Popular science abstract

A growing interest has recently been observed in natural sources of bioactive substances and food products, which – apart from their primary function of supplying nutrients – would exhibit high health-promoting and symbiotic values, triggering the state of eubiosis of gut microbiota. Food of this type includes products for special nutritional purposes, called functional foods. Apart from their nutritive values, they regulate and modify the physiological and metabolic processes in the human body. They are also used in the prophylaxis of chronic non-communicable diseases, which are the main cause of many pathological conditions of the global population in the XXIst century. Ample research works based on medical surveys have indicated a strong, positive correlation between the effect of consumed food products, especially those rich in polyphenolic compounds or probiotics, and the human body health status and well-being, thus prompting the need for more extensive research into these issues within the discipline of food technology and nutrition. Health-promoting compounds, represented mainly by secondary plant metabolites, exhibit strong antioxidative properties, protecting the body against oxidative stress induced by the excess production of reactive oxygen species that were not eliminated from the body via natural repair mechanisms. In turn, the probiotic microorganisms (including psychobiotics) maintain the proper gut microbiota, thus strengthening the immune system, exhibiting the anti-carcinogenic activity, inhibiting the growth of pathogens or they affect well-being. It is noteworthy that the phytochemicals and bacteria are degraded when exposed to environmental factors or technological processes, which decreases their survivability, bioaccessibility, and bioavailability in the body.

Given the above data, it seems necessary to search for and implement methods that would protect natural biological compounds valuable for the human body and also pure cultures of probiotic microorganisms, including psychobiotics. These expectations can be met by the encapsulation technique, which allows producing synbiotics enriched in polyphenolic compounds. The published results of scientific studies prove the advisability of employing the encapsulation technique to protect phytochemicals and microbials introduced into the food matrix. However, sparse information can be found on the production of encapsulated synbiotics fortified with bioactive compounds featuring controlled bioaccessibility and bioavailability. In addition, the mechanism of interactions between components of synbiotics and digestive enzymes has not been fully elucidated yet. It is also essential to determine the stability of novel, model synbiotic cereal products during their production and storage.

Therefore, the major scientific goal of this Project is to determine the possibility of employing the microencapsulation process to produce synbiotics enriched in polyphenolic compounds and assessing the impact of this process on the survivability of microorganisms as well as the stability and health-promoting value of bioactive compounds in terms of their bioaccessibility and bioavailability in model in vitro systems both the synbiotics and the model products.

The Project's research hypothesis assumes that the encapsulation of probiotic microorganisms, including psychobiotics, with bioactive compounds enables producing a synbiotic featuring a high health-promoting value, stability of polyphenols, and survivability of microorganisms, and being potentially utile as fortifying agents of functional foods alleviating pathological lesions induced by wrong dietary patterns and long-lasting stress. On the other hand, the encapsulation is seen as a perfect process ensuring the controlled release and bioavailability of probiotics (including psychobiotics) and polyphenolic compounds. As an element of an everyday diet, the novel, model synbiotic foods produced in the scope of the Project can prove effective in the prevention of chronic inflammatory conditions and depression.

The planned research is expected to extend the scientific knowledge about the possibilities of producing effective synbiotics based on probiotic microorganisms, including psychobiotics, and polyphenolic compounds using the microencapsulation method to ensure their controlled release during digestion. The planned analyses of the model synbiotic products will contribute to the development of cereal products, indicating the direction of their use. This research issue should be perceived as a novel and innovative scientific approach to the problem posed by the limited effect of health-promoting compounds and microorganisms on intestinal dysbiosis and by the excess formation of reactive oxygen species in the human body.