The role of lactic acid bacteria isolated from food in neuroprotective activities due to maintaining homeostasis of the human gastrointestinal tract

In recent years, microbiota has been proposed as an essential player in brain development due to connection which has been established between the gut and the brain, called the “brain-gut axis”. Microbiota modulation by supplementation with probiotics may impact cognitive functions. However, the ability of probiotic species and food components to influence established gut microbiota has not been proven enough yet. Intestinal microorganisms, due to their participation in metabolic processes, have a significant impact on the metabolism of the whole body. The balance of this microbiome is necessary to maintain the proper health of the host and prevent many diseases. Therefore, researchers hypothesized that in people in whom the number of certain groups of microorganisms is too low, deliberate reproduction or administration of probiotics may be beneficial.

The author of the research project, therefore, asks the questions: If lactic acid bacteria of the *Lactobacillus* genus from own strain collection, are able to modulate the intestinal microbiota? If these *Lactobacillus* bacteria or their metabolites can play a neuroprotective role?

The aim of the project is determine the neuroprotective capacity due to modulate the intestinal microbiota and the production of metabolites after administration of the potential probiotic food-origin lactic acid bacteria strains using the Simulator of the Human Intestinal Microbial Ecosystem (SHIME®) model.

Eight *Lactobacillus* strains of the own Department of Food Gastronomy and Food Hygiene WULS-SGGW collection, selected in accordance to our previous study, as well as two reference probiotic strains (*L. plantarum* 299v and *L. rhamnosus* GG) will include in the study as a research material. The research project will consist of 3 tasks, spread over 48 months. Task 1. Screening tests (*in vitro*) of food-origin *Lactobacillus* bacteria. Task 2. Assessment protective effect on SH-SY5Y neural cells due to specific metabolite synthesis. Task 3. Assessment of the influence of *Lactobacillus* cells on the modulation of healthy and cognitive impairment human microbiota in the SHIME model.

The use of Simulator of the Human Intestinal Microbial Ecosystem (SHIME®) dynamic models, is undoubtedly pioneering and novel approach for studying the composition and function of the intestinal microbiota. The human digestion is simulated in an environment in which the numbers and proportions of the different microorganisms and the conditions such as temperature, pH, inoculum and retention time, are all similar to those of the human organism. Although, *in vivo* experiments are ideal and more representative to evaluate the administration of pro- and prebiotics, the cost, time and ethics may be a limiting factor. Alternatively, the use of *in vitro* models may be able to simulate the microbiological and physiological processes of the gastrointestinal tract, and when associated with molecular analyses, may facilitate the understanding of the functioning of different systems or pathways, as well as complementing *in vivo* studies, with the advantage of the possible control of several parameters.

The undertaken research will provide new knowledge on the role of food-origin *Lactobacillus* bacteria in neuroprotective activities and maintaining homeostasis of the human gastrointestinal tract, especially will identify SCFA, GABA-producers, anti-oxidant and immunomodulator species.

The research project will allow for the development of a scientific discipline of food technology and nutrition by expanding the knowledge about the behavior of selected *Lactobacillus* strains in the presence of healthy and cognitive impairment disorders intestinal microbiota and emphasize their role in neuroprotective activity by maintaining gut health. Human nutrition has an important impact on microbial development intestinal diversity. Moreover, the research results can identify of mechanisms responsible for the effect and will allow for the formulation of further research hypotheses and the launch of further research.