

ABSTRACT

Interaction between intestinal microbiota and host mucosal immune system plays crucial role in maintenance of mucosal homeostasis. Dysbiosis, altered composition of microbial communities, has been shown to be associated with life-style diseases such as inflammatory bowel disease (IBD) or allergies. In this regard, probiotics are valuable tool for the improvement of gut microbiota disbalance and proper stimulation of the immune system.

In this thesis we focused on taxonomical classification of *Bifidobacterium longum* human origin strains by PCR-based methods, *in vitro* characterization of immunomodulatory properties of selected *Bifidobacterium* and *Lactobacillus* strains and evaluation of the beneficial effect of selected bacterial strains in IBD and allergy experimental mouse models.

We investigated four different PCR-based methods and biochemical analysis for the taxonomical classification of twenty-eight *B. longum* isolates from the healthy human faeces. The Amplified Ribosomal DNA Restriction Analysis was the only method to be able to differentiate the analyzed strains into the *B. longum/infantis* subspecies.

We showed that the analyzed immunostimulatory properties of bifidobacterial strains are strictly strain-specific. In a mouse model of acute ulcerative colitis, we have demonstrated that prophylactic administration of *B. longum ssp. longum* CCM 7952 prevented development of severe forms of intestinal inflammation which was associated with the preserved tight junction proteins expression and improved epithelial barrier function.

We demonstrated the butyrate-producing *Clostridium tyrobutyricum* DSM 2637 prophylactic effect on dextran sodium sulphate (DSS)-induced colitis in immunocompetent BALB/c and immunodeficient SCID mice.

In a mouse model of birch pollen allergy, we demonstrated that neonatal mother-to-offspring mono-colonization of germ-free (GF) mice with *B. longum ssp. longum* CCM 7952 prevented the allergic sensitization development, likely by Treg response activation.

We have revealed that colonization of GF mice with the mixture of *Lactobacillus rhamnosus* LOCK0900, LOCK0908 and *L. casei* LOCK0919 enhanced the gut mucosa integrity and ameliorated allergic sensitization to birch pollen.

Taken together, determination of the precise probiotic effect mechanism has to come from the correlation of *in vitro* data with the outcomes *in vivo*. This thesis brings better understanding of the probiotic strains immunomodulatory potential that have important implication for their use in IBD and allergy prophylaxis or therapy.