PhD Project Advertisement

Project title: Improving oral iron absorption in infants using prebiotics and probiotics to modify the gut microbiota

Project No: FBS2024-046-Lewis-rs

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Project description:

Iron deficiency is the most prevalent micronutrient deficiency globally effecting around 1.2 billion people, and oral iron supplementation is a widely used strategy to prevent and treat iron-deficiency anaemia in infants and young children. However, oral iron supplements are associated with gastrointestinal side effects, including an increased risk of enteric infection. They could aso be linked with reduced weight-gain, which is important for anaemic, malnourished children. Our previous work has shown that limiting oral iron consumption reduces these risks.

Partial absorption of dietary iron is a persistent problem and varies between 2-13%. Recent human studies show that specific prebiotics and probiotics can increase iron absorption to up to 51%. Prebiotics and probiotics act on the gut microbiota which resides in the lower part of the intestine. However, in rodent models iron is absorption happens in the highest part of the intestine where microbial populations are limited. This conundrum leads to our research question: how can prebiotic and probiotic-induced alterations to the lower-intestinal microbiota influence iron absorption in the upper intestine? This is important because understanding the mechanisms involved could lead to the development of ultra-low oral iron supplements in combination with specific prebiotics and probiotics which prevent anaemia whilst limiting the negative side-effects.

Piglets are valuable models for human infants because they share many biological characteristics with humans. In addition, their precocial nature permits early separation from maternal interference so their diet can be tightly controlled. Furthermore, if left untreated with iron, piglets will develop anaemia in the first weeks of life. For these reasons, piglets are valuable models for exploring iron supplementation in infants.

This project will use a piglet model to explore the mechanisms underlying oral iron adsorption, which are currently poorly characterised. It will then screen various probiotic and prebiotics, using in vitro gut model systems, to identify the best candidate to improve iron absorption via microbiota modification and iron conversion. Finally, the candidate prebiotic and/or probiotic will be used in a piglet model for human infants to see if our findings translate into a species closely related to humans.

Training opportunities:

The successful candidate will be trained in metagenomics, gas chromatography/mass spectroscopy, microscopy, flow cytometry, in vitro gut model systems, 4-colour fluorescence immunohistology, statistical analysis and designing and carrying out large animal trials (under supervision).

Specific training will be provided in analytic techniques including:

- Microscopy (4-colour quantitative immunofluorescence)
- Microbiota population analysis (high throughput sequencing, fluorescent in situ hybridization coupled with flow cytometry).
- Metagenomics
- Iron bioavailability assays (ICP-MS)
- *In vitro* gut modelling
- Metabolic profiling (gas chromatography/mass spectroscopy)
- Statistical techniques in handling large datasets

Student profile:

We are looking for applicants with a degree background in immunology, metabolism, microbiology nutrition and/or gut health (or other appropriate subject). Due to the multidisciplinary nature of this program, we do not expect the successful candidate to have knowledge and experience in all relevant areas. Full support and training will be provided by experienced staff.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2023/24 this is £18,622 and it will increase slightly each year at rate set by UKRI.

Equality Diversity and Inclusion:

The FoodBioSystems DTP is committed to equality, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website.

In accordance with UKRI guidelines, our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

References:

https://www.sciencedirect.com/science/article/pii/S0022316622005983#:~:text=Conclusions,enhancers%20of%20supplemental%20iron%20absorption.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the FoodBioSystems website.