PROBIOTIC STRAINS OF BIFIDOBACTERIUM ADOLESCENTIS

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Introduction:
Bifidobacteria are natural inhabitants of the gastrointestinal tract possessing genetic adaptations that enable colonization of this habitat. Bifidobacteria contribute to maintaining gastro-intestinal homeostasis through strain-dependent interactions with the host. Mechanisms involved include reducing mucosal antigen load, improving the intestinal barrier, and inducing regulation of local and systemic immune responses. In this study we investigated the taxonomic diversity and functional effects of strains of Bifidobacterium adolescentis to identify new isolates with a probiotic potential.

Methods:
B. adolescentis strains were isolated from healthy humans and characterized taxonomically by 16S rDNA sequencing, DNA-DNA relatedness, and genomic sequencing. Carbohydrate utilization was determined using the API 50 CH assay. Potential improvement of the intestinal barrier was assessed in vitro, by measuring the ability of strains to increase trans-epithelial electrical resistance (TER) across Caco-2 cell monolayers. Potential immune-regulatory effects of the B. adolescentis strains were investigated by determining the induction of cytokines in human PBMC derived dendritic cells (DC). In vivo effects of one selected strain were determined in a dextran sodium sulphate (DSS) colitis rat model. Rats were dosed with freeze-dried bacteria suspended in PBS for 2 weeks prior to and during colitis-induction with 3% DSS in the drinking water for additionally 9 days. During the study, disease activity index (body weight, stool consistency score and fecal bleeding score), whole gut permeability, colonic macroscopic and microscopic scoring were measured and compared to the DSS control group.

Results:
Four taxonomic subgroups of B. adolescentis different from the type strain were identified by specific 16S rDNA signatures, coding DNA sequences and carbohydrate utilization profiles. A subset of strains was found to increase TER up to 150% compared to untreated controls. Some strains strongly induced IL-10 (> 1000 pg/ml) resulting in a high IL-10:IL-12 ratio. B. adolescentis BIF038 strongly increased TER and induced high IL-10 secretion. This strain was further studied in the DSS colitis model. DSS induced body weight loss (19 g), whereas BIF038 treatment reduced DSS-induced weight loss to 14 g (P = 0.002). Whole gut permeability as determined by CrEDTA urinary secretion decreased by 30% (P = 0.057) in treated animals compared to DSS alone. BIF038 reduced stool consistency scores by 10% (P = 0.048), reduced the number of animals with a fecal bleeding score at termination by 30%, reduced histological scoring by 26% (P = 0.049), and macroscopic scoring at termination by 19%.

Discussion:
In vitro data indicated that B. adolescentis BIF038 could be a new probiotic candidate that improves the intestinal barrier and induces a regulatory mucosal immune response. The DSS colitis model showed that BIF038 prevented and/or attenuated inflammation and tissue damage in the gastrointestinal tract and ameliorated DSS-induced body weight loss, thus confirming the beneficial effects of this strain demonstrated in vitro.

Keywords: Bifidobacterium, Probiotics, Adolescentis, Barrier, Immune, Colitis

References: