

Popular science description of the project titled *How Phosphorus-Containing Food Additives Affect the Gut and Metabolic Health of the Body: Having the Guts to Tackle Phosphates*

Phosphorus is a basic mineral nutrient necessary for the proper functioning of our body, which has to be supplied in appropriate amounts with food. Phosphorus, apart from calcium, is the basic building material for bones and teeth, and its relatively large amounts are also found in the brain. By being a part of various chemical compounds, phosphorus also has important regulatory functions in our body, among others, by influencing an appropriate, slightly alkaline blood pH and by being an important component of our body's cells, including compounds that are energy carriers or genetic material. Phosphorus occurs naturally in food products as a part of more complex organic compounds, and its richest sources are cheese, pulses, eggs, meat and whole grain cereals. However, this mineral is also added to food along with additives of natural or synthetic origin, deliberately prepared in order to improve the technological process and give the appropriate properties of the final products. For this reason, the content of phosphorus, among others, in the form of phosphoric acid derivatives called phosphates is often significantly increased in highly processed food products, and the presence of this type of products on the market is common nowadays. As a consequence, there has been an increase in phosphorus intake over the past decades and it is currently estimated to be 2-3 times higher than official dietary recommendations, which may have an impact on our health and goes hand in hand with the observed increase in the incidence of certain chronic diseases. So far, it has been proven that excessive consumption of phosphate overloads the kidneys when they do not function properly, however, the literature data suggest that, after ingesting compounds rich in phosphorus, disorders in other organs and systems may also occur, including the gastrointestinal tract and the cardiovascular system. However, there is a lack of properly controlled and conducted nutritional studies in this area, which would allow for an unequivocal assessment of the impact of phosphorus-containing food additives on health.

The aim of this project is to verify by using strictly designed diets how phosphorus-containing food additives affect the gut and metabolic health of the body. Based on the literature data, we suppose that some of these additives may contribute to the development of chronic intestinal disorders and other diet-related diseases, such as the metabolic syndrome and cardiovascular disease. We assume that phosphorus-containing food additives can affect the gut function and the body as a whole, both directly and indirectly through bacteria in the distal intestine, which may depend on a number of interrelated factors. The most important of these factors are: 1) chemical structure of phosphorus-containing food additives, including the complexity of the compounds and the percentage of phosphorus in them, 2) the consumption level of the additives containing phosphorus during the day, 3) the degree of their absorption from the gastrointestinal tract and utilization by the body, and 4) the presence of gastrointestinal disorders in the body ingesting these additives. In this project, nutritional experiments will be conducted on laboratory rats (healthy and with intestinal disorders), which will serve as a research model reflecting the status of our health. These experiments will be based on specially prepared diets, in which the tested additives will be included in accordance with the assumptions and aims of our four specific research tasks. The subject of the research will be: I) phosphates with different degree of complexity used in the meat industry, among others; II) chemically modified (phosphorylated) starches, which are used, among others, as thickening agents in various food products. It is these additives that are among the most commonly used additives containing phosphorus in food production, and moreover, they have been selected on the basis of the available literature describing their potential impact on health.

The realization of this project will help in determining what is the role of the most frequently used phosphorus-containing food additives in health and disease and in verifying their safe dietary levels and hazards resulting from their regular consumption. The planned research will also help explain the complicated mechanisms by which phosphorus-containing food additives affect the gut and metabolic health of the body. The results of this project may also contribute to the development of new strategies in the prevention and treatment of diet-related diseases, and they may initiate changes in official dietary recommendations and even in the way how food is produced around the world.