Project Details	
Project Code	MRCPHS25Ex Lowe
Title	Exploring the feasibility and efficacy of an aerobic exercise intervention in improving dietary self-regulation in adolescents and young adults
Research Theme	Population Health Sciences
Summary	Adolescents are the largest consumers of ultra-processed calorie-dense foods of any other age group. This is of concern, as diet quality can impact the development of the brain systems and associated cognitive control processes necessary to regulate calorie-dense food consumption, creating a vicious cycle between dietary behaviours and cognitive functioning. In this project, you will test the feasibility and efficacy of an aerobic exercise intervention to improve dietary self-regulation in adolescents and young adults. You will integrate cognitive tests and neuroimaging to examine underlying mechanisms.
Description	Unhealthy diets are the leading cause of chronic illness and preventable death worldwide. Consuming a diet rich in ultra-processed, calorie-dense foods is associated with an increased risk of developing obesity, type 2 diabetes, cardiovascular disease, and mental health conditions (e.g., depression and anxiety). Increasing evidence has suggested an association between executive functions (EF) and the integrity of the underlying neural systems, specifically the prefrontal cortex, and overconsumption behaviours. Individuals with lower EFs are more prone to overconsumption behaviours. Over time, the overconsumption of calorie-dense foods can negatively impact the function and structure of the prefrontal cortex, leading to a decline in EFs and increased reward sensitivity. This further perpetuates overconsumption behaviours, creating a vicious cycle between diet quality and brain health. Interventions aimed at enhancing EFs may potentially break this cycle. This may be especially pertinent for individuals with poorer EFs who would gain the most from EF-enhancing interventions. Exercise interventions are one of the most promising means of improving EFs. Across the lifespan, exercise interventions have been shown to improve EFs and memory via exercise-induced changes in the structure and function of the PFC and hippocampus. Moreover, aerobic exercise can decrease neural responsivity to calorie-dense food cues, modulate hunger circuits, and increase dietary self-regulation, with the latter being mediated by exercise-induced improvements in EFs. During adolescence, the brain undergoes substantial neurodevelopment and is uniquely malleable and susceptible to environmental influences and experiences, including exercise, suggesting that exercise interventions during adolescence could be impactful. However, there is a lack of research examining the potential of exercise to improve dietary behaviours in adolescent populations. The proposed project will take an interdisciplinary approach to assess the feasibility and efficacy of aerobic exercise interventions to improve dietary behaviours during adolescence and young adulthood (ages 13-25). Potential moderating mechanisms (e.g., exercise-induced changes in EFs, food reward, post-exercise compensatory beliefs, or food-related memory) will be assessed Key research objectives/questions:

	1. Can aerobic exercise improve dietary self-regulation in adolescents and young adults? 2. What potential mechanisms drive this effect (e.g., improved EFs, reduced reward sensitivity)? 3. Is the magnitude of the effect larger for "at-risk populations" (e.g., individuals with obesity or ADHD)? Throughout the studentship, the student will have the opportunity to work on several research projects (described below) designed to address these objectives. The student can modify and adjust several aspects of the studies in consultation with supervisors. The student will be able to take ownership of several aspects of the proposed studies, including the tasks used to assess the key outcomes, the control task, and the composition of the post-exercise buffet meal. In addition to the experimental studies outlined below, the student will conduct a systematic review or meta-analysis on the relationship between exercise and EFs AND/OR dietary behaviours. **Project 1:** Project 1 will examine the acute effects of moderate and high-intensity aerobic exercise on food choice, executive functions, and post-exercise food consumption. As the acute response to a given intervention is likely to reflect the overall effectiveness and magnitude of the response of longer interventions, findings from this study will inform Project 2. A sample of adolescents and young adults (aged 13-25) will be recruited to attend a single laboratory session. Participants will be randomized to exercise and control conditions. Pre-and-post exercise, participants will complete a food-choice task, measures of hunger, desire to eat, and food cravings, and several measures of EFs, reward processing/motivation, and food-related memory. Post-exercise, participants will complete a "bogus taste test," and calories consumed will be measured. Targeted recruitment strategies will be used to try and recruit a diverse sample of participants and a sample of "high-risk" participants with obesity or ADHD (i.e., individuals prone to dysregulated eating behaviours or poor EFs). Obesity and ADHD symptomology are the most common determinants/risk factors of low EF at a population level. The student can modify the "high-risk" group used in this study. Prior to the start of the project, the student will have the opportunity to engage in patient public involvement (PPI) through online focus groups with individuals and parents from the target "high-risk" populations. This will help identify research priorities and co-create a suitable intervention design. **Project 2:** Project 2 will build off Project 1 to pilot the feasibility, acceptability, and efficacy of a 12-week school-based exercise intervention in adolescents and young adults. Comprehensive EF, memory, and reward assessments will be completed at baseline and post-intervention. Ecological momentary assessment will be integrated into the study design to assess "real-time" measures of food cravings, consumption, mood, and intervention acceptance. Project 3: If funding allows, a subset of participants in Project 4 will complete structural [anatomical, DTI] and functional MRI pre-and post-intervention. Here, we will model potential structural and functional changes in the prefrontal cortex and hippocampus; the student will work with the supervisors to refine the regions of interest.

Supervisory Team	
Lead Supervisor	
Name	Dr Cassandra Lowe
Affiliation	Exeter
College/Faculty	Health and Life Sciences
Department/School	Psychology
Email Address	c.lowe4@exeter.ac.uk
Co-Supervisor 1	
Name	Dr Dani Ferriday
Affiliation	Bristol
College/Faculty	Faculty of Life Sciences
Department/School	School of Psychological Science
Co-Supervisor 2	
Name	Dr Natalia Lawrence
Affiliation	Exeter
College/Faculty	Health and Life Sciences
Department/School	Psychology
Co-Supervisor 3	
Name	
Affiliation	
College/Faculty	
Department/School	