



## VITAMIN MANUAL



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Sources: "Hauptsächlich Ernährungsmedizin" (Mainly Nutritional Medicine), Biesalski, 4th Edition and "Lehrbuch der Lebensmittelchemie und Ernährung" (Text Book on Food Chemistry and Nutrition), Ebermann and Elmadfa, 2008, and documents from a lecture in Giessen about Human Food.



# Micro Nutrients

*The human body needs energy, even when not under strain, to breath, for the heart to beat, the brain to function, blood to circulate and for normal metabolism. The energy required is consumed with foods, and gleaned mainly from the micro nutrients carbohydrates, proteins and fats. 1g of carbohydrates contains 17.6 Kj (4.2kcal), 1g of fat 38.9 Kj (9.3 kcal), 1g of protein 17.2 Kj (4.1 kcal). After eating, food is digested so that nutrients are reduced down to their smallest components, that are absorbed via the intestines and transported into the cells where they contribute to energy gain and to the build up of the body as well as to metabolic functions.*

## 1.1 - Proteins

Proteins or albumins are micro molecules built up of amino acids. They not only provide the cells with a structure but also transport metabolic components as "molecular machines", catalyze chemical reactions, work as ionic pumps and recognize signal substances.

### 1.1.1 - Amino Acids

Amino Acids are the smallest components of proteins. They are differentiated into essential (leucine, isoleucine, valine, phenylalanine, tryptophan, methionine and threonine) and non-essential amino acids. Amino acids are essential for life, cannot be produced by the body itself and have to be taken in with foods. The term BCAA summarizes the three essential amino acids leucine, isoleucine and valine. The name is down to their chemical structure: Branched Chain Amino Acids. In comparison to other amino acids they have special properties. Their metabolism happens, for example in the muscles directly. Approximately one

third of the proteins muscles are comprised of consist of BCAA. Amino acids are important for the biosynthesis of proteins, the building substances in muscles fibers, tendons and bones - that means for muscle build up and maintenance, i.e. they contribute to the maintenance of and increase in muscle mass. Essential amino acids have high bioavailability and place no strain on either the kidneys or the liver when breaking down.

### 1.1.2 - Proteins

For example skin, hair and muscles consist of proteins (albumin). Proteins contribute to the maintenance of muscle mass and to its growth.

Proteins can have the following functions in an organism:

- The protection and defense against microorganism (toxins and antibodies)
- Body structure (protein structure, collagens, keratin), movement (muscle proteins)
- Metabolism (enzymes), transport (haemoglobin), signal functions (hormones)
- Reserve substances (energy providers when starving)

### 1.1.2.1 - Milk Proteins

Milk protein consists of whey (curds) protein and casein. A whole milk protein in contrast to a whey protein has the advantage of containing all the amino acid fractions in milk, both BCAAs and also glutamine. Through the casein in it, it additionally significantly increases the human body's feeling that it has had sufficient to eat.

#### 1.1.2.1.1 - Whey Proteins

Whey protein has a high amino acid balance as far as the branch chained amino acids leucine, isoleucine and valine are concerned. It is also metabolized very quickly in the stomach and intestines so it has little impact on the body feeling it has had sufficient to

#### 1.1.2.1.2 - Casein

Casein for its part has both the excellent branch chained amino acids leucine, isoleucine and valine (although there is less leucine than in whey protein), and also a high portion of glutamine. Casein is metabolized more slowly so it also has a significant impact on the body feeling it has had sufficient to eat. That has particular advantages for weight reduction.

#### 1.1.2.2 - Soya Protein

Soya protein is the highest quality plant-derived protein, but it has a significantly lower proportion of the branch chained amino acids (BCAAs leucine, isoleucine and valine) and also a small amount of methionine. It is important that the soya protein does not contain any gene-manipulated soya and that it pleasantly tastes of soya.

### 1.2 - Fats

Fats, or lipids, belong to the micro nutrients, the human organism's main energy provider from food. Fats are a heterogeneous class of substances that is not soluble in water. Their different properties depend on the different fatty acid contents, their chain length and the degree of saturation. The fats found in foods and relevant for human nutrition are triglycerides, i.e they consist of a glycerin molecule and three fatty acids. One criteria by which they are differentiated is saturation. That means the number of single and dual bonds occurring in the fat molecules.

There are

- Saturated fatty acids (only single compounds)
- Mono unsaturated fats (single bonds plus one double bond)
- Poly unsaturated fatty acids (several bonds)

Foods with a high amount of saturated fatty acids: for example butter, cream, lard. In the form of hidden fats i.e. not visible from the outside, they are part of meat, sausages, cheese, sauces etc. Whether fat in food is rich in mono or poly unsaturated fats can be seen in its consistency. The more solid a fat is, e.g. after it has been kept in the fridge, the higher the proportion of saturated fats. Those foods contain predominantly omega 6 fatty acids. Fats that are liquids at 20° C (around 70°F), oils, are characterized by a high portion of unsaturated fatty acids. It is not possible to see if these are mono or poly unsaturated.

Foods with a high portion of unsaturated fatty acids: in particular vegetable oils, whereby olive oil and peanut oil are rich in mono unsaturated fatty acids, linoleic acid contains many twice unsaturated fatty acids and linseed oil and fish oils are characterized by their high content of poly unsaturated fatty acids. Avacados, seeds, nuts and fatty deep-sea fish such as mackerel, salmon, herring and tuna.

Generally fat-soluble foods are absorbed much more poorly than water-soluble ones that can be taken in by the intestines' epithelial cells. Micelles are created from the fatty acid molecules (triglycerides) in the intestinal lumen that are stored in brush border membranes from where their content is absorbed either

passively, or in the case of free fatty acids by carriers, into the intestinal cells through the cell walls and from there into the bloodstream. Fat soluble substances such as vitamins A,D,E and K as well as omega 1 and Q10 can only be absorbed in this way – i.e. together with fats.

In Germany in general, too many saturated fatty acids and omega 3 fats are absorbed that are stored in the body as energy reserves. Cholesterol is part of cell membranes and is needed to synthesize steroid hormones, active vitamin D and bile acid. Fats also carry taste and aroma, aid in the absorption of fat soluble vitamins and serve as elements to structure cell membranes, where they must be protected against oxidation. They are also hormones and signal substances in the body.

#### 1.2.1 - Omega 3 Fatty Acids

Unsaturated fatty acids are divided into omega 3 fatty acids and omega 6 fatty acids. The ratio of omega 6:Omega 3 should be less than 5:1.

Nowadays the ratio is usually 22:1. Omega 3 fatty acids (alpha linoleic acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) are essential, poly unsaturated fatty acids, usually part of the fatty acids in fatty fish, but also in certain vegetable oils and in algae. They are essential for the human body as it cannot produce them itself. EPA and DHA should be in a ratio 1:4, as DHA plays an important role for heart and brain.

Omega 3 fatty acids play a role in inflammatory reactions, blood clotting and pain sensation. They make a major contribution to keeping heart and circulation healthy, are components in cell membranes, in particular in nerve tissue, and they contribute to normal brain function. Sufficient provision of docosahexaenoic acid (DHA) is an important requirement for brain development and to maintain mental achievement levels to a high age. Eicosanoids from omega 3 fatty acids are generally described as good, whereas fatty acids from omega 6 are described as bad eicosanoids.

In general, fatty acids are very poorly absorbed. However, nowadays, patent-pending technology is available to micellize natural ingredients during production, improving and increasing the bioavailability of these important raw materials.

#### 1.2.2. - Linoleic Acid

Alpha linoleic acid is a triple unsaturated omega 3 fatty acid. It is part of many naturally occurring fats and oils (linseed, soya and rape-seed oil). Alpha Linoleic acid is an essential nutrient that is needed to synthesize the important omega 3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These in turn are preliminary stages of eicosanoids that are said to have anti-inflammatory properties.

#### 1.2.3 - Conjugated Linoleic Acid (CLA)

A group of twice unsaturated fatty acids around linoleic acid is described as conjugated linoleic acid. Some partial health claims are made with regard to weight management, the immune system and insulin resistance but these are not judged by EFSA to be scientifically proven.

#### 1.3 - Carbohydrates

Carbohydrates are a main part of our food and are necessary to cover energy requirements. Carbohydrates consist of differing numbers of molecules, so they are divided by their amount of sugar into simple sugars (monosaccharides), two-fold sugars (disaccharides) and complex sugars (oligosaccharides 3-9 and polysaccharides). Important carbohydrates are glucose (dextrose) and fructose (fruit sugar) as monosaccharides, household sugar (saccharose) in the disaccharide group and starch (from grains and potatoes) as polysaccharides.

Carbohydrates are extremely important for the energy supply to cells, muscles and, in particular, the brains. All carbohydrates are split into monosaccharides in the intestines to be able to absorb them. Blood sugar levels in the body are strictly regulated and kept constant to be able to supply those organs with glucose that are dependent upon it, such as brain, red blood cells and kidney medulla. Other organs can also gain energy from carbohydrates by converting them to ATP, the body's energy supplier.

If too many carbohydrates are absorbed, they can be stored in the liver and muscles. Superfluous glucose can be stored as triglycerides in fat cells.

#### 1.4 - Soluble and insoluble Fibers

Fibers are vegetable substances that count as carbohydrates. These cannot be broken down and absorbed, reach the lower areas of the intestines and serve there, for example, as nutrients for intestinal bacteria. Fibers are highly saturated, promote digestion, reduce cholesterol levels by turning cholesterol into bile and indirectly promoting the absorption of calcium, magnesium, iron and zinc. A difference is made between water-soluble and insoluble fiber. Insoluble fibers such as cellulose cannot be fermented by intestinal bacteria. Pectin, inulin, fructo-oligosaccharides and galactose oligosaccharides are water-soluble fibers. These are metabolized by intestinal bacteria to short-train fatty acids, that serve intestinal cells as energy substrate, reduce pH values so restricting the growth of pathogenic intestinal bacteria. There are scientific indications for preventative properties. Rich provision of fibers in food would prevent intestinal diverticulum forming and could also promote growth of health-promoting bifidobacteria and lactobacteria. Fibers, though, restrict the absorption of minerals and trace elements if they are drunk at the same time.



# Vitamins

*Vitamins are essential for human metabolism (necessary for life) as a body cannot produce/ synthesize them itself (with the exception of vitamin D), so regular provision of them with food is indispensable. A body needs vitamins to protect it against oxidative stress as co-factors for many metabolic processes (energy gain and protein structure) as well as for the immune system to function normally. Foodstuffs of vegetable and animal origin contain vitamins. Deficiencies can have repercussions some of which are very serious.*

## 2.1 - Fat soluble Vitamins

Fat soluble vitamins are absorbed by the body with fats in food. They can be stored in the body. In general, fat soluble vitamins are very poorly absorbed. However, nowadays, patent-pending technology is available to micellize using natural ingredients during production, accelerating, improving and increasing the bioavailability of these important raw materials.

### 2.1.1 - Vitamin A

Vitamin A can be absorbed from food of animal origin or as pro vitamin A (beta carotene) from plants. Provitamin A (beta carotene) is converted by the body to active vitamin A to maintain its full function. Vitamin A makes an important contribution to the maintenance of normal vision and plays a role in mucous membrane, immune system and skin functions. Beta carotene is additionally an effective antioxidant that protects cells against oxidative stress.

### 2.1.2 - Vitamin D

Vitamin D is the only vitamin that the body can produce itself under the influence of ultraviolet light. In general, the supply of vitamin D is poor worldwide, although vitamin D has important functions in the body. To form vitamin D the midday sun is necessary and the use of sun protection factors in cosmetics considerably reduces its production. Vitamin D is needed to regulate calcium and phosphate metabolism and in doing so it makes an indispensable contribution to maintaining normal bones and teeth. For normal immune system function, sufficient provision of vitamin D is also decisive. There are indications that it also influences heart and blood vessels and vitamin D is also called the "good mood" vitamin.

### 2.1.3 - Vitamin E

Vitamin E is an important antioxidant that is found in every cell to protect it against oxidative stress so guaranteeing normal cell function. Only around 30% of vitamin E taken in with food can be absorbed. Special technology enables that amount to be significantly increased to achieve faster, greater and better absorption.

### 2.1.4 - Vitamin K

Vitamin K in its active form contributes to transforming blood clotting factors so is highly important for blood clotting. It is always sufficiently present in normal food.

## 2.2. - Water soluble Vitamins

The group of water soluble vitamins contains B vitamins and vitamin C. These vitamins, with the exception of vitamin B12 cannot be stored by the body so must always be supplied with food. Good sources of B vitamins are wholemeal products, vegetables and most fish and meat.

### 2.2.1 - Vitamin B1 (Thiamin)

Thiamin is an important co-factor in energy and carbohydrate metabolism, which is why requirements depend on a person's energy needs. Thiamin contributes to the prevention of weakness and fatigue and plays an important role in the functioning of the brain and of nervous systems.

### 2.2.2 - Vitamin B2 (Riboflavin)

Riboflavin is of central importance as a co-factor to energy gain from sugars and fats. It is also a co-factor of redox systems that protect the body against oxidative stress, and for forming essential hemoglobin that transports oxygen through the body. Vitamin B2 is also important to stabilize lense proteins, so making it possible to see normally. Vitamin B2 is also needed for iron metabolism and contributes to normal functioning of the nervous system. Riboflavin is also needed as a co-factor in neutron transmitter production, e.g. serotonin. Tiredness and fatigue can be reduced with vitamin B2.



### 2.2.3 - Vitamin B3 (Niacin)

Niacin is needed for many important reactions in the organism, among other things, it plays a part in yielding energy so reducing tiredness and fatigue. Niacin is involved in building up and in decomposing carbohydrates, fatty acids and amino acids. It also supports the normal functioning of the nervous system and concentration.

### 2.2.4 - Vitamin B5 (Pantothenic Acid)

Pantothenic makes a contribution to the metabolism of carbohydrates, fats and amino acids as a co-factor. Beyond that it is involved in the synthesis of steroids, in hemoglobin that transports oxygen and in neuro-transmitters, so supporting concentration and achievement levels.

### 2.2.5 - Vitamin B6 (Pyridoxine)

Pyridoxine is essential for amino acid metabolism and synthesizing proteins, and also plays a role in glycogen/ carbohydrate metabolism so contributing to energy provision and to normal energy metabolism. Vitamin B6 is also needed for the nervous system to function and as a co-factor in reducing homocysteine levels (a probable risk factor for arteriosclerosis).

### 2.2.6 - Vitamin B7 (Biotin)

Biotin or vitamin H is needed to provide energy in the metabolism of fatty acids and amino acids. It is good for skin, hair, nails and concentration and important for the normal functioning of the nervous system.

### 2.2.7 - Vitamin B9 (Folic Acid)

Folic Acid is an important vitamin that is needed for cell division and embryonic development. It also plays a role in amino acid metabolism, is important for the immune system and in conjunction with vitamin B12 can protect against cardiovascular diseases. Paediatricians in Germany require sufficient provision of folic acid in the last quarter before a pregnancy to reduce the risk of brain damage or of incomplete closure of the neural tube (spina bifida) during the first weeks of a pregnancy.

### 2.2.8 - Vitamin B12 (Cobalamin)

Cobalamin is primarily found in foodstuffs of animal origin. For active intake, it is necessary to combine it with a protein formed in the skin cells of the stomach's mucous membranes, the intrinsic factor. Vitamin B12 is needed to form red blood cells and it prevents the degeneration of the spinal cord. Along with folic acid and vitamin B6, vitamin B12 serves as a contributory factor in reducing the level of homocysteine (a probable risk factor for arteriosclerosis). A vitamin B12 deficiency can result in anemia and in destruction of the peripheral nerves (polyneuropathy). Vitamin B12 (cobalamin) is therefore necessary for normal blood formation. According to recent studies around 50-60% of all vegetarians and vegans do not take in enough vitamin B12 and should supplement it. At advanced age and in people taking gastric acids inhibitors, intake is also reduced.

### 2.2.9 - Vitamin C

Vitamin C is a strong antioxidant that protects the body and also the eye lenses against oxidative stress (in that case, in conjunction with lutein and zeaxanthin). It is needed for fatty acid metabolism so contributing to energy yield. Vitamin C simultaneously increases iron intake and contributes to normal functioning of the immune system and the nervous system (synthesis of neurotransmitters). Collagen formation also requires vitamin C, contributing to normal cartilage and bone function.

# Bulk Elements

*Bulk elements are inorganic compounds in the body that are normally available in sufficient quantities. Yet they are still essentially important for the body, because many metabolic processes depend on sufficient of these substances being available. The amount of absorption of these substances depends on many factors. Each mineral has different qualities in absorption, they can also interact, e.g. intake is reduced when fibers are simultaneously taken.*

## 3.1 - Calcium

Calcium is primarily found in dairy produce and vegetables. Calcium contributes to maintaining normal bones and teeth. Sufficient supply from youth to mid life is important for the skeleton to remain stable at advanced ages (prevention of osteoporosis, especially for women). Its intake is strongly coupled to vitamin D provision. The body also needs calcium for muscles to work properly. Calcium is a co-factor for many enzymes in the body and important for cell division and blood clotting. Calcium should always be combined in the right ratio with magnesium.

## 3.2 - Potassium

Plant substances like fruit and vegetables are rich in potassium. The content can be significantly minimized by processing, especially cooking. Potassium is essential for regulating water levels. It is important for a healthy heart and for nerves and muscles to function. Potassium plays a decisive role in energy metabolism, glycolysis. It is usually sufficiently available with food.

## 3.3 - Magnesium

Magnesium is especially found in wholemeal produces, nuts and pulses and is a co-factor for many enzymes, that have a role in energy metabolism (carbohydrate, protein and fat metabolism). Magnesium plays a role in reducing tiredness and fatigue. Magnesium is also an important structural element in the body and is needed for normal muscle functions. It is also important for heart function and signal transmission in the human organism. As the counter balance to calcium it relaxes muscles so preventing cramps. Magnesium contributes in this way to normal functioning of the nervous system and of muscles.



## 3.4 - Sodium

Sodium is plentiful in cheese types and smoked sausages in particular. It is needed to regulate the water balance and influences the acid-alkaline balance. It is also important for nerve functions and co-factor of several enzymes. During endurance sports, especially on warm days, significant sodium loss can occur.

## 3.5 - Phosphate

Phosphate is part of the body's phosphate buffer system essential for life, playing a role in the acid-alkaline balance. It is also an essential part of bones, teeth, cell walls and DNA. Phosphate is part of ATPs, the cells' universal, energy carriers, that are needed for most body processes.

## 3.6 - Chloride

Chloride plays a role in transmitting signals in the body and can activate different enzymes. It is also involved in regulating the acid-alkaline balance.

# Trace Elements

*Trace elements are also inorganic compounds in the body that are present in a lower concentration than bulk elements. Yet they are still essential for the body. They are also involved in the regulation of the metabolism and are needed for optimal physical and mental performance.*

## 4.1 - Chromium

Meats, brewer's yeast, cheese and wholemeal products are especially rich in chromium. Chromium is an essential trace element for carbohydrate and fat metabolism. It supports muscle build up and the sensitivity to insulin in the human organism's target cells. Chromium has forms with different bioavailability, for example chromium picolinate is absorbed much better than normal chromium.

## 4.2 - Cobalt

Cobalt is the central atom of vitamin B12 and therefore involved in important reactions in the organism. It can prevent cardiovascular disease.

## 4.3 - Iron

Iron is highly important for physical performance, in hemoglobin it transports oxygen (essential for life) through the body. Iron is also needed to yield energy from food, is part of the enzymes in the breathing chain, in which ATP, the energy source for human activity is produced. As part of antioxidant enzymes iron protects cells against oxidative stress. Iron with good bioavailability is primarily found in raw ingredients of animal origin. Iron from vegetables is only slightly bioavailable. Girls and women up to the menopause need iron. Iron absorption is improved by small amounts of vitamin C.

## 4.4 - Fluorine

Fluorine, as a non-essential trace element, is an important factor in preventing caries.

## 4.5 - Iodine

Iodine is needed for the synthesis of thyroid hormones, that play an essential role in growth, brain development, bone formation, regulation of energy metabolism and the basic metabolic rate.

## 4.6 - Copper

Wholemeal products, nuts, fish and shell fish are especially rich in copper. Copper is part of the breathing chain that makes energy available to the body in the form of ATP. Copper protects against free radicals, is involved in transforming them into less damaging substances. Copper is needed for building hemoglobin (transporting oxygen in the blood), so therefore is closely connected to iron metabolism. Copper also contributes to cross linking collagen and elastin so maintaining normal connective tissues.

## 4.7 - Manganese

Manganese is part of different enzymes in the body. It is needed for carbohydrate metabolism, among other things. Manganese as a part of an antioxidant enzyme protects against radical oxygen compounds. With vitamin K it aids blood clotting. Manganese is also needed to store calcium in bones and teeth.

## 4.8 - Molybdenum

Molybdenum is an essential trace element that is a co-factor of enzymes, e.g. in carbohydrate metabolism.

## 4.9 - Selenium

Liver, scallop and pulses are rich in selenium, but the content is constantly falling due to soil low in selenium. According to many studies, selenium is reported to be a generally deficient trace element. As part of an anti-oxidative enzyme selenium protects cells against radical oxygen compounds and therefore against oxidative stress. It also contributes to normal immune system function and is important in regulating oxygen processes as it is involved in activating thyroid gland hormones. Selenium can bind heavy metals so reducing their toxicity.

## 4.10 - Zinc

Zinc can be predominantly found in products of animal origin making it a trace element that is often important for vegetarians. It contributes to normal carbohydrates and fatty acid metabolism. It is also important for growth and contributes to normal fertility. Zinc is also needed for immune defense and is part of anti-oxidative enzymes. Zinc is needed to maintain normal bones and for smooth skin, hair and nails.



# Other Nutrients

## 5.1 - Algae Powder

Algae have high vitamin B12 and amino acid content. They can also contain plant omega 3 fatty acids.

## 5.2 - Ayurvedic Herbal Aroma

Herb and spice knowledge that is thousands of years old can be found in Ayurvedic medicine. Herbs and spices are used as they normally would be in food. They should have beneficial effects on intestines, absorption and the immune system. (e.g. curcuma)

## 5.3 - Chondroitin

Chondroitin is an important part of cartilage and contributes to its resisting compression. In combination with collagen, chondroitin ensures the structural integrity of tissue. Chondroitin sulphate is said to help against degenerative diseases of the joints, if it is often combined with glucosamine. In addition chondroitin sulphate has indicated anti-inflammatory effects in vitro.

## 5.4 - Coenzyme Q10 (Ubichinon)

Foods such as scallops, liver, fish and eggs are relatively rich in coenzyme Q10. Vegetable foodstuffs usually only contain small amounts with the exception of soya and rape-seed oil. It belongs to the group of vitaminoids. Its known physiological functions are its role in the breathing chain and its function as an antioxidant (electron donator). It has a role in forming ATP (enriched phosphate= and therefore in energy yield). It seems to be an important nutrient from the 35th year of life as the body gradually loses its ability to form it. In general, coenzyme Q10 is absorbed very poorly as it is a fat soluble substance. However, nowadays, patent-pending technology is available to micellize using natural ingredients during production, accelerating, improving and increasing the bioavailability of this important raw material.

## 5.5 - Curcuma/Curcumin

Curcuma is one of the ginger plants and its main component is curcumin, that serves as a taste carrier and a color. Curcumin has many positive effects on the human organism, as well as an anti-inflammatory effect, beneficial influence on the nervous system, the blood sugar level and on fat metabolism. Intestinal functions are also beneficially effected. Unfortunately, natural curcuma is hardly absorbed by the intestines at all. However there are now special techniques to increase and improve curcuma's bioavailability to optimize its absorption for use in the body.

## 5.6 - Enzymes (e.g. Amylases, Lactases, Proteases)

Enzymes have important functions for the optimal digestion and subsequent absorption of micronutrients (protein, fat and carbohydrates).

## 5.7 - Glucosamine

Glucosamine in the human body is part of the connective tissues, cartilage and joint fluid. Several scientific studies have proved its effect to protect cartilage, often in combination with chondroitin sulphate.

## 5.8 - Guarana

Guarana extract contains tannin-bound caffeine that is released slowly and cheers up for a long period. Bound caffeine acts differently in the body from the non-bound form. Guarana has a stimulating effect on the central nervous system without making nervous at the same time. It increases the muscle and brain performance, stimulates the respiratory center and promotes energy yield from glucose and fatty acids.

## 5.9 - Isoflavones

Isoflavones are secondary plant substances, so called phytoestrogens. Research results related to antioxidative properties, indicate positive effects on blood fat levels, the cardio-vascular system and the maintenance of bone matter after the menopause. There are also initial indications of supportive effects for men with night troubles too.

## 5.10 - Green Coffee Bean Extract

Green coffee bean extract contains naturally occurring polyphenols, activates fat metabolism, reduces glucose absorption and its storage in fat cells so supporting weight loss. Green coffee bean extract has an additional strong antioxidative effect.



## 5.11 - L-Carnitin

Carnitin has important functions for fat metabolism: it transports long-chain fatty acids through the mitochondria membrane for oxidation as it is necessary as a co-factor and has an optimum effect when under aerobic strain (i.e. in endurance training).

## 5.12 - Lecithin

Lecithin is one of the group of phospholipids (as part of all tissue and organs). It promotes brain, nerve and organ performance and is therefore highly important for the fitness and function of a human organism.

## 5.13 - Lutein

Lutein is a carotenoid that plays an important role in eye metabolism together with zeaxanthin as both occur in high concentrations in the central area of the retina and build a protective layer there against the attack of free radicals and against blue light. They are the only carotinoids that occur in the lenses and the retina. That makes them especially important for maintaining the health of vision, along with vitamin A. In general lutein is poorly absorbed. However, nowadays, patent-pending technology is available to micellize using natural ingredients during production, accelerating, improving and increasing the bioavailability of this important raw material.

## 5.14 - Mate Extract

Mate extract stimulates nerves, muscles and the metabolism, has a diuretic effect, activates and strengthens circulation, promotes the creation of saliva and gastric juices so aiding digestion. In South America it is considered to be performance boosting and hunger reducing.

## 5.15 - Probiotics

Lactic acid bacteria and bifidobacteria belong to the probiotics. There are many different lactic acid bacteria, such as the important Lactobazillus acidophilus and Lactobazillus reuteri. They ensure improved micro flora in the intestines. Using probiotics in food should stabilize the intestinal barrier. There are studies about L. Reuteri that considerably reduce the number of days of an illness, improve dental health and reduce flatulence in the intestines. There are thousands of different studies about these bacteria's role in health protection, but no determinative scientific clarity has been forthcoming. The change to the stool pH makes the living conditions for undesirable germs more difficult.

## 5.16 - Secondary Plant Substances

Secondary plant substances belong to the group of bioactive substances. They are non-essential, but have been considered in numerous scientific experiments to be an important factor in maintaining health. Secondary plant substances comprise numerous different chemical compounds that are estimated to amount to around 30,000 individual substances. Some of them are carotinoids, polyphenols and phytoestrogens. Among other things, they have an antioxidative effect (against free radicals), regulate blood pressure, cholesterol levels and blood sugar levels, promote circulation, strengthen the immune system and are effective against bacteria, viruses and fungi.



## 5.17 - Stevia

Low-calorie sweetener from a South American plant. Stevia is a natural alternative to sugar and sweetener. Since 2012 stevia has been allowed in the EU but has gained little use due to it relatively metallic after taste (like licorice). However, there are special procedures that mask this after-taste with natural substances to achieve a sweetness that tastes good so that it can be used in foodstuffs. Stevia does not activate insulin metabolism so is good for people who cannot tolerate sugar and also if skin is irritated.

## 5.18 - Water

The largest part of our body is comprised of water, making it the most important component. Water accounts for up to 60% of our body weight. It is important for regulating the temperature, makes oxygen transport possible and brings all the nutrients to the cells. At least 2 liters (4.2 pints) of water a day should be drunk.



# VITAMIN MANUAL

