

Ulcerative colitis is a chronic, incurable disease of the large bowel affecting 3 million people globally, including 100 thousand in Poland. Abdominal pain, diarrhea, blood in feces, and chronic fatigue all belong to its symptoms. Patients experience a number of difficulties in daily life, including lower efficacy at work and the necessity to chronically take anti-inflammatory and immunosuppressive (taming immunity) medications, some of which give side effects. The causes of the disease are not well understood, but it is known that it results mainly from the influence of environment, via dysregulation of the immune system. The disorientated immune system begins to attack the large bowel of the patient and to overreact to beneficial bacteria, which thrive inside it.

Vitamin K is a group of chemical compounds, which allow the organism to turn on important functions of several proteins. Vitamin K is present in the diet and produced from its components by intestinal bacteria. After absorption by the organism, the vitamin aids some proteins to convert from inactive to active forms by enabling the binding and use of calcium ions. Therefore it is not surprising, that vitamin K (and especially menaquinone-7 belonging to vitamin K2) has key importance for the health of bones, which contain a large deposit of calcium. It also helps to protect blood vessels against calcium deposition and stiffening, and so atherosclerosis, by taking away the unnecessary calcium. Finally, calcium is necessary for blood clotting and because of this severe vitamin K deficiency causes bleeding. Understanding of these processes already helps newborns, who receive vitamin K at birth, which protects them against bleeding into the brain.

Yet, the significance of vitamin K2 has not been fully explored. Research conducted using cell lines revealed that vitamin K2 may reduce overactivity of immune cells. If such effect was confirmed in humans, it would be immensely interesting, because we need safe drugs exhibiting such effects. Vitamin K in the form of menaquinone-7 (K2, which interests us) is a substance produced by microbiota in the intestine of a healthy person, that is also approved as a “novel food” by the European Union. How can it be verified if this specific type of vitamin K2 can positively influence the immune system, which would be so useful in autoinflammatory and allergic maladies?

To stand up to this challenge we plan to conduct a study, in which patients with ulcerative colitis will participate. They will receive vitamin K2 (menaquinone-7) in a larger or smaller dose or a neutral substance (placebo), depending on random allocation. After one month we will take bloods to measure the activity of genes in white cells and in their particular subtype important for the disease (CD4+). Thanks to financing from the Polish National Science Centre we will be able to check what is the influence of vitamin K2 (menaquinone-7) on the activity of all 20 thousand genes in immune cells in general and in their specific subtype (CD4+). It will be a novelty on a global scale, and great help in understanding how vitamin K2 influences humans. Because vitamin K2 is associated with the intestinal bacteria, we will also investigate the relationships between them and the effects of vitamin K2 on gene activity. We will precisely determine the level of vitamin K2 deficiency in our patients by using three different methods, which will assess its various aspects – and we will also link these data to the influence of vitamin K2 on gene activity. Moreover, we will take genetics into account. To answer the question how vitamin K2 influences the immune system of patients with ulcerative colitis, we will use advanced computer methods, in the use of which we are experienced.

We hope that the results of this project will lead to attempts at the use of vitamin K2 (menaquinone-7) in the treatment of ulcerative colitis, Crohn’s disease (which is similar), and other inflammatory maladies, where one of fundamental treatment options are steroids, e.g., asthma or rheumatoid arthritis. However, until we understand how exactly menaquinone-7 works, and until adequate studies are finished, it should be remembered that menaquinone-7 is not indicated in the treatment of inflammatory bowel disease. Our research is needed to change this and help patients in a simple, natural and inexpensive way.