KBMO DIAGNOSTICS

METABOLIC INSIGHTS PROFILE
NEXT GENERATION ORGANIC ACIDS

Accession Number: URN_250925-00005
Name: WILSON, ETHAN
Date of Birth:
Sex:
Practitioner: Tammi Hall

Sample Type: Urine
Date of Collection:
Time of Collection:
Date Completed: 03/10/2025
Date Reported: 03/10/2025

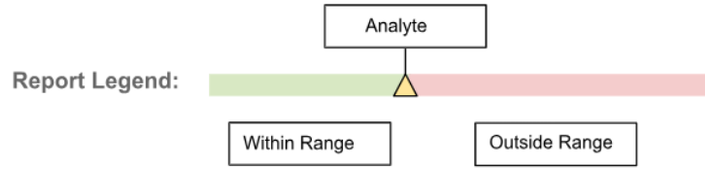
Metabolic Insights Profile

The Metabolic Insights Profile provides actionable information by analyzing urine Microbial Metabolites, Detoxification Indicators, Metabolic and Mitochondrial Function Markers, Nutritional Markers & Oxalates, and Neurotransmitter Metabolic Markers.

Reference Ranges for this test profile were established by sampling a healthy population. The mean and standard deviation were calculated, and ranges were determined to be 2 standard deviations of the mean.

Results that are elevated are noted with an "H" and a red marker appears to the left of the analyte name. Values that are below the lower limit of quantitation are designated as <LLOQ and above the upper limit of quantitation are indicated as >ULOQ.

The graphical representation of the result is a yellow triangle marking where the result falls within or outside of the reference range.



This test was developed and its performance characteristics were determined by KBMO Diagnostics, LLC. It has not been cleared by the U.S. Food & Drug Administration (FDA)."
Methodology: LC/MS/MS; Enzymatic (Creatinine)

Microbial Metabolites

Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
Fungal Metabolites				
1 Arabitol	1.00		0.0 40.0	≤40.0
2 Citramalic	2.00		0.0 5.0	≤5.0
3 5-Hydroxymethyl-2-furoic	3.00		0.0 40.0	≤40.0
4 Furancarbonylglycine	5.00		0.0 25.0	≤25.0
5 Furan-2,5-dicarboxylic	4.00		0.0 4.0	≤4.0
6 Tricarballylate	5.00 H		0.0 2.5	≤2.5
7 Ascorbic/Erythorbic	3.00		0.0 10.0	≤10.0
Clostridia Metabolites				
8 HPHPA	5.00		0.0 45.0	≤45.0
9 m-Cresol-sulphate	2.00		0.0 90.0	≤90.0
10 3-Indoleacetic	3.00		0.0 5.0	≤5.0
Bacterial Metabolites				
11 Benzoic	5.00 H		0.0 2.0	≤2.0
12 Hippuric	3.00		0.0 200.0	≤200.0
13 4-Hydroxybenzoic	5.00 H		0.0 0.7	≤0.7
14 4-Hydroxyphenylacetic	2.00 H		0.0 1.2	≤1.2
15 4-Hydroxyphenyllactic	6.00 H		0.0 5.0	≤5.0
Miscellaneous Microbial Metabolites				
16 Tartaric	5.00		0.0 25.0	≤25.0

Detoxification Indicators

Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
17 L-Pyrogluatamic acid	2.00		0.0 40.0	≤40.0
18 N-Acetylcysteine (NAC)	5.00 H		0.0 1.0	≤1.0
19 8-Hydroxy-2-deoxyguanosine	4.00 H		0.0 0.0	≤0.008

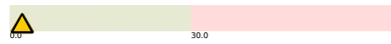
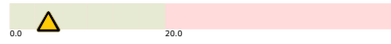
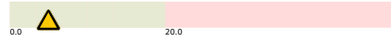
Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
20 2-Hydroxybutyric	2.00		0.0 8.0	≤8.0
21 2- hydroxyhippuric	5.00 H		0.0 2.8	≤2.8

Metabolism and Mitochondrial Function

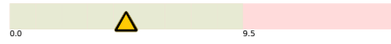
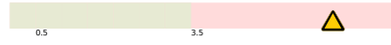
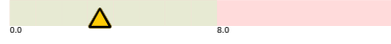
Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
Citric Acid Cycle				
22 Citric Acid	3.00		0.0 500.0	≤500.0
23 Cis-Aconitate	5.00		0.0 5.0	≤5.0
24 Isocitric	2.00		0.0 45.0	≤45.0
25 2-Oxoglutaric	5.00		0.0 38.0	≤38.0
26 Succinic acid	3.00		0.0 8.0	≤8.0
27 Fumarate	5.00 H		0.0 4.0	≤4.0
28 Malic acid	2.00 H		0.0 1.0	≤1.0
Glycololysis Metabolism/Lactic Acid Cycle				
29 Pyruvic acid	3.00		0.0 20.0	≤20.0
30 L-Lactic acid	5.00		0.0 30.0	≤30.0
31 2,4-dihyroxybutanoic acid	9.00		0.0 50.0	≤50.0
Fatty Acid Metabolism				
32 Suberic acid	36.00 H		0.0 3.0	≤3.0
33 Ethylmalonate	5.00		0.0 10.0	≤10.0
34 3-Hydroxybutyric	7.00		0.0 10.0	≤10.0
35 Acetoacetic	5.00		0.0 25.0	≤25.0
36 Methylsuccinic	3.00		0.0 10.0	≤10.0
39 Sebacic	5.00 H		0.0 0.5	≤0.5

Nutrition and Oxalates

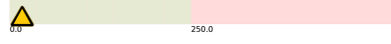
Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
Nutrients				
38 Xanthurenic acid	2.00 H		0.0 1.6	≤1.6
39 4-Pyridoxic (B6)	14.00 H		0.0 10.0	≤10.0
40 Pantothenic (B5)	3.00		0.0 3.0	≤3.0
41 Glutaric (B2)	5.00		0.0 8.0	≤8.0
42 Formiminoglutamic acid (FIGLU)	2.00		0.0 2.5	≤2.5
43 Methylmalonic (MMA)	5.00 H		0.0 4.0	≤4.0
Pyrimidine Metabolites				
44 Uracil	3.00		0.0 3.0	≤3.0
45 Thymine	5.00 H		0.0 1.0	≤1.0
Oxalates				
46 Oxalic	4.00		0.0 35.0	≤35.0
47 Glycolic	2.00		0.0 90.0	≤90.0
48 Glyceric	5.00		0.0 5.0	≤5.0
Inborn Errors of Metabolism				
49 3-Methylglutaconic	2.00		0.0 50.0	≤50.0
50 2-Oxoisovaleric	6.00		0.0 100.0	≤100.0
51 Malonic	4.00		0.0 50.0	≤50.0
52 2-Oxoisocaproic	2.00		0.0 100.0	≤100.0
53 2-Oxo-4-methiolbutyric acid	3.00		0.0 10.0	≤10.0
54 3-Hydroxy-3-Methylglutaric (CoQ10)	3.00		0.0 100.0	≤100.0
55 Mandelic	5.00		0.0 10.0	≤10.0
56 3-Phyenyllactic	4.00		0.0 10.0	≤10.0
57 Homogentisic	3.00		0.0 20.0	≤20.0
58 Orotic Acid	14.00		0.0 16.0	≤16.0

Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
59 4-hydroxybutyric	1.00			≤30.0
60 2-Hydroxyisovaleric	5.00			≤20.0
61 2-Hydroxyisocaproic	3.00			≤15.0
62 3-Methyl-2-oxovaleric	5.00			≤20.0

Neurotransmitter Metabolism Markers

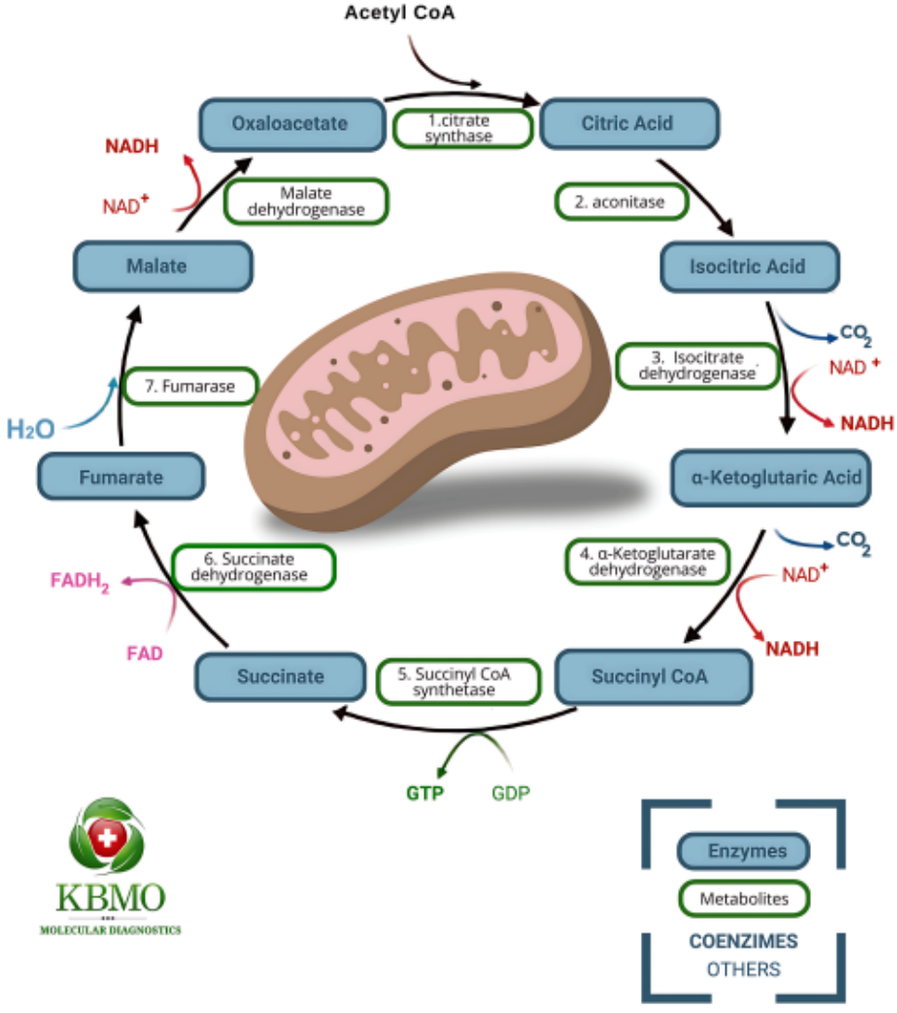
Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
63 Homovanilate (HVA)	5.00			≤9.5
64 Vanilmandelate (VMA)	6.00 H			>0.5 or <3.5
65 HVA/VMA ratio	5.00 H			≤3.0
66 5-Hydroxyindoleacetate (5-HIAA)	4.00			≤8.0
67 Kynurenic acid	6.00 H			≤2.0
68 Quinollinic acid	0.30			≤1.0
69 Kynurenic acid/ Quinolinic Acid	4.00 H			≤1.0

Miscellaneous Metabolism Metabolite

Metabolic Marker	Current Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)	Graphical View	Ranges (mmol/mol Cr)
70 Creatinine	10.00			≤250.0

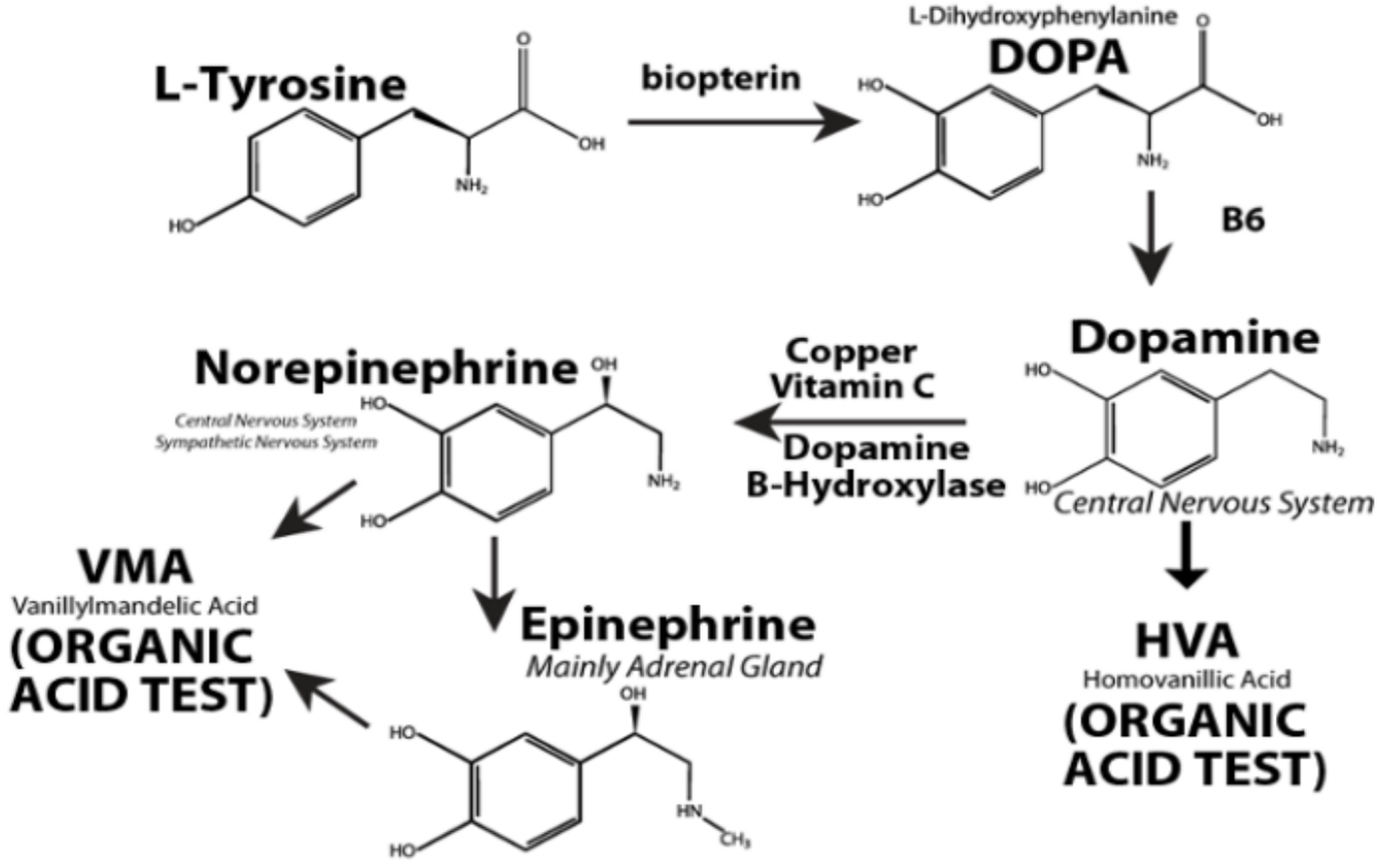
Citric Acid Cycle

Within the cell citric acid is produced in mitochondria from acetyl-coenzyme A (acetyl-CoA) and oxalacetate via the action of the enzyme citrate synthase and enters the citric acid cycle (also termed tricarboxylic acid cycle or Krebs cycle) mainly in the liver and also in skeletal muscle and renal cortex.46 The citric acid cycle is the final common pathway for the oxidation of carbohydrates, fatty acids, and amino acids. In this cycle, citric acid is used to generate energy through the oxidation of the acetyl component of acetyl-CoA derived from carbohydrates, fats, and amino acids.



Neurotransmitter Metabolism

DOPA and dopamine are metabolized into their final product, homovanillic acid (HVA), while norepinephrine and epinephrine are metabolized into vanillylmandelic acid (VMA).



Out of Range Results

Metabolic Marker	Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)
6 Tricarballylate	5.0	
Produced by Fusarium during the production of the toxin fumonisin (8). Can also be produced by a strain of aerobic bacteria (9).		
11 Benzoic	5.0	
Common food preservative in packaged foods and also is present naturally in some fruits. Elevated benzoate could indicate an inadequate amount of glycine or pantothenic acid for conjugation reactions(18). Can be produced by intestinal bacteria but other elevations should be present to confirm (19).		
13 4-Hydroxybenzoic	5.0	
Strains of E. coli can produce p-hydroxybenzoate from glucose (23).		
14 4-Hydroxyphenylacetic	2.0	
The detection of large amounts of p-Hydroxyphenylacetate is associated with Giarddia lamblia infestation as well as other anaerobic bacterial overgrowths (24).		
15 4-Hydroxyphenyllactic	6.0	
Patients with high amounts of p-Hydroxyphenyllactic could have a bacterial overgrowth in their gut(25).		
18 N-Acetylcysteine (NAC)	5.0	
Mostly used as a precursor for glutathione. Can also have anti-bacterial and anti-biofilm properties. If the patient is supplementing with NAC and values go up considerably that could indicate a problem in glutathione production. Supplementation with glutathione may be necessary (32, 33).		
19 8-Hydroxy-2-deoxyguanosine	4.0	
Produced when guanine bases are subjected to oxidative damage and positively correlated with inflammation. Toxin exposure could lead to increased amounts of 8-OHdG. Green tea and exercise have been shown to decrease 8-OHdG levels (34).		
21 2- hydroxyhippuric	5.0	
Produced by bacteria and high values could indicate an overgrowth of bacteria. 2-Hydroxyhipuric is also a metabolite of aspirin. High values could also indicate patient is at risk of forming type 2 diabetes (17).		
27 Fumarate	5.0	
Extremely high values are uncommon. Can lead to developmental delay, hypotonia, and microcephaly (45). Extremely low values are seen with patients with autoimmune disease (44)		
28 Malic acid	2.0	
Is converted to oxaloacetate by malate dehydrogenase. If this conversion is inhibited by lack of NAD or vitamin B3, it can lead to elevated levels. Is present in many fruits and vegetable3s as well a preservative in beverages (46). Patients with autoimmune disease may see decreased amounts (44).		

Out of Range Results (continued...)

Metabolic Marker	Result (mmol/mol Cr)	Previous Result (mmol/mol Cr)
32 Suberic acid	36.0	
Elevated levels could indicate ketosis undergoing in the body (54).		
39 Sebacic	5.0	
Elevations in urine indicate the body is using fat for energy which could be the result of a ketogenic diet. Symptoms associated with high levels include: increased thirst, increased urination, fatigue, fruity-smelling breath, and confusion (56).		
38 Xanthurenic acid	2.0	
Xanthurenic is a product of the kynurenine pathway which is one of the routes of tryptophan catabolism. When B6 is low xanthurenate could build up in the body and be excreted in urine. Conditions that are correlated with high xanthurenate include inflammatory diseases and immune suppression (60).		
39 4-Pyridoxic (B6)	14.0	
Correlated with B6 intake. Low values could indicate the patient is deficient in B6 (61)		
43 Methylmalonic (MMA)	5.0	
High values of MMA could indicate B12 deficiency. Patients taking B12 typically lowers MMA(65).		
45 Thymine	5.0	
In patients with pyrimidine degradation defects thymine can increase in several different body fluids. This can cause neurological issues because of built up toxicity(67).		
64 Vanilmandelate (VMA)	6.0	
A metabolite of epinephrine and norepinephrine. Can show up low in urine samples if patients have a copper deficiency, enzyme deficiency, or inhibition from pathogenic bacterial metabolites in the gut (81).		
65 HVA/VMA ratio	5.0	
The ratio indicates how well dopamine is converted to epinephrine. A high ratio is seen is people with copper deficiencies, mutations to enzymes, or inhibitions to the enzymes by toxins.		
67 Kynurenic acid	6.0	
Metabolite of tryptophan. Kynurenic acid has some neuroprotective properties in the brain. It has the ability to stimulate NMDA receptors(84).		
69 Kynurenic acid/ Quinolinic Acid	4.0	
High value in this ratio could indicate that tryptophan is being metabolized through the kynurenine pathway rather than the serotonin pathway (86). Higher values have been seen in patients with depression (87).		