COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age: **42 YEARS**
Sample Taken Day: **16 NOVEMBER 2022**	Date of Analysis: **16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

CELLULAR ENERGY, METABOLISM and MITOCHONDRIAL FUNCTION

CARBOHYDRATE METABOLISM (GLYCOLYSIS CYCLE)

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
8	2-Hydroxybutyric Acid	0,92	< 2.00
190	Lactic Acid	7,42	0.30 – 16.40
243	PyruvicAcid	16,72	1.00 – 18.00

FATTY ACID METABOLISM (β- & ω-OXIDATION)

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
60	AcetoaceticAcid	32,00	< 67.00
355	3-Hydroxy 3-Methylglutaric	7,45	< 10.00
357	3-Hydroxybutyric (BHBA)	3,40	< 17.60
448	Adipic Acid	5,99	0.40 – 12.90
525	5-Hydroxyhexanoic Acid	4,27	0.80 – 5.70
622	Ethylmalonic Acid	6,77	0.40 – 6.50
784	Azelaic Acid	4,23	0.50 – 15.00
792	Sebacic Acid	0,95	< 2.00
857	Pimelic Acid	1,96	0.50 – 3.50
893	Suberic Acid	1,69	< 2.90
1844	Methylsuccinic Acid	3,99	0.80 – 10.80
	3-Υδροξυ-Αδιπικό Οξύ	5,13	3.10 – 6.00

NUCLEIC ACID METABOLISM

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
262	Thymine	1,49	< 3.00
289	Uric Acid	51,05	12.5 – 37.5*
300	Uracil	12,08	1.40 – 22.80

*mg/dL

Mesogeion 6, Ambelokipi 115 27 ● Tel: 210-7777.654 ● FAX: 210-7777.634 ● www.athenslab.gr

Vasilis J. Sideris
Medical Doctor
Biopathologist

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age: **42 YEARS**
Sample Taken Day: **16 NOVEMBER 2022**	Date of Analysis:**16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

CELLULAR ENERGY, METABOLISM and MITOCHONDRIAL FUNCTION

AMINO ACID METABOLISM

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
19	2-Oxoisovaleric Acid	0,23	< 1.10
130	Homogentisic Acid	3,63	< 2.00
205	Phenylpyruvic Acid	0,73	< 2.00
407	2-Hydroxyisovaleric Acid	4,81	0.20 – 10.00
491	2-Oxo-3-Methylvaleric Acid	3,10	0.40 – 4.80
522	3-Methylglutaconic Acid	7,38	2.80 – 8.30
691	Malonic Acid	1,41	0.20 – 3.20
695	2-Oxoisocaproic Acid	1,07	< 2.00
752	3-Methylglutaric Acid	0,41	< 2.00
755	4-Hydroxyphenyllactic Acid	1,42	0.20 – 2.60
779	Phenyllactic Acid	0,32	0.20 – 2.00
707	4-Hydroxyphenylpyruvic Acid	1,42	0.10 – 8.70
23	3-Hydroxyisobutyric Acid	6,87	4.10 – 19.00
694	2-Hydroxyglutaric (L-) Acid	27,53	2.00 – 46.00
396	2-ethyl 3-hydroxypropionic Acid	2,59	1.30 – 2.90
354	2-Methyl-3-Hydroxybutyric Acid	2,17	< 6.20
5	2-Ketobutyric Acid	0,58	< 4.10
746	Hydroxyisocaproic Acid	0,87	< 1.00
317	2-Hydroxy-3-Methylpentanoic Acid	0,47	< 7.90
428	3-Hydroxyglutaric Acid	0,27	< 4.60
812	N-acetylaspartic Acid	6,87	< 13.00

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender:	Age: **42 YEARS**
Sample Taken Day: **16 NOVEMBER 2022**	Date of Analysis: **16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

CITRIC ACID CYCLE (KREBS CYCLE)

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
94	Citric Acid	135,23	10.00 – 484.0
72	cis-Aconitic Acid	39,87	2.70 – 44.00
193	Isocitric Acid	82,42	16.00 – 118.0
208	2-ketoglutaric Acid (AKG)	17,10	2.00 – 72.00
254	Succinic Acid	8,15	0.50 – 33.30
134	Fumaric Acid	1,09	0.20 – 1.80
744	Malic Acid	1,86	0.06 – 5.30

NUTRITIONAL METABOLITES

VITAMIN MARKERS & METHYLATION MARKERS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
202	Methylmalonic Acid	1,89	< 3.60
225	2-Oxoadipic Acid	0,35	< 0.80
379	Methylcitric Acid	1,03	< 2.00
661	Glutaric Acid	1,80	0.50 – 2.60
700	3-Hydroxypropionic Acid	11,77	3.10 – 11.80
754	3-Hydroxyisovaleric Acid	24,34	6.90 – 25.00
854	Formiminoglutamic Acid	0,63	< 0.80
881	Xanthurenic Acid	1,50	< 1.70

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age: **42 YEARS**
Sample Taken Day: **16 NOVEMBER 2022**	Date of Analysis: **16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

GASTROINTESTINAL SYSTEM – MALABSORPTION AND DYSBIOSIS MARKERS

GASTROINTESTINAL MALABSORPTION METABOLIC MARKERS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
197	Indoleacetic Acid (IAA)	4,63	0.60 – 5.40
209	Phenyl acetate Acid (PAA)	0,45	0.20 – 0.45

BACTERIAL DYSBIOSIS METABOLIC MARKERS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
20	4-Hydroxyphenylacetic Acid	14,23	1.40 – 29.00
423	3,4-Dihydroxyhydrocinnamic Acid	0,49	< 2.00
440	3-Hydroxyphenylacetic Acid	6,06	1.40 – 15.00
500	4-Hydroxybenzoic Acid	4,76	0.60 – 4.20
669	2-Hydroxyphenylacetic Acid	2,65	0.36 – 4.50
714	Hippuric Acid	359,31	19.0 – 622.0
1858	p-Cresol	160,78	0.10 – 75.0
1870	Benzoic Acid	0,78	< 4.30
2643	HPHPA*	1,73	0.90 – 15.30

*3-(3-Hydroxyphenyl)-3-hydroxypropanoic Acid

FUNGAL OVERGROWTH METABOLIC MARKERS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
426	Citramalic Acid	3,53	2.50 – 4.50
439	2-Furoylglycine	5,13	0.70 – 5.80
646	L-Arabinose	13,74	0.80 – 19.40
956	Tartaric Acid	1,48	0.10 – 15.00
4812	2,5-Furandicarboxylic Acid	5,00	0.10 – 5.40
13701	3-oxoglutaric Acid	7,18	< 2.00

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age: **42 YEARS**
Sample Taken Day:**16 NOVEMBER 2022**	Date of Analysis: **16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

NEUROTRANSMITTERS

NEUROTRASMITTER METABOLIC MARKERS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
118	Homovanillic Acid (HVA)	3,71	0.90 – 5.50
232	Quinolinic Acid	5,10	0.90 – 15.10
291	Vanillilmandelic Acid (VMA)	2,37	0.60 – 3.40
715	Kynurenic Acid	2,14	0.90 – 4.20
763	5-Hydroxyindoleacetic Acid	2,27	< 7.20
3332	MHPG*	0,20	< 0.20

*3-Methoxy-4-Hydroxyphenylglycol sulfate

TOXICANTS & METABOLIC DETOXIFICATION MARKERS

TOXICANTS AND DETOXIFACATION INDICATORS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
226	Orotic Acid	3,80	< 2.25
267	Pyroglutamic Acid	9,99	4.50 – 24.90
729	2-Hydroxyisobutyric Acid	5,09	1.30 – 7.40
1587	Phenylglyoxylic Acid	2,34	< 7.30

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age: **42 YEARS**
Sample Taken Day: **16 NOVEMBER 2022**	Date of Analysis: **16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

OXALIC ACID METABOLITES

OTHER MARKERS

Code	TEST	RESULT (mmol / mol Creatinine)	REFERENCE RANGE (mmol / mol Creatinine)
115	Glycolic Acid	8,24	2.90 – 78.10
139	Glyceric Acid	1,44	0.20 – 6.00
2329	Oxalic Acid	20,33	< 33.30

562	Urine Creatinine	101,38 mg/dL

From 4/4/2022 some changes have been made in the reference ranges due to changes in specific techniques of the derivatization method before GC/MS testing.

Notes

- The laboratory methods used for the above analyses are LC-MS, GC-MS, HPLC & Spectrophotometry
- The code numbers of organic acids and other compounds are the corresponding codes of Human Metabolome Database (HMDB)
- In the graphic display, Median Value (Blue vertical line) ± 1 Standard Deviation (SD) (Green Bar) and also ± 2 Standard Deviations (Blue Horizontal Lines) of reference values are displayed. Pathological values are found in the red part of the graphic display
- Reference values are age dependent

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age:**42 YEARS**
Sample Taken Day: **16 NOVEMBER 2022**	Date of Analysis:**16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	

Notes and General Comments

Diagnostiki Athinon's MetaBolomiX™ test of organic acids in the urine provides a "snapshot" of metabolism, based on the products the body excretes in the urine. Organic acids are small molecules, by-products of cellular activity, digestion and intestinal flora metabolism.

MetaBolomiX™ urine organic acids test is used to detect nutritional deficiencies in the body, to detect genetic mutations in the enzymes involved in metabolism, to assess the functional status of the mitochondria, as well as to assess the function of the gastrointestinal and nervous systems.

Organic acids are a large group of compounds used in the basic metabolic processes of the body. They are derived from proteins, fats and carbohydrates in foods and are used by the body to produce energy and create the necessary building blocks in cells. Organic acid analysis has long been used to detect or exclude and monitor certain inherited metabolic disorders.

The test of urine organic acids provides a broad overview of body function. A simple urine sample can be used to evaluate simultaneously the function and health of the Intestine, the Liver, the Nervous System, the Energy Metabolism and Mitochondrial Health and the deficiencies in various nutrients. Understanding how these subsystems operate at any given moment allows for in-depth analysis of systems interactions.

The laboratory evaluation of many systems and organs at the same time and the analysis of biochemical pathways, such as the urine organic acids measurement with MetaBolomiX™, allow the patient to be treated as a whole. Investigating all the possible causes of a pathological condition enables proper diagnosis, implementation of appropriate treatment and effective management of patients.

All the above are general comments.
Consult your Doctor for interpreting the results and administering the most appropriate treatment regimen for you.

IMPORTANT NOTE: Specialized tests are carried out for research purposes and as ancillary or complementary analyses in the context of a conventional laboratory test. Specialized tests should only be used in conjunction with other established medical data (e.g. medical history, symptoms, clinical examination, results of other tests, etc.).

COMPREHENSIVE URINE ORGANIC ACIDS TEST *MetaBolomiX™*
Metabolic and Nutritional Profile v2.0

Name:	Gender: **FEMALE**	Age:**42 YEARS**
Sample Taken Day:**16 NOVEMBER 2022**	Date of Analysis: **16 NOVEMBER 2022**	
Specimen: **Urine**	Patient Code Number:	Printing:

Personalized Interpretation of Results

Carbohydrates Metabolism (Glycolysis Cycle)

Without any pathological findings

Fatty Acids Metabolism (β- and ω-Oxidation)

Ethyl malonic acid belongs to the class of compounds known as branched fatty acids. Increased metabolites of the metabolism of omega-fatty acids in the urine may be the result of carnitine deficiency, fasting or increased dietary triglycerides consumption (eg coconut oil). Highly elevated values may indicate a genetic disorder, such as in patients with acyl-coenzyme A short-chain dehydrogenase deficiency, which is a disorder in fatty acid metabolism. Disorders in fatty acids oxidation are associated with symptoms such as hypoglycaemia and lethargy. Regardless of the cause, the intake of dietary supplements containing L-carnitine or acetyl-L-carnitine may improve clinical symptoms.

Nucleic Acids Metabolism

Uric acid is the end product of purine metabolism and is produced by the action of the enzyme xanthine oxidase. Purines can come either from the catabolism of the food intake or from the destruction and recycling of the body's own cells. Elevated levels of uric acid in the urine usually accompany elevated plasma uric acid levels unless there is reduced uric acid excretion by the kidneys. Urine uric acid levels reflect the amount of nutritional purines and the catabolism of endogenous nucleic acids. Most often the increase in uric acid is a result of nutrition and less often due to malignancy or some metabolic disorders such as Lesch-Nyhan syndrome or decreased renal uptake of uric acid due to tubular disorder (Fanconi syndrome).

Amino Acids Metabolism

Homogentisic acid is an intermediate metabolite of the amino acids' tyrosine and phenylalanine metabolism. The high concentration of homogentisic acid in the urine may be due to a genetic disorder of metabolism, alkaptonuria. Minor increases may be indicative of heterozygous vectors of the disease or may be due to metabolic disorders as a result of decrease in the necessary co-factors (Fe, vitamin C, O2). In patients with mild to moderate increase, it is recommended administration of vitamin C, N-acetyl cysteine (NAC) and iron and improve the oxygenation of the body. Further testing for vitamins and body's iron stores may be needed.

Citric Acid Cycle (Krebs Cycle)

Without any pathological findings

Vitamin Markers and Methylation Markers

Without any pathological findings

Gastrointestinal Malabsorption Metabolic Markers

Without any pathological findings

Bacterial Dysbiosis Metabolic Markers

4-Hydroxybenzoic acid or p-hydroxybenzoic acid is a derivative of benzoic acid an indicator of intestinal malabsorption. Increased concentrations of 4-hydroxybenzoic acid in the urine may result, in addition to intestinal malabsorption, by eating foods, such as jams, that contain preservative derivatives of benzoic acid. Therapeutically, it is recommended administration of probiotics and exclude foods containing benzoic acid derivatives.

p-cresol or 4-methyl-phenol is the end product of protein catabolism mainly of the amino acids tyrosine and phenylalanine by intestinal microbes. Elevated concentrations of urine p-cresol indicate overgrowth of Clostridium difficile, other clostridia, and members of the enterobacteriaceae family in the gastrointestinal tract. This metabolite is often elevated in patients with autism, psychiatric disorders, and gastrointestinal disorders. p-cresol inhibits the enzyme dopamine beta-hydroxylase, leading to neurotransmitter imbalance. In addition, an increase in p-cresol in the urine can be a result of exposure to toluene and some other chemicals (furans). Therapeutically, the administration of glutamine (strengthening of the intestinal epithelium), regulation of the intestinal microbiome (probiotics) and administration of natural or medicinal antimicrobial substances are recommended. Further testing of the gut microbiome (EnteroScan) may be needed.

Fungal Overgrowth Metabolic Markers

Increased concentrations of 3-oxoglutaric acid in the urine indicate fungi overgrowth. Therapeutically, it is recommended to regulate the intestinal microbiota (probiotics), administration of natural or pharmaceutical antifungal substances and appropriate diet to reduce fungal overgrowth. Further intestinal microbiota testing (EnteroScan) may be needed.

Neurotransmitter Metabolic Markers

Without any pathological findings

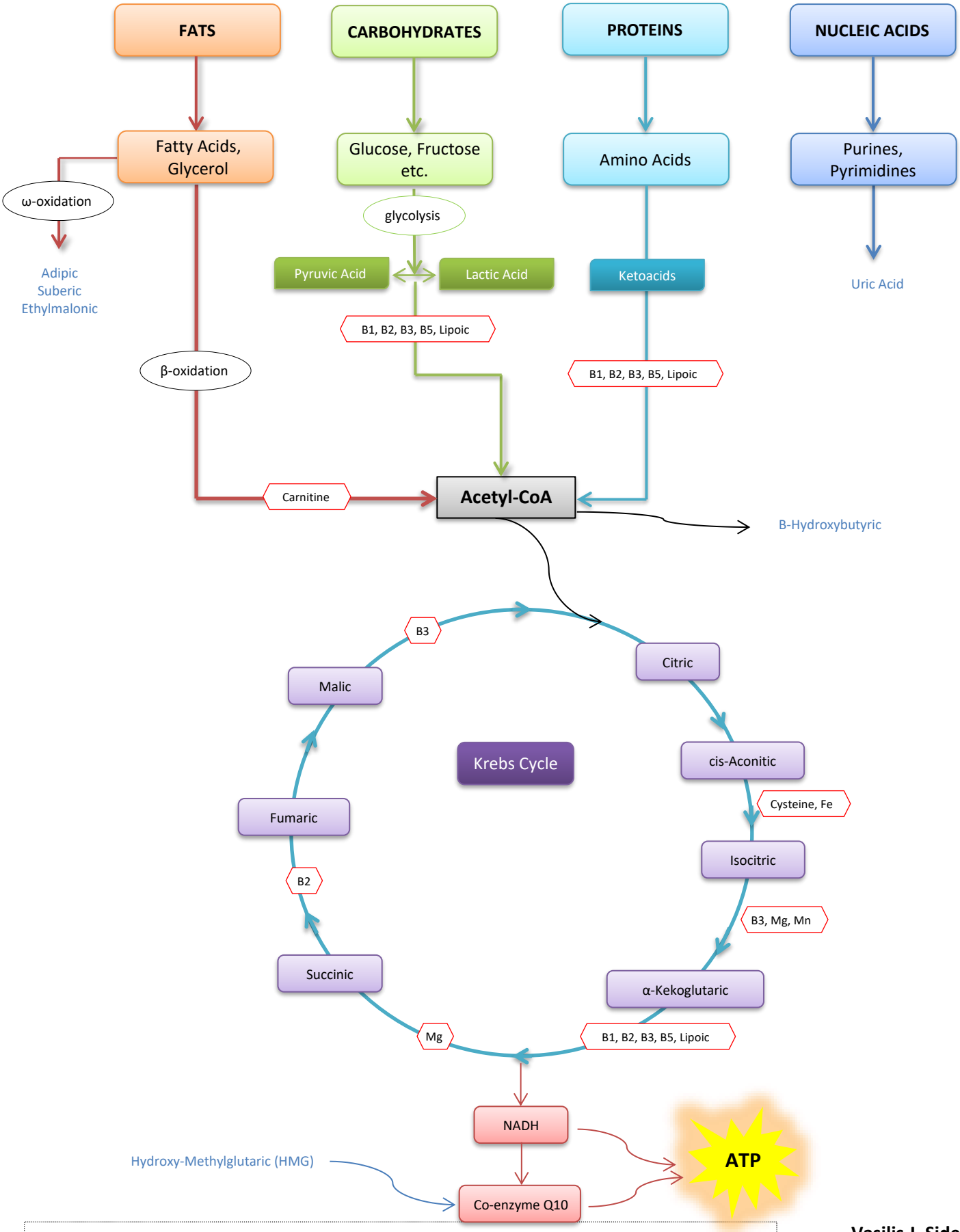
Toxicants and Detoxification Markers

Orotic acid is a metabolite of asparaginic acid, a precursor molecule in the synthesis of pyrimidines. Very small amounts of orotic acid can also be synthesized by the human body (vitamin B13). Increases in orotic acid in urine are most often associated with liver damage due to chronic alcohol intake, with toxicity of certain drugs to the liver, due to viral hepatitis, urea cycle disorder and ammonia toxicity. Increases in orotic acid in urine may also be the result of a reduction in the necessary metabolism co-factors (vitamins B2, B3, B6, Mg, serine, glutamine, glycine). A significant amount (up to 50%) of the secreted orotic acid in the urine may be of nutritional origin. The richest dietary sources are cow's milk and other dairy products as well as vegetables such as carrots and beets. Very high concentrations of orotic acid may be due to inherited metabolism disorders of ammonia or orotic acid. Therapeutically, it is recommended administration of missing factors and support of liver function. Further testing of vitamins and minerals, amino acid status and functional liver testing may be needed. The increase in orotic acid may also be due to exposure to the herbicide glyphosate, part of which is metabolized to ammonia.

Oxalic Acid Metabolites

Without any pathological findings

SUMMARY OF CELLULAR METABOLISM



Mesogeion 6, Ambelokipi 115 27 ● Tel: 210-7777.654 ● FAX: 210-7777.634 ● www.athenslab.gr

Vasilis J. Sideris
Medical Doctor
Biopathologist