bio|vis DIAGNOSTIK

DAkkS Deutsche Akkreditierungsstelle D-ML-13188-01-00

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External ID

Name	**Muster**	Date of Birth	**19.01.1957**	Order ID	**11630661**
First Name	**Muster**	Sex	Male	Order Date	23.11.2018
Sampling Date	22.11.2018 07:30	Validation Date	Thomas Gugerel	Findings Status	**Final Report**
Sample Material	E	Validation on	28.11.2018	Findings Date	29.11.2018

Test	Result	Unit	Standard Range	Previous Result
Orthomolecular and Mitochondrial Medicine				
Fatty Acid Status - Whole blood				
Saturated Fatty Acids				
Myristaleic acid 14:0	14,01	mg/l	10,8 - 36,7	E NA) GC
Palmitic acid 16:0	623,48	mg/l	554 - 858	E NA) GC
Stearic acid 18:0	**188,93**	mg/l	191 - 270	E NA) GC
Arachidic acid 20:0	3,81	mg/l	3,78 - 6,14	E NA) GC
Behenic acid 22:0	**10,61**	mg/l	11,2 - 18,1	E NA) GC
Saturated fatty acids	840,84	mg/l	789 - 1161	NA) GC
Monounsaturated Fatty Acids				
Oleic acid 18:1, n-9	671,40	mg/l	585 - 996	E NA) GC
Palmitoleic acid 16:1,n-7	55,96	mg/l	21,2 - 63,4	E NA) GC
Nervonsäure	**18,76**	mg/l	33,3 - 50,5	E NA) GC
Monounsaturated fatty acids	746,12	mg/l	647- 1057	NA) GC
Polyunsaturated Fatty Acids, Omega 3				
alpha-linolenic acid 18:3,n-3	15,30	mg/l	8,8 - 40	E NA) GC
Eicosapentanoic acid 20:5,n-3	23,55	mg/l	16,41 - 56,54	E NA) GC
Docosahexaenoic 22:6,n-3	99,63	mg/l	69,3 - 156,5	E NA) GC
Omega 3 - fatty acids	138,48	mg/l	100 - 246,2	NA) GC
Polyunsaturated Fatty Acids, Omega 6				
Linoleic 18:2,n-6	**565,03**	mg/l	683 - 1130	E NA) GC
Gamma-Linolensäure	6,36	mg/l	4,60 - 17,9	E NA) GC
Dihomo-gamma-Linolensäure	29,68	mg/l	29,5 - 64,8	E NA) GC
Arachidonic acid 20:4,n-6	**229,73**	mg/l	230 - 377	E NA) GC
Omega 6 - fatty acids	**830,80**	mg/l	1027 - 1539	NA) GC
Ratio				
Eicosanoic-Balance	**10,3**		> 15	NA) RECHN
Lc Omega-3-Index	**4,8**		> 8	NA) RECHN
Omega-6/3-ratio	6,0		< 8	NA)

Changed reference range after modification and validation.

E=EDTA

* cooperate analytics (R), A) accredited, NA) not accredited

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Fatty Acids

Ascertaining **the fatty acids** gives an overview of the absorption and distribution of the fatty acids in humans. In addition, the calculation of the most important indexes show how the different fatty acids are balanced with respect to each other. What is often not known: Individual fatty acids or fatty acid groups carry out complex and sometimes even conflicting metabolic functions. They significantly influence the risk of several chronic illnesses. Therefore, the selective dietary intake of specific fatty acids is the key in both prevention and treatment of chronic illnesses.

The aim is a balanced ratio of fatty acids in fatty acid metabolism.

General functions of fatty acids
Fatty acids perform an important function in construction and remodeling of new cell structures, e.g. around the cell membrane. Here they influence not only blood fluidity, but also the activity and permeability of the cell membranes. Fatty acids also play a fundamental role in the function of nerve cells and the brain as well as in the neurological development in children. Fatty acids are the base material for the formation of tissue hormones with regulative functions in the organism and they have a balancing effect on the eicosanoid metabolism.

Certain fatty acids such as **docosahexaenoic acid** (DHA) and **eicosapentaenoic acid** (EPA) have an anti-inflammatory effect and reduce the risk of arteriosclerosis as well as protects us from cardiovascular illnesses with its blood-pressure regulating function and also support the immune system.

Saturated fatty acids

Total of saturated fatty acids is within normal range.
Excess saturated fatty acids are stored in the fat-storing cells and in the long run could lead to excess weight, high cholesterol levels, higher risk of inflammation and insulin resistance.

The most important fatty acids are **palmitic acid** and **stearic acid**. The saturated fatty acids **myristic acid, arachidic acid and behenic acid** occur in only small quantities in vegetable and animal fats and therefore play a subordinate role. The decisive question is whether the level of saturated fatty acids is within normal.

Monounsaturated fatty acids

The total of monounsaturated fatty acids is in the normal range.
Monounsaturated fatty acids remain neutral in fat metabolism, i.e. contrary to polysaturated fatty acids, they are neither inflammation inducing nor inflammation inhibiting. Monounsaturated fatty acids have the same positive effect on blood fluidity as the unsaturated fatty acids and simultaneously exhibit the highest stability against oxidation in this group of unsaturated fatty acids.

Monounsaturated fatty acids have a preventive effect in cardiovascular diseases by improving the ratio of HDL and LDL and reducing triglycerides and total cholesterol in place of increased levels of saturated fat.

Oleic acid is within **normal range**.
Oleic acid is the most commonly found fatty acid of all the monounsaturated fatty acids. It is a staple in the Mediterranean diet and strengthens and protects the cardiovascular function. The main source is olive oil, but rapeseed, avocado and macadamia oil also contain a high percentage of oleic acid.

Palmitoleic acid is within normal range.
Palmitoleic acid is a monounsaturated fatty acid that the organism produces on its own from palmitic acid. It has a similar structure to the fatty acids of the skin and is therefore used in cosmetic products.

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Nervonic acid is low.
Nervonic acid is an omega-9 fatty acid which the body typically forms on its own. High concentrations are found in the nerve cells, especially in the myelin sheath. Nervonic acid is important for re-formation and re-generation of nerve cells.
Some nervous disorders associated with a myelin deficiency or defect are believed to be associated with a lack of nervonic acid, such as multiple sclerosis.

Omega-3 fatty acids, polyunsaturated fatty acids

Total of several unsaturated omega-3 fatty acids is in the normal range.
Omega-3 fatty acids are inflammation inhibitors, e.g. in rheumatoid arthritis, prevent arteriosclerosis, have a positive effect as phospholipids on the cell membrane function, improve blood fluidity, protects against vascular diseases and are favorable for blood pressure and hearty rhythm.

Alpha-linolenic acid (ALA) is in normal range.
Alpha-linolenic acid increases the fluidity of the cell membranes, has a favorable effect on the brain, the retina, the gonads and promotes bone metabolism.

Eicosapentaenoic acid (EPA) is in the normal range.
EPA is formed from alpha linolenic acid (ALA), if ALA is present in sufficient quantity and if delta-6-desaturase is secreted in sufficient quantity. EPA is the initial substrate for forming the anti-inflammatory hormone (eicosanoid). EPA is antagonistic of the inflammation inducing arachidonic acid (AA).

EPA is important for the formation of cell membrane and is beneficial in chronic inflammatory diseases such as rheumatoid arthritis. EPA acts as a preventive against cardiovascular diseases, inhibits thrombosis and reduces blood pressure.

Docosahexaenoic acid (DHA) is in the normal range.
DHA is the most unsaturated fatty acid and to a small extent, can be formed from alpha-linolenic acid. DHA increases the fluidity and permeability of the cell membranes (important for the transport of nutrients and waste products through the cell membrane), supports the information exchange functions in the brain as well as the functions of the retina and the mitochondria. DHA has a preventive effect against Alzheimer's and dementia, also helps in lowering blood pressure similar to EPA, it keeps the blood viscosity low and protects against plaque built-up in blood vessels. DHA reduces the risk of cardiovascular disease, prevents cardiac arrhythmia, is anti-inflammatory and during pregnancy it is especially important for the neurological development of the fetus. Low DHA-levels are associated with breast cancer, PMS, high blood pressure, diabetes and depression. DHA is an optimal fatty-acid building block for brain function.

Omega-6 fatty acids, polyunsaturated fatty acids

The total of omega-6 fatty acids is low.
Omega-6 fatty acids are found in plants, seeds and animal products. If animals are fed an omega-6 rich food, then their products also have more omega-6 fatty acids. The key agents are linoleic acid and arachidonic acid. Linoleic acid is predominantly of plant origin, while the arachidonic acid is predominantly of animal origin.

Reduction in the total of omega-6 fatty acids indicates a decreased or impaired absorption of fats.

Linoleic acid (LS) is low.
LA is essential and the base material for all other omega 6 fatty acids. It has an effect contrary to alpha-linolenic acid and can turn into both gamma-linolenic acid and the highly inflammatory arachidonic acid. Passing through the intermediate stages of gamma linolenic acid and di-homo-gamma linolenic acid, it is a precursor of the inflammatory tissue hormone (prostaglandin). However, linoleic acid is an important compo-

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nent of the cell membrane, supports healthy functioning of the skin and cell growth and regeneration. It is also beneficial in case of skin rashes. Linoleic acid regulates metabolic processes.

Deficiency in **linoleic acid** can lead to skin disease and eczema, delays would healing and an acute deficiency in linoleic acid can lead to hair fall, susceptibility to infections and cardiovascular problems.

Gama-linolenic acid (GLA) is in the normal range.
GLA is formed from essential linoleic acid or assimilated through nutrition. It has an anti-inflammatory effect, reduces the blood pressure, reduces the risk of cardiovascular diseases and the risk of thrombosis. GLA has a beneficial effect on atopic dermatitis, rheumatoid diseases and PMS.

Di-homo-gamma-linolenic acid is in the normal range.
DGLA is a product of linoleic acid through the intermediate stage of gamma linolenic acid (GLA) and is the precursor to arachidonic acid. Eicosanoids are formed from DGLA, which have an **anti-inflammatory** effect that is opposite of the eicosanoid of arachidonic acid effect. Thus, the properties of the DGLA are comparable to those of the omega-3 fatty acids EPA and DHA. DGLA can block out arachidonic acid from the cell membranes.

Level of arachidonic acid (AA) is low.
AA is formed in an organism by the conversion of linoleic acid to AA. However, a large part of it is absorbed via animal food. Arachidonic acid is an important component of the cell membrane, especially nerve and brain cells.

Very low levels can cause immune deficiency and impaired wound healing. It is also believed to be related to ADHD and mental disorders. A plant-based diet is arachidonic acid-free, which is why vegans and vegetarians have lower levels of arachidonic acid. Nutritional arachidonic acid deficiency is very rare in western diets and can result from an extremely low-fat diet.

Ratios

Omega-3 index is low.
The omega-3 index is the proportion of long-chain omega-3 fatty acids EPA and DHA, based on the total amount of fat absorbed. It is considered a **risk factor for cardiovascular diseases**, i.e. a high omega-3 index is associated with a lower risk of cardiovascular disease, particularly sudden cardiac death.

A low **Omega-3-Index** indicates a reduced supply of EPA and DHA in relation to total fatty acids and may increase the risk of cardiovascular disease.

Omega-6 / Omega-3 ratio is in the normal range. Inflammatory and anti-inflammatory effects of fatty acids on the formation of tissue hormones are largely balanced.

Both fatty acid groups have an antagonistic effect on lipid metabolism through the formation of pro-inflammatory and anti-inflammatory eicosanoids (tissue hormones), which are found in lipid metabolism. The aim is to balance the two fatty acid groups. Compared to the Stone Age diet, the intake of omega-6 fatty acids in today's "western" diet has greatly increased and changed the ratio of omega-6 to omega-3 fatty acids.

The EPA/AA ratio (eicosanoid balance) is low.
The eicosanoid balance is evidence of the current inflammatory readiness. Whereas arachidonic acid promotes inflammation inducing hormones, EPA increases the formation of anti-inflammatory messengers. Both fatty acids behave antagonistically in fat metabolism. They compete for the same enzyme, so administering EPA can reduce the inflammatory eicosanoids of arachidonic acid (competitive inhibition).

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The result suggests an imbalance between pro-inflammatory arachidonic acid and anti-inflammatory eicosapentaenoic acid might have an adverse effect on inflammatory processes such as atherosclerosis, cardiovascular disease, rheumatoid arthritis, etc.

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Fatty acids therapy

Recommendations for fat consumption
The **recommended total fat intake** (30% of the energy requirement) is 60 – 80 g of fat daily. As a general rule, consumption of **animal fats** should be reduced and saturated fat should only be consumed in small amounts, at most only 2 to 3 times meat/week).

Replace more of **saturated fatty acid** with monounsaturated fatty acids. Olive oil can be used as long as the recommended total fat intake is not exceeded consistently.

Recommendation: If possible, use cold-pressed oils!

Supplement dose (e.g. omega-3 fatty acids) depends on the tested deficiency as well as on the age and history of the patients. Higher doses can be given as therapy than for purely preventive measures.

A dietary supplement with **nervonic acid** can be recommended for neurological disorders.

Improving the **EPA / AA-ratios** is possible by increasing consumption of EPA and reducing arachidonic acid (less meat and sausages).

To increase the **omega-3 index** it is also recommended to eat fat marine fish 2 to 3 times a week or alternatively substitute fish oil or algae oil capsules as a vegan alternative.

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.*

The key omega-3 and omega-6 fatty acids in mg / 100 g

Food – fatty	AA (n-6)	EPA (n-3)	DHA (n-3)	Linolenic acid (n-3)	Linoleic acid (omega-6)	Omega6 / Omega3-ratio
Herring, salted	23	1770	586	54	132	0.06
Halibut, smoked	38	128	338	23	16	0.11
Tuna fish	287	1620	2440	250	273	0.13
Mackerel, salted	171	645	1150	251	171	0.17
Linseed oil				52800	14300	0.27
Shrimp, cooked	80	243	187	9	73	0.35
Salmon	65	949	1520	338	999	0.38
Mussel	53	18	59	114	98	0.49
Fruit-linseed				8700	6050	0.7
Hard cheese	30			332	540	1.72
Rapeseed oil				8580	15000	1.75
Mountain cheese (goat)				191	356	1.86
Cow milk	3			23	42	1.96
Beef	43	17		263	115	2.32
Butter	114		10	423	1220	3.08
Pork	226	33		357	1160	3.55
Walnut				1020	42	4.12
Walnut oil				12200	52400	4.3
Cocoa butter				296	1990	6.72
Soya bean oil				7700	52900	6.87
Wheat germ oil				7800	55700	7.14
Stewing hen	775	34	420	164	3710	7.26
Chicken egg - (white and yolk)	56		75	80	13300	8.94
Olive oil				855	8320	9.73
Lamb chop	139	32		195	2280	10.66
Lard	1700			1010	9350	10.94
Avocado				111	1510	13.6
Palm oil				500	9600	19.2
Peanuts				528	13800	26.14
Wild boar meat	37	15			624	44.07
Corn oil				960	55500	57.81
Pumpkin seed oil				480	49200	102.5
Cashew nut				81	8620	106.42
Hazelnut				58	6370	109.83
Almond oil				191	22500	117.8
Grapeseed oil				480	65900	137.29
Safflower oil				470	75100	159.79
Almond, sweet				44	11500	261.36
Sunflower oil				178	50200	282.02
Brazil nut		14		62	29100	382.89

AA = arachidonic acid **EPA** = eicosapentaenoic acid **DHA** = docosahexaenoic acid

Source: BLS 3.02, Optidiet plus 6.0