Project Title:
Role of low-calorie sweeteners in weight management, glycaemic control and health outcomes in older adults.

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Background to the project:
The global prevalence of obesity and diabetes has increased markedly over recent decades with significant implications within the social, economic and health arenas. Low-calorie sweeteners (LCS) are food additives which impart a sweet flavour without the associated energy and therefore are commonly used as sugar substitutes in weight management and diabetes control strategies. Despite stringent safety assessments prior to introduction to the human food chain, LCS use remains controversial; however, research approaches fail to adequately establish LCS intakes and therefore improved methods of doing so are necessary to properly elucidate potential effects on health. A novel urinary biomarker approach for assessing LCS intakes has been developed at Ulster and this project will focus on applying this approach to investigate the relationship between LCS and health. The Trinity, Ulster and Department of Agriculture (TUDA) study is an observational study of a convenience sample of 5,186 older adults recruited from both the North and South of Ireland as part of a cross-border collaborative project (the National Nutrition Phenotype Database Project). This project will utilise the well-characterised TUDA cohort to investigate the intakes of LCS in a more reliable way and will use the data generated to explore the relationship between LCS and health.

Objectives of the research project:
The primary objective of this research project is to investigate the role of LCS and health outcomes in older adults, with a focus on obesity and diabetes. The well-characterised TUDA cohort will be utilised to achieve this objective.

Within this PhD work the following specific research objectives will be considered:

1. A systematic review investigating the relationship between LCS and diabetes and obesity.
   - Measure of achievement: Published paper reporting the outcomes of Objective 1.

2. To describe the risk of obesity and diabetes in an older adult population.
   - Measure of achievement: Published paper reporting the outcomes of Objective 2.

3. To validate a urinary biomarker approach for assessing LCS intake in older adults.
   - Measure of achievement: Published paper reporting the outcomes of Objective 3.

4. To investigate the intake of LCS in an older Irish adult population via a urinary biomarker approach.
   - Measure of achievement: Completion of follow up study in TUDA +5 and published paper reporting the outcomes of Objective 4.

5. To explore the relationship between LCS intake and obesity and diabetes in an older adult cohort.
   - Measure of achievement: Completion of follow up study in TUDA +5 and published paper reporting the outcomes of Objective 5.

6. Dissemination of project outcomes and continue to develop networks for multidisciplinary research in relation to LCS and health with Centres of Excellence nationally and internationally.
   - Measure of achievement: Evidence of presentations and published abstracts at various national and international conferences.
The outcomes of this PhD project will be to provide a better understanding of LCS use and health outcomes, specifically in relation to weight management and glycaemic control; such issues of obesity and diabetes continue to represent a major impact on population health.

**Methods to be used:**
This research proposal will utilise and build further on the existing TUDA Ageing Cohort study. This rich resource, which has recently become available for investigation, provides detailed information on a range of factors contributing to the development of chronic diseases of ageing in older adults, and provides a platform to enable research that will provide a greater understanding of how to maintain better health while ageing.

**Objective 2**
Participants and study design: As a follow on from our recent work investigating cognitive function in older Irish adults in relation to diabetes and subsequent nutritional factors in older adults (Porter et al., under review), we will conduct new analysis of existing data from the original TUDA cohort (n = 5,186) to further explore the risk of diabetes and obesity within an older population.

**Objective 3**
Participants and study design: A sub-sample (n = 100) of the TUDA 5+ cohort, a follow-up study of 600 participants from the original cohort 5 years after their initial investigation, will be recruited to provide a urine sample and dietary intake data specific to LCS. Urine samples will be analysed to simultaneously determine excretions of five commonly consumed LCS, namely acesulfame-k, cyclamate, saccharin, steviol glycosides and sucralose using a novel analytical methodology developed at UU. Given that LCS are not found elsewhere in the diet, excretion is specific to LCS intake. Biomarker data will be compared to self-reported dietary intake data with the specific aim of investigating correlations between the two.

**Objectives 4 and 5**
Participants and study design: The full TUDA 5+ cohort (n = 600) will be utilised to firstly assess LCS intakes in this population (Objective 4) and secondly to investigate LCS intake in relation to obesity and diabetes (Objective 5). Existing TUDA 5+ data on general health and biomarkers of metabolic health (i.e. glycosylated haemoglobin) will be considered and associations between LCS use and these markers will be investigated. LCS intake will be assessed by implementing the validated urinary biomarker approach along with the administration of a LCS-focused food frequency questionnaire to assess habitual LCS intakes and to identify intakes of LCS which cannot be assessed via a biomarker approach alone (notably aspartame).

**Skills required of applicant:**
- Excellent written and oral communication skills
- Excellent interpersonal skills
- Willingness to learn new skills and techniques
- Ability to work as part of a team
- Ability to work on own initiative
- Ability to complete a project within a specified time
- Organisational skills and record keeping

**References:**


Porter K et al (under review) Impact of diabetes and metformin usage on B-vitamin status and cognitive function in older adults: TUDA aging cohort study.