Depression is one of the most common mental disorders. The incidence of depressive disorders is about twice as high in women as in men, especially in the reproductive age. The period of pregnancy is accompanied by many stressful situations, which in turn contribute to the development of anxiety and depression, which exposes the offspring to prenatal stress. Stress during pregnancy has adverse consequences and affects the neurodevelopment and behavior of the fetus and newborn. The long-term behavioral effects of prenatal stress in the offspring include problems with psychomotor development and emotional regulation, attention deficits, anxiety, and depression. There is still a need for safe, accessible and effective complementary interventions to treat maternal prenatal depression and anxiety and consequently prevent adverse effects of prenatal stress in offspring.

The mechanisms underlying the effects of prenatal stress on the fetus are still unclear. They may be associated with changes in the hypothalamic-pituitary-adrenal axis, which exposes the fetus to stress hormones (cortisol, corticosterone) from the mother, which may cross the placenta and affect the development of the offspring. In addition, recent studies indicate that changes in the mother's microbiome due to exposure to chronic stress increase the risk of neuropsychiatric disorders in the offspring. The birth and early life of a child are the main times when microbes colonize the body. Obtaining altered microflora from the mother may contribute to changes in neurological development in the offspring, including behavioral changes, and to modifying the composition of the gut microbiome in adolescence. This may be due to the presence of the brain-gut-microbiome axis, which is a bi-directional communication pathway between the gut microflora and the brain involving neuronal, endocrine and immune mechanisms. As demonstrated by numerous clinical and animal studies, it has a significant impact on many aspects of the body's functioning, including metabolism and the function of the central nervous system. Disturbances in axis working can lead to the development of anxiety and depression. It has been shown that dietary supplementation of specific bacteria strains can lead to neurochemical changes in the brain and, consequently, improve mental health.

The main aim of the project is to evaluate the impact of the maternal treatment with *Lactobacillus rhamnosus* JB-1 bacteria on behaviour, levels of brain metabolites, plasma cytokines and corticosterone, and the composition of the microbiome of the offspring exposed to prenatal stress. To achieve this goal, we will use a model of chronic unpredictable mild stress (CUMS) on pregnant female rats. At the same time, dams will receive JB-1 probiotic bacteria or a placebo. We will then apply behavioral tests to assess the anxiety levels of mothers and their offspring. In addition, we will assess the level of neurometabolites in the hippocampus *in vivo* using the non-invasive magnetic resonance spectroscopy (MRS). We will assess the concentration of pro-inflammatory cytokines in the plasma (interleukin (IL) -1 β and tumor necrosis factor-α, TNF-α) and the stress hormone-corticosterone in adolescent offspring using specific enzyme immunoassays (ELISA). Finally, we will perform next-generation sequencing (NGS) to determine the composition of the offspring microbiome.

Our research may provide evidence of a beneficial effect of dietary supplementation with *Lactobacillus rhamnosus* JB-1 bacteria on symptoms related to depression and on the composition of the microbiome in offspring exposed to prenatal stress. The obtained results may be important in the prevention and support of the treatment of depressive disorders accompanying the period of pregnancy, and thus may provide effective strategies in reducing the negative effects of prenatal stress.