# The interaction of several biofactors is crucial for protection against osteoporosis

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Osteoporosis is a disease which is associated with the excessive degradation of bone tissue together with a loss of bone substance and a reduction in the stability and elasticity of the bones. This increases the risk of bone fractures and causes deformations of the skeletal system, resulting in strong osteogenic pain. 80% of those affected are women, although men are also at risk in older age. Approximately every third woman suffers from osteoporosis after menopause, with around half of men and women aged over 75 suffering from this disease. Early prophylaxis is therefore particularly advisable for women, especially if they have known risk factors.

There are risk factors for the development of osteoporosis which it is very difficult for us to influence. These include women with osteoporosis in the family history, the surgical removal of the ovaries or premature menopause, a low body weight in youth, a constitution that has a tendency to osteoporosis (petite women with low body weight), as well as inflammatory rheumatic diseases that are treated with corticoids. In addition, however, there are significant risk factors which we can very well influence. These include a lack of physical activity, smoking, too much alcohol or coffee and a diet which contains insufficient quantities of minerals and vitamins that are important for bone development.

Among the biofactors, the importance of an adequate supply of calcium and vitamin D has long been known, and also has priority in the minds of patients. Less attention is given on the other hand to the importance of vitamin K for the bone metabolism. Vitamin K is also crucially important for the formation of blood coagulation factors and the bone metabolism. Vitamin K-dependent proteins in the bone metabolism are required in order to bind vital Ca ions with high affinity. This is the pre-requisite for sufficient bone density and therefore stable bone resilience to loads. Without sufficient vitamin K levels, the bone protein osteocalcin is only converted into the functionally active form to an inadequate degree.

Plenty of clinical evidence has been submitted over recent years for the relationship between vitamin K and bone density. Raised serum concentrations of insufficiently carboxylated osteocalcin and low serum concentrations of vitamin K are associated with reduced bone density and increase the risk of thigh fractures. The significantly lower risk of femoral neck fractures with the adequate intake of vitamin K has been sufficiently demonstrated. The increase in bone density experienced by osteoporosis patients who take additional vitamin K has also been shown. In view of these findings, an adequate supply of vitamin K has taken on increasing importance over the last few years.

Magnesium is also involved in the bone metabolism. The promotion of the development of osteoporosis due to a lack of magnesium has been demonstrated both experimentally and clinically. As magnesium deficiency is very widespread, the

effective prophylaxis of osteoporosis therefore also requires an adequate supply of magnesium.

One further mineral which must be available in sufficient quantities in order to ensure bone stability is fluorine. Fluoride ions are incorporated in exchange for OH ions of hydroxylapatite in the bones and tooth enamel in the form of fluorapatite, which become harder as a result. As the daily fluorine requirements in Germany are insufficiently covered by the daily diet, the additional supply of fluorine in small quantities is an effective factor supporting the prophylaxis of osteoporosis. This is widely recognised and does not contradict the disputed use of fluorine in high doses for the treatment of existing osteoporosis.

The additional significance of copper and manganese is also under discussion. However, the clinical relevance of these findings and the assessment of the risk-benefit relationship require further investigation.

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