FoodBioSystems DTP - PhD Project Advertisement

Project Title:

FBS2021-91-Kliem: Bioaccessibility of lipids from dairy products: the cheese matrix

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Project Description:

The perception that milk and dairy products have adverse effects on health and risk factors for chronic diseases, especially cardiovascular diseases (CVD) is changing, mainly due to the outcome of long-term prospective cohort studies that have demonstrated significantly reduced CVD mortality and markers of risk in high, compared with low dairy consumers. Evidence from randomised control trials suggests that different dairy products can exert contrasting effects on CVD risk, with dairy fat in the form of cheese resulting in lower plasma total and LDL-cholesterol concentrations than dairy fat in the form of butter. This supports evidence from animal and human studies that the physico-chemical properties of the cheese matrix may minimise cheese lipid absorption from the digestive tract. It is thought this may partially be related to the formation of calcium soaps of fats in the post-gastric phase which are not as easily absorbed. A recent *in vitro* study concluded that more solid dairy matrices form calcium (Ca) soaps more readily than more liquid products. However it is not known whether this is observed with different cheese types, which have varying production methods. Although hard cheeses such as Cheddar remain popular with consumers, there has been increased consumption of softer cheeses over recent years. Also, it is possible that the cheese fatty acid (FA) profile/Ca content/Ca form may have an impact upon this matrix effect; Ca soaps are more readily formed with saturated compared with unsaturated FA.

This project will unravel the mystery of the “cheese matrix” effect. This will be achieved by using a combination of techniques (some novel), to establish the mechanism behind why cheese lipid appears to not be as accessible

for absorption compared with other lipid sources. Firstly the project will adapt an established *in vitro* semi-dynamic gastric/small intestinal digestion model at the University of Surrey. Then a range of different cheese types will be prepared at the University of Reading's Food Processing Centre, using milk from cows at the University's Centre for Dairy Research. These types will vary in terms of physical (hardness) and chemical (Ca content, pH, FA profile) structure in order to create a range of properties which might impact upon digestion. Cheese will be ripened and stored as appropriate for cheese type, with samples at different maturity stages also analysed. Different microscopy techniques (environmental scanning electron microscopy, confocal microscopy), will be employed to assess the physical structure of the cheese. Following this the cheeses will be subjected to digestion within the *in vitro* model. Samples of digesta from the model and cheese will be analysed for composition (including presence of Ca soaps, fatty acid profile) at the University of Surrey, and labelled lipases will be used in order to visualize enzyme/substrate proximity during digestion.

This project offers a unique opportunity for a "food chain"-based PhD project. Not only does it incorporate all aspects of the food chain (from primary production, through processing, to *in vitro* digestion and then commercial aspects through links with industry) but it includes a combination of methodologies which are novel and have not been used with dairy products before, such as the use of labelled lipases. This project will be of great interest to dairy processors, and by fully understanding the effect of the cheese matrix on lipid bioaccessibility, it will contribute significantly to knowledge of lipid digestion within all food matrices.

Supervision and training will be shared by the University of Reading and University of Surrey, who have an excellent track record for collaboration. Both offer a comprehensive Researcher Development Programmes, comprising of over 150 courses, development workshops and activities to gain skills required for a career in research.

Training opportunities:
The student will receive training in laboratory analysis (at both sites), cheese making and food safety/hygiene practices (University of Reading Food Processing Pilot Plant). This project will also incorporate a short work placement in a UK processing facility (Arla Foods).

Student profile:
This project will be suitable for students with a degree in food science, nutrition or a closely related science. Some laboratory experience would be advantageous.

Funding particulars:
Laboratory work in this project will be partially supported by Arla Foods. The project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.
The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.
The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply
Please go to FoodBioSystems DTP website for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.