PhD Project Advertisement

Project title: Optimising the safety and nutritional quality of insect protein ingredients
Project No: FBS2024-035-MillsC-sq

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Project description:

A significant proportion of anthropogenic green house gas emissions come from food production, and particularly farmed animals such as cattle. Identifying alternative, sustainable, sources of protein for food and feed use is essential to help tackle the climate emergency. One of these is derived from insects which have been part of the diet in other parts of the world but not been widely consumed by European populations. In addition to its nutritional quality, insects can be reared on food waste, which has been estimated to contribute 8-10% of green house gas emissions. However, it has been shown that insects can concentrate up environmental pollutants including toxic metals like cadmium and lead (1), whilst more humane approaches to insect rearing may increase levels of unintended allergens from insect feed like gluten (2). Insect protein may also cause allergic reactions in people with crustacean shell-fish allergies. The impact of using food waste or processing of insect ingredients on the nutritional quality and allergenic potential of insect-derived protein is largely unknown and it may also be that processing procedures could reduce the potential of insect protein to cause allergic reactions.

Working with research teams based at the University of Surrey, Queens University Belfast and FERA Science Ltd (the UK National Reference Laboratory for Food) we will work to discover how to enhance the safety and nutritional value of insect protein ingredients. The work will also capitalise on unique pilot-scale facilities at FERA to rear and process insects in different ways as well as state of the art facilities for specialist analysis of proteins at Belfast and Surrey and human intervention studies at Surrey. The project will (1) checking which types of food waste streams are best for insect rearing; (2) optimise processing of food waste and insects to assure safety, including reducing the potential for both unintended allergen presence and reduce the allergenic potential of insects themselves; and (3) Optimising the nutritional quality using a combination of in vitro tools (biochemical analysis, digestibility and uptake studies using cell models of the gut) and a pilot scale human intervention study.

Focusing on black soldier fly larvae as a model insect rearing system tolerant of different types of food waste streams, insect larvae will then be grown and processed using different regimens designed to enhance their nutritional quality which are safe to eat. These will then be characterised with regards their safety (including allergenicity) to allow identification of waste streams used in insect rearing and downstream processing to produce insect protein ingredients with reduced allergenicity which are safe to eat. These ingredients will then be prepared in different ways to optimise their nutritional quality which will be assessed using in vitro tools. On this basis up to two of the best performing insect ingredients will then be selected and used in a pilot scale human intervention study monitoring amino acid uptake into the circulation. We will also explore options to use something called heavy isotopic labelling of protein, which allows us to directly trace how someone digests proteins into their building blocks, called amino acids, and then how those amino acids are absorbed by the body and used to make muscle protein through, for example, small muscle biopsies. This will show whether the insect protein can be absorbed by the human body as well as allow a comparison with foods, like cow's milk, which are highly digestible. The results of this research will help pave the way to realising the potential of insect proteins for human nutrition.

Training opportunities:

You will have the opportunity to gain first-hand experience of working in some of the world leading laboratories with hands-on training provided in insect husbandry. harvesting and downstream processing (FERA), safety risk assessment and characterization (Queens University Belfast), allergenicity assessment ,in vitro digestion systems, cell culture and human studies (Surrey),You will also gain transferable skills such as project management, learn to identify potentially important commercial findings and how to protect or exploit them. You will be working with an academic team used to commercializing research, setting up start-ups and importantly have the chance to spend at least 3 months working at the FERA laboratories at York, UK.

Student profile:

A BSc (Hons at least 2I) in biochemistry, nutrition or biological science or equivalent experience. The candidate should have a desire to work in a multidisciplinary project and to gain experience working in an innovative, national reference laboratory for food, FERA Science Ltd capitalizing on the (at least) 3 months placement with them during the four year project.

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:

(1) Roffeis, et al Journal of Cleaner Production, 199, 792-806. (2) https://www.food.gov.uk/research/risk-profile-on-edible-insects#3-allergenicity-hazards; (3) Mancini et al (2020) Food Control 110: 107014; (4) Broekmann et al J Allergy Clin Immunol 2016 137 1261-3; (5) Mattar et al Food Chem. 2021 362:129879; (6) MIlls et al Env Sci and Technol 2022 56 12210-12217;

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