Effects of selected non-digestible dietary carbohydrates on the composition of the large intestinal microbiota and susceptibility to salmonella infections - DTU Orbit (24/12/2018)

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The mammalian intestinal tract is a complex ecosystem colonised by a high and diverse number of commensal bacterial. Bacteria colonising the intestinal tract have a profound impact on host health e.g. by acting as a barrier against colonisation by pathogens and by contributing to digestion of complex food components. In this regard there is a considerable interest in dietary components that can modulate the gut microbiota and potentially improve gut health. Some gut bacteria, known as probiotics, are believed to improve gut health upon ingestion, whereas non-digestible (ND) dietary carbohydrates, known as prebiotics, are food components aimed at selectively stimulating such beneficial bacteria already colonizing the intestinal tract. In this regard, prebiotics and other ND dietary carbohydrates may improve host resistance to intestinal infections by selectively modulating the composition of the gut microbiota or by stimulating the immune response. Salmonella is a genus of Gram-negative bacteria that are a major cause of food-borne illness globally. Several studies with probiotics have demonstrated protective effects against murine Salmonella infections, while studies with prebiotics have shown conflicting results. Therefore the aim of the present thesis was to investigate the effect of selected ND dietary carbohydrates on the large intestinal microbiota and susceptibility to Salmonella enterica serovar Typhimurium SL1344 infection in mice. The thesis contains an introduction to the digestive function of the gastrointestinal tract and the associated microbiota, followed by a description of dietary strategies for modulation of the intestinal microbiota with particular emphasis on effects on Salmonella infections. Subsequently, three manuscripts are presented based on the experimental studies performed. Results presented in Manuscript I demonstrated no in vivo protective effect of the investigated carbohydrates against the Salmonella infection. In contrast, two of the investigated substrates (fructo-oligosaccharides and xylo-oligosaccharides) demonstrated an adverse rather than a protective effect against the infection. Manuscript II investigated diet-induced changes in the large intestinal microbiota of mice exhibiting a reduced resistance to the Salmonella infection. Diets supplemented with fructo-oligosaccharides or xylo-oligosaccharides induced a number of microbial changes in the faecal microbiota including an increase in the Bacteroidetes phylum, the Bacteroides fragilis group and in Bifidobacterium spp., while reductions were observed in the Firmicutes phylum and the Clostridium coccoides group. The findings thus suggest that some microbial changes in the large intestine may increase the infectious potential of Salmonella. The last study, presented in Manuscript III, was performed during a research stay at CSIRO Food and Nutritional Sciences, Australia. In this study a two-stage continuous fermenter was used to determine if incubating human faeces with xylo-oligosaccharides (XOS) lowers faecal water genotoxicity induced by protein fermentation. XOS fermentation was seen to reduce faecal water genotoxicity in vessel 1, but to increase the genotoxicity in vessel 2. Butyrate concentrations were significantly elevated in both vessels and could be related to an increase in the C. coccoides group. Other microbial changes observed, including a reduction in Bifidobacterium spp. and sulphate-reducing bacteria, suggest that quantities of some bacterial species are related to changes in faecal water genotoxicity. Conclusively, the studies contribute to our knowledge of the effect of some ND dietary carbohydrates on the composition of the large intestinal microbiota and the effect such changes may have on the susceptibility to Salmonella infections or the risk of developing colon cancer.

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