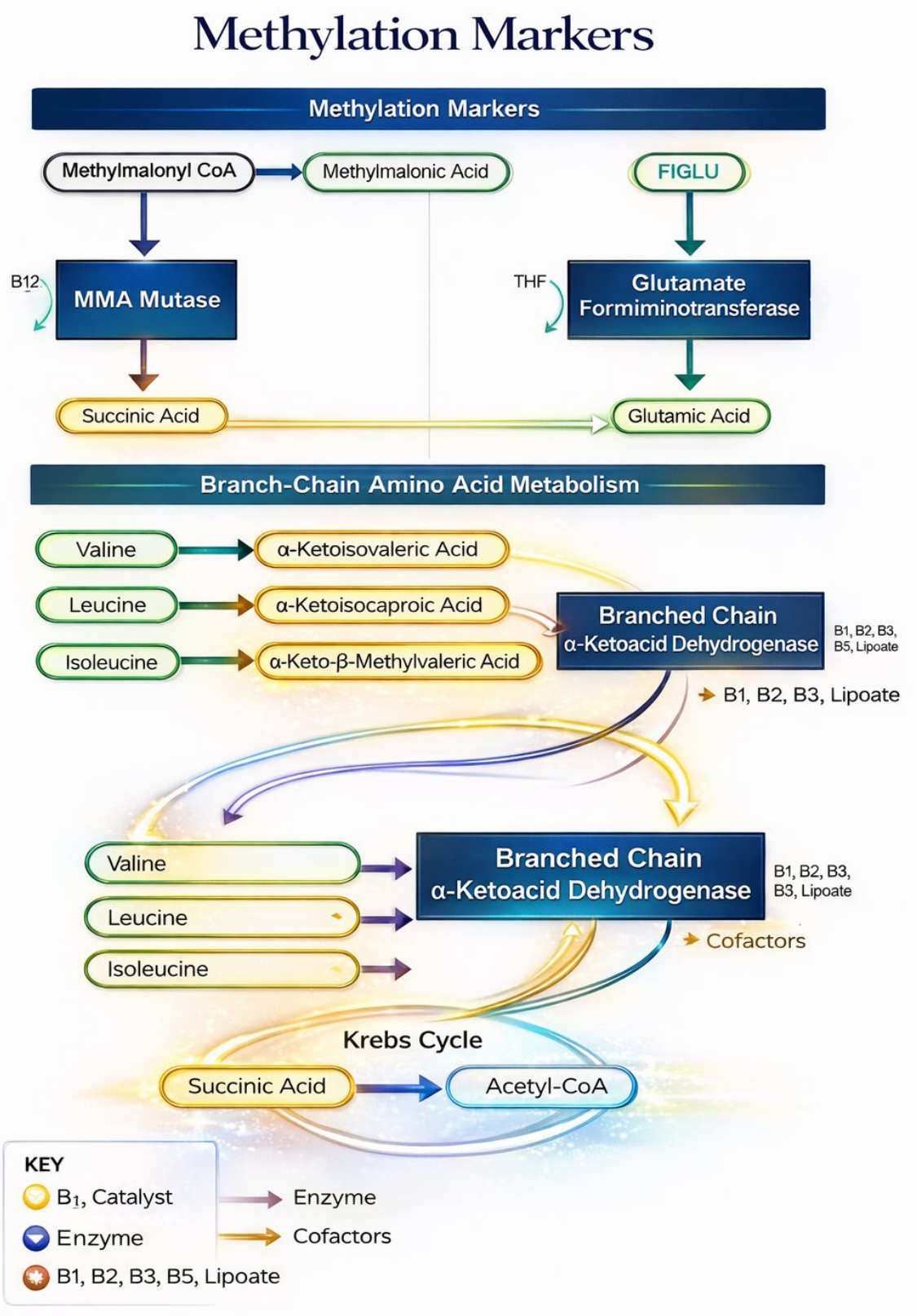
Citric acid cycle, beta-oxidation, electron transport chain, and key cofactor dependencies.

PATHWAY REFERENCE — COMPREHENSIVE NEUROTRANSMITTER PATHWAY



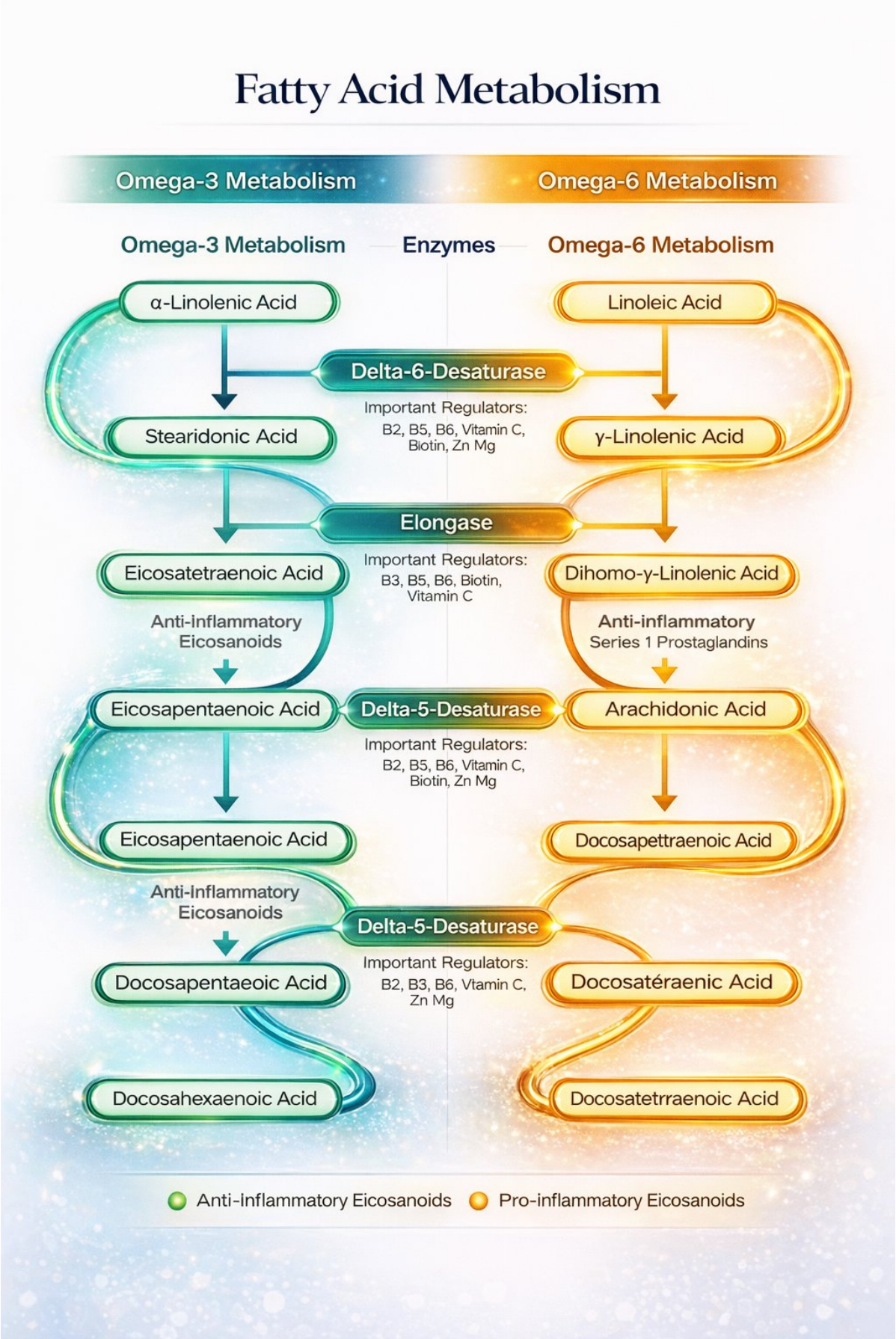
Dopamine, serotonin, and catecholamine synthesis routes with cofactor requirements.

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



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

PATHWAY REFERENCE — 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

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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

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