B vitamins are among the group of water-soluble vitamins. Because of the key role B vitamins play in energy metabolism, a certain relation exists between human vitamin requirements and energy expenditure. Needs are increased by chronic inflammatory diseases in particular. In addition, decreased resorption and poor storage of water-soluble vitamins can cause symptoms of deficiency.

**ID-Vit® is a new biological measurement method for reading the level of effective B vitamins**

The standard method for detecting B-vitamin levels is quantification via HPLC, in which the substance quantity of B vitamins is determined. This may be done in serum, EDTA plasma or intracellularly (in the cruror after separating out liquid blood components). This method does not differentiate between active and inactive vitamin metabolites, however. For example, vitamin B6 represents a combination of 6 interconvertible substances, namely pyridoxal (PL), 1-pyridoxine (PN), pyridoxamine (PM), pyridoxal 5-phosphate (PLP), 1-pyridoxine 5-phosphate (PNP), pyridoxamine 5-phosphate (PMP) and the end product of vitamin B metabolism – 4-pyridoxic acid. It is generally accepted that PLP is the most effective element, although for vitamin effectiveness the ratios of the individual metabolites are crucial.

**How does reading bioactive vitamins work?**

With ID-Vit®, the blood samples are pretreated enzymatically and put on a microtiter plate in diluted form that is coated with vitamin-sensitive Lactobacillus or Saccharomyces strains. The medium, which is individually composed for each vitamin, contains all the ingredients necessary for bacterial growth except for the vitamin to be measured. When the patient’s blood is added, the germ grows until the vitamin is depleted. The growth of microorganisms is measured as turbidity in an ELISA reader after 72h and compared with a standard concentration series. The amount of bioactive vitamin is directly proportional to microorganism growth.

**Fig. 1** The findings show that despite normal vitamin B6 blood level, functionally there is a clear deficit.

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**Fig. 2** This test measures the content of bioactive vitamin based on the growth of selectively vitamin-dependent indicator microorganism.

**Where do the ID-Vit® values lie as compared to conventional analysis?**

The results between the ID-Vit® assay and the HPLC method showed a good correlation for the 5 established vitamins. Only with vitamin B2 no correlation was recognizable, possibly due to the fact that the metabolites flavin mononucleotide and flavinadeninenucleotide are effective here. However, deviations were found in all vitamins, especially in the limit range of the standard values, which can be explained by the different levels of active and inactive components. In 5 to 15 % of the cases, functional deficiencies were found which could not be detected by conventional substance analysis. This affected both blood levels and intracellular levels.

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**Test     Result      Unit       Reference Range**

- **Vitamin B1 bioaktiv i. E.** 43.5 µg/l > 39.8
- **Vitamin B2 bioaktiv i. S.** 102 µg/l > 85.4
- **Vitamin B6 bioaktiv i. S.** 4.33 µg/l > 10.1
- **Vitamin B12 bioaktiv i. S.** 372 µg/l > 358
- **Folic acid bioaktiv i.S.** 10.5 µg/l > 8.8

The vitamin B6 level is functionally too low. From a functional standpoint, the levels of the other vitamins are adequate.
Advantages of measuring bioactive B vitamins

This test measures the vitamin B metabolites actually effective in vivo. Bioactivity is thus of more indicative value than level measurement when the indication is to be provided for a substitution therapy or for controlling therapeutic success.

Use of the ID-Vit® test is recommended for gauging supply status when plasma, serum or intracellular levels are in the grey area.

Vitamin B6 (pyridoxal, pyridoxine, pyridoxamine)

Vitamin B6 is effective as pyridoxal phosphate in numerous enzymatic reactions across all areas of metabolism, particularly as a cofactor in the transamination, decarboxylation, dehydrogenation and cleavage reactions in amino acid metabolism. Vitamin B6 is especially important in the derivation of serotonin from tryptophan and as a cofactor of diamine oxidase (DAO). The primary clinical symptoms of deficiency are neurological disorders (ataxia, paresis), insomnia, irritability, disturbed sensitivity, inflammation of the skin and mucous membranes, neuritis with burning pain, blood count changes (cytopenia, microcytic anaemia), histamine intolerance, impaired enteral trace element resorption and increased homocysteine.

Vitamin B12 (cobalamin)

The most important vitamin in the group of B12 vitamins is the coenzyme B12, which functions as a cofactor of various enzymes. Cobalamines contain the trace element cobalt as the central atom. The biologically inactive form is cyanocobalamin (= vitamin B12), which is converted into the biologically active form, adenosylcobalamin (= coenzyme B12). Besides adenosylcobalamin, methylcobalamin (methyl-B12, MeCbl) is another biologically active form.

Early clinical symptoms of vitamin B12 deficiency can be seen in tingling and cold sensation in hands and feet, exhaustion and concentration disorders. Deficiency symptoms can cause diseases such as pernicious anaemia and damage to the central nervous system (funicular myelosis). A possible link also exists between B12 deficiency and dementia.

Folic acid

Folic acid is taken in from food as a precursor for the active coenzyme tetrahydrofolic acid (THF). Like vitamins B6 and B12, THF plays a central role in C1 metabolism. Due to its function in DNA synthesis, folic acid plays an important role in the formation of new cells, including immune cells and intestinal epithelia. Folic acid deficiency primarily affects rapidly dividing cells, such as haematopoietic cells, which, as with B12 deficiency, can lead to pernicious anaemia.

Material and pre-analysis

Vitamin B1: 1 EDTA tube (uncentrifuged)
Vitamin B2, B6, B12 and folic acid: 1 whole blood tube or centrifuged serum

Sample receipt within 24 hrs has to be ensured. Within the Berlin city area, we offer a courier service (+49 (0)30 7701-250). For collections beyond Berlin, please contact our complimentary courier service (+49 (0)30 77001-450).

Costs

Costs per vitamin B1, B2, B6 are 33.22 € and 14.57 € for B12 or folic acid.

Literature