

Modulation of gut microbiota by indigestible dietary carbohydrates

Summary

Consumption of dietary fibres (DF) should be increased to comply with the dietary guidelines and fuel various beneficial metabolites produced by the gut microbiota such as short chain fatty acids (SCFA). Microbiota also produces gases that, in sensitive persons including irritable bowel syndrome patients (IBS), trigger disturbing and at worst disabling gastrointestinal (GI) symptoms, leading to the avoidance of fibre-rich foods. The amounts and formation patterns of the gases are highly individual and interrelated to GI parameters such as gut pH and transit rate. Current PhD position is a part of the project, which aims to develop and validate a concept to match DF types to gut microbiome subtypes for optimal metabolic output. The project identifies major DF-metabolising microbiome types prevalent in Nordic countries using existing metagenomic, dietary and GI symptoms data, considering also endogenous glycans. This doctoral position is planned for *in vitro* studies and microbiome-tailored food development at Tallinn University of Technology, Estonia. Cultivation experiments include screening tests as well as deeper metabolic studies on how gases are formed by targeted microbial consortia from different dietary fibres. The most potential fibres will be selected for microbiome-tailored food development. This study is interdisciplinary and will integrate researchers from different fields - chemistry, biotechnology, molecular biology, bioinformatics and food science. We collaborate with University of Helsinki and Örebro University.

| | |
|-----------------------|---|
| Research field: | Chemistry and biotechnology |
| Supervisors: | Kaarel Adamberg Signe Adamberg |
| Availability: | This position is available. |
| Offered by: | School of Science Department of Chemistry and Biotechnology |
| Application deadline: | Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich) |

Description

Most individuals with IBS, the most prevalent GI disorder in developed countries, affecting around 11% of population, report worsening of symptoms by food. Supplementation with DF or a fibre-rich diet is recommended to IBS patients as soluble DF improves IBS symptoms. However, IBS patients are sensitive to intestinal gas because of their visceral hypersensitivity. IBS patients often avoid DF, and diet low in fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAPs) is widely used in IBS management. However, in the longer term, a low-FODMAP diet may negatively impact the gut microbiome and lower the production of DF-derived compounds supporting gut, metabolic and mental health. Project results will enable personalized prevention and alleviation of gut symptoms that are common in the general population and severely diminish the quality of life of IBS patients, as well as novel opportunities to select DF to bring individually tailored health benefits.

Specific research questions to be addressed are as follows:

1. Which substrates and microbial combinations reduce excessive gas formation? The aim is to characterise gut microbiomes using *in vitro* cultivation based methods to identify metabolic phenotypes (metabotypes). DF combinations yielding an optimal gas to SCFA ratio will be selected for food development.
2. What type of DF characterize the main Nordic foods? The aim is to develop a novel database of chemical composition of DF in high-fibre foods enabling the analysis of nutrition-microbiome interactions at functional and molecular level.
3. What is the best food matrix to deliver optimal DF mixture. Bread is a staple food that is predominantly consumed in refined form but has high potential for rational design to support healthy eating, also from the perspective of recent gut microbiota research. The aim is to develop fermented food prototypes for proof-of-concept (POC) studies in healthy volunteers and IBS patients, to study whether consumption of the microbiome-tailored food improves GI symptoms and IBS markers compared to unmatched fibre, using breath monitoring, metagenome, metabolome and glycan analyses (POC carried out in Finland and Sweden).

Responsibilities and tasks

- Setup and conduct cultivation experiments, gas analyses and chromatographic analyses
- Data analysis and interpretation of results (microbial physiology)
- Collect food compositional data from food databases, literature search and data analysis
- Supervision of MSc or BSc students
- Contribute to the organization of research and stakeholder workshops where project findings are presented

Applicants should fulfil the following requirements:

- a master's degree in food, microbiology or biotechnology sciences
- a solid background in microbial physiology
- experienced in cultivation and analytical methods (and willing to learn these subjects)
- a clear interest in the topic of the position
- experience in data analysis (Excel, R or other programming language)
- excellent command of English
- strong and demonstrable writing and analytical skills
- capacity to work both as an independent researcher and as part of an international team
- capacity and willingness to provide assistance in organizational tasks relevant to the project

The following experience is beneficial:

- Metagenomics analyses
- Working knowledge of bioinformatics and statistics
- Modelling of cell metabolism (flux balance analysis)
- Working with microbial consortia

The candidate should submit a research plan for the topic, including the overall research and data analysis strategy. The candidate should explain his/her experience in the context of study topics.

We offer:

- 4-year PhD position in one of the leading microbiome research centers in Estonia with a top supervisor in the field of advanced cultivation of microbial cells.
- The chance to do high-level research in collaboration with international team.
- Opportunities for conference visits, research stays and networking with leading universities and research centers in the fields of food and microbiome research.

About the department

The Department of Chemistry and Biotechnology is an interdisciplinary research center of Tallinn University of Technology that focuses on food, chemistry and gene technology: <https://taltech.ee/en/departament-chemistry-biotechnology>

For further information, please contact Kaarel Adamberg kaarel.adamberg@taltech.ee or Signe Adamberg signe.adamberg@taltech.ee



To get more information or to apply online, visit <https://taltech.glowbase.com/positions/796> or scan the the code on the left with your smartphone.