

Immunomodulating properties of pre-fermented whey beverage enriched with chokeberry juice and colostrum

The recent years have marked a clear increase in the awareness of health risks caused by civilisation diseases (i.a. obesity, diabetes, allergies, inflammation of the digestive tract) and the spread of viral infections. This fact has contributed to an intensive search for foods rich in biologically active components that would strengthen the human body. The combination of various raw materials is a common practice in the food industry, however research works carried out so far are mainly focused on improving the technological properties of products and their rheological and sensory characteristics. There is little or no data on the impact of individual food components and their mixtures on the health status. Therefore, the proposed project addresses the urgent need to obtain and disseminate knowledge on the differential impact of individual food components and their mixtures on a consumer's health.

The aim of the project is to investigate the effect of bioactive whey protein (S), colostrum (K) and chokeberry juice polyphenols (A), in the form of a pre-fermented mixture (SKA), with the participation of a potentially probiotic bacteria set developed by the project author in their previous studies and deposited in the collection of the IAR&FR PAS in Olsztyn. The project is a continuation of a research investigation where a unique strain set enabled fermentation of whey to reduce the allergenic properties of the proteins contained within. **The hypothesis** is that the combination of the bioactive components studied and their pre-fermentation with a unique potentially probiotic bacteria set will enhance the immunoregulatory effect of the mixture.

The research planned will be conducted exclusively *in vitro*, and at the first stage it will include determining the proportions /quantitative selection of raw materials in the mixture and the establishing the optimal pre-fermentation conditions. In the next stage, simulated gastrointestinal digestion of individual components and their pre-fermented mixture will be carried out, and the biological activity of the hydrolysates obtained will be analysed using human intestinal epithelial cell model (Caco-2, cancer cells and HIEC-6, healthy cells). Epithelial cells will be cultured under standard conditions and in the state of induced inflammatory reaction (in the presence of bacterial lipopolysaccharide, LPS). The measured parameters of epithelial cell immune response (cell proliferation, level of immune response markers: cytokine expression and level of pro- and anti-inflammatory pathway interleukins) will allow to unequivocally determine the immunoregulatory potential of the components and their pre-fermented mixture. The scope of analyses will be completed by the microbiological characterisation of the pre-fermented SKA mixture. The proposed procedure allows to obtain reliable results with **the omission of experiments on laboratory animals**, implementing at the same time the replacement rule, constituting the **3R** principle.

One of the most important **expected effects** of this investigation will be generating new knowledge on the influence of individual food components and their pre-fermented mixture (SKA) on human intestinal epithelial cells. Analysis of the levels of immunological markers will enable identifying the optimal composition of the mixture to ensure its beneficial effect on the immune system. Moreover, demonstration of the synergistic effect of whey, colostrum and chokeberry juice will be an added value of the tested composition.

In the future, the results of the project may be the basis for the development of a beverage dedicated to people during convalescence, e.g. after suffering from infectious and non-infectious diseases. What is also crucial, the project proposes measures to valorise a by-product of the agri-food industry (whey), this way contributing to global drive towards circular economy models. The results of the planned research will provide a scientific basis for further projects of an interdisciplinary and innovative nature, as it will indicate the possibilities of using the raw materials studied in the food, biotechnology and pharmaceutical industries.