

**External ID**

Name	<b>Muster</b>	Date of Birth	<b>01.06.1948</b>	Order ID	<b>11630963</b>
First Name	<b>Muster</b>	Sex	Female	Order Date	23.11.2018
Sampling Date	22.11.2018 07:00	Validation Date	Thomas Gugerel	Findings Status	<b>Final Report</b>
Sample Material	U	Validation on	27.11.2018	Findings Date	27.11.2018

Test	Result	Unit	Standard Range	Previous Result
<b>Orthomolecular and Mitochondrial Medicine</b>				
<b>Organic Acids in Urine (Complete)</b>				
Creatinine enzymatic (Urine)	501	mg/l	290 - 2260	U A) PHOT
<b>Fatty Acid Metabolism</b>				
Adipate	0,58	mg/g Crea	< 2,5	U NA) LCMS
Suberate	0,78	mg/g Crea	< 1,9	U NA) LCMS
Ethyl Malonate	3,23	mg/g Crea	< 4,0	U NA) LCMS
<b>Glycolysis/Carbonhydrate Metabolism</b>				
Lactate	<b>22,55</b>	mg/g Crea	1,7 - 20,5	U NA) LCMS
Pyruvate	<b>7,82</b>	mg/g Crea	< 5,4	U NA) LCMS
β-Hydroxybutyrate	1,47	mg/g Crea	< 3,2	U NA) LCMS
<b>Organic Acids of the Citric Acid Cycle</b>				
Citrate	603	mg/g Crea	160 - 786	U NA) LCMS
Cis-Aconitate	37,71	mg/g Crea	14,0 - 62,5	U NA) LCMS
Isocitrate	75,82	mg/g Crea	31 - 88	U NA) LCMS
Alpha-Ketoglutarate	<b>30,93</b>	mg/g Crea	< 30,0	U NA) LCMS
Succinate	5,43	mg/g Crea	< 8,0	U NA) LCMS
Fumarate	<b>1,65</b>	mg/g Crea	< 0,8	U NA) LCMS
Malat	<b>2,89</b>	mg/g Crea	< 2,6	U NA) LCMS
Hyoxymethylglutarate	2,77	mg/g Crea	< 4,35	U NA) LCMS
<b>Organic Acid of the Vitamin Metabolism</b>				
Alpha-Ketoisovalerate	0,25	mg/g Crea	< 0,35	U NA) LCMS
Xanthurenate	0,37	mg/g Crea	< 0,65	U NA) LCMS
Methyl-Malonic Acid	0,91	mg/g Crea	< 1,8	U NA) LCMS
<b>Metabolic products of neurotransmitters and aromatic amino acid</b>				
Vanillyl Mandelic Acid	3,09	mg/g Crea	1,3 - 3,7	U NA) LCMS
Homo Vanillyl Mandelic Acid	6,30	mg/g Crea	1,6 - 6,5	U NA) LCMS
5-Hydroxy-Indole Acetate	<b>6,56</b>	mg/g Crea	1,2 - 4,7	U NA) LCMS
Kynurenate	1,10	mg/g Crea	0,8 - 3,3	U NA) LCMS
<b>Dysbiosis Marker</b>				
D-Arabinitol	5,45	µg/mg Krea.	< 6,0	U NA) LCMS
Hydroxy-Benzoic Acid	0,31	mg/g Crea	< 0,6	U NA) LCMS
Citramalate	<b>7,10</b>	mg/g Crea	< 5,8	U NA) LCMS

Changed reference range after modification and validation.

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**Biovis Diagnostik MVZ  
GmbH**

Justus-Stadt-Str. 2  
D-65555 Limburg Offheim

Phone: (+49) 6431 / 21248-0  
Fax: (+49) 6431 / 21248-66  
Email: info@biovis.de

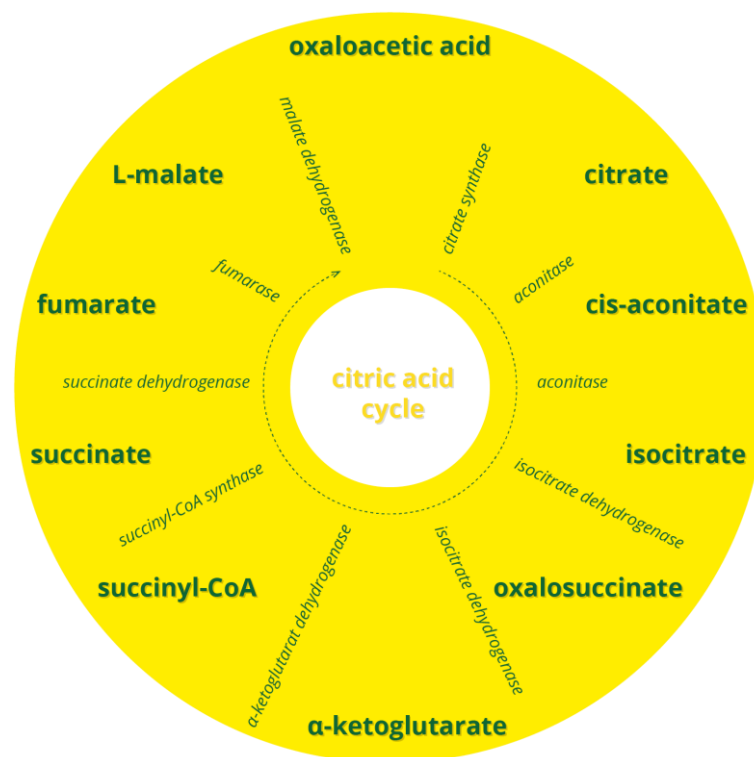
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## Organic Acids

The determination of organic acids allows for a general overview about the utilization of nutrients consumed with food as well as their transformation to energy (ATP). This transformation is carried out with the aid of enzymes and their co-factors. If these co-factors are missing or if the enzymes do not function optimally - this may lead to accumulation of intermediate products. The concentration of intermediate products provides for conclusions in regard to vital substance (vitamins and minerals) deficiencies.

Metabolic products of neurotransmitters in urine may indicate disorders of the stress hormone balance. Dysbiosis markers reflect intestinal bacterial imbalance.



## Lactate

The **lactate** (lactic acid) value is increased. Lactate is developed during the anaerobic decomposition of pyruvate (pyruvic acid). This decomposition path of pyruvic acid is used by the body, if the aerobic energy production via the citric acid cycle is overloaded.

Attention: Increased lactate in urine may also simply indicate extreme high external consumption of lactic acid.

## α-Ketoglutarate

**The α-Ketoglutarate value is increased.**

α-ketoglutarate increased may have various causes. The most important influential factors are **coenzyme Q10 deficiency**, **statin treatment** and **excessive intestinal fungus population**. Other possible causes for α-ketoglutarate increases may be longer systemic glucocorticoid therapies, various carbohydrate intolerances (e.g. fructose malabsorption) and very high-protein diets.

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$\alpha$ -ketoglutarate increases may be genetically induced. In case of genetic types one finds levels of 200 mmol / mol creatinine to more than 1000 mmol / mol creatinine. This will lead to metabolic disorders of the essential amino acid leucine.

### Fumarate (fumaric acid)

#### The fumarate in the urine is increased.

First, an external fumaric acid intake should be excluded. If this is not present, an increased Fumarsäureaufbau from phenylalanine, or tyrosine, could be present, which may speak for a catabolic metabolism. A review of amino acid status and markers of catabolism (including urea, creatinine, uric acid, and LDH).

Fumarate is produced in the citric acid cycle from succinate (succinic acid), the enzyme necessary for this is succinate dehydrogenase, also complex II of the mitochondrial respiratory chain. It is the only membrane-bound enzyme in the citrate cycle and, as complex II of the respiratory chain, integrated directly into the electron transport chain of the mitochondria. The enzyme catalyzes the oxidation of succinate to fumarate and the reduction of ubiquinone (coenzyme Q 10) to ubiquinol.

The succinate dehydrogenase is also a complementary medicine relevant enzyme, since the transfer of Elektronen by riboflavin (vitamin B2: FAD  $\leftrightarrow$  FADH) and especially ubiquinone Ubiquinol (coenzyme Q10) takes place. The riboflavin derivatives are also relevant to the function of the enzyme; Vitamin B2 deficiency can lead to low fumarate.

In addition to the importance of fumarate in the citric acid cycle, fumarate has immunomodulatory effects and may be e.g. B. lower the interleukin-2. As a result, fumaric acid and derivatives can also be used in autoimmune diseases, with the use of psoriasis having been proven above all.

### Malate

#### The malate value is increased.

Malate is an intermediate of the citric acid cycle and plays an important role in energy production. If it is elevated, coenzyme Q10 and B3 deficiency must be considered.

### 5-Hydroxy Indole-Acetic Acid

#### 5-Hydroxy Indole-Acetic Acid is increased.

5-HIAA is a metabolic product of serotonin.

Increased values are frequently triggered by anti-depressant therapies. Paracetamol, indomethacin (pain killer) and benzodiazepine may lead to falsely increased values as they alter the activity of  $\gamma$ -amino-butyric acid and thus also have an influence on acetylcholine and serotonin metabolism.

Significantly increased HIAA values may also indicate a carcinoid (a tumour with hormonal active cells, which among others also produce serotonin). In this case an analysis in 24h collected urine is indicated.

### Citramalic Acid

#### The citramalic acid value is increased.

**Citramalic acid** is a metabolic product of yeasts and anaerobic bacteria. Increased concentrations in urine indicate enhanced intestinal population of these bacteria. The intestinal tract should be restored by probiotic therapy.

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## Organic Acids – Therapy and Dosage

	1-2 years	2-4 years	4-8 years	8-12 years	12-16 years	Adults
<b>Folic Acid</b>	0.2 mg	0.2 mg	0.4 mg	0.4 mg	2.5 mg	2.5 mg
<b>Vitamin B5</b>	5 mg	5 mg	10 mg	25 mg	50 mg	100-500 mg
<b>Vitamin B6</b>	1 mg	2.5 mg	2.5 mg	5 mg	10-50 mg	10-200 mg
<b>Vitamin B2</b>	2.5 mg	5 mg	20 mg	20 mg	25-50 mg	20-400 mg
<b>Vitamin B3</b>	10 mg	25 mg	50 mg	100 mg	200 mg	200-1000 mg
<b>Biotin</b>	0.1 mg	0.1 mg	0.5 mg	0.5 mg	1-2.5 mg	1–10 mg
<b>Magnesium</b>			500 mg	500 mg	500 mg	500-1500 mg
<b>Manganese</b>	1 mg	2 mg	2 mg	2 mg	5 mg	5-10mg
<b>Chromium</b>	25 µg	50 µg	50 µg	50-100 µg	50-100µg	50-200 µg
<b>Phenylalanine</b>			500 mg	500 mg	500 mg	500-1500 mg
<b>Coenzyme Q10</b>	1 mg/kg/BW	1 mg/kg/BW	30-60 mg	50-100 mg	100-200 mg	100-400 mg
<b>Iron</b>	10 mg	20 mg	20 mg	20-50 mg	50-100 mg	100-200mg
<b>Copper</b>	0.1 mg	0.1 mg	0.2 mg	0.5 mg	0.5 mg	1-2 mg
<b>Vitamin C</b>	100 mg	250 mg	500 mg	1000 mg	1000 mg	1-5 g
<b>Vitamin B12 Hydroxy-Cobalamin</b>	1 µg	1 µg	1.5 µg	1.8 µg	2 µg	3 µg
<b>α-lipoic acid</b>						0.2-1g
<b>Carnitine</b>	25-150 mg/kg/BW per day					

The table shows the vital substances mentioned in the text as well as the respective age-dependent dosage.

With kind regards

Your Biovis-Diagnostik

**Attention:** The recommendations given are only advice based on the compiled findings and possible clinical information. They are exclusively addressed to the therapist/physician and are **not intended** for direct transfer to the patient. They cannot replace diagnosis and therapy of the treating therapist. The recommendations for therapy are a suggestion. The responsibility for the final selection/measure/dosage lies with the medical professional/therapist responsible for each individual case. Please also note that there may be contraindications/interactions associated with the recommended medication/nutritional supplements for pre-existing primary diseases and when taking certain medication. These must be investigated by the medical professional/therapist before starting therapy.