RESEARCH GROUP: NICHE

Project Title: When to eat and when to exercise: evaluation of the impact of timing on energy balance and obesity.

Supervisor(s): Dr Ruth Price and Prof Alison Gallagher
External Supervisor: Prof Marie Murphy (SESRI)

Important notes:
- All PhD supervisors are required to be either Full or Associate BMSRI members.
- The lead or first supervisor MUST be a Full member of the Research Institute (with the exception of newly appointed academic staff who were given a commitment of a PhD studentship allocation at time of interview)

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Level: PhD

Background to the project:
Overweight/obesity is a major health problem worldwide and most interventions focus on dietary intake and physical activity (PA). There is a growing recognition that factors such as timing of eating occasions and PA may contribute to the metabolic response to food intake and thus to energy balance and obesity. In the UK, guidelines on healthy eating and PA levels necessary to benefit health are available [1,2] but these recommendations do not consider the timing of eating or exercise. Recent studies suggest that the time of day when exercise is performed, a highly discretionary aspect of behaviour, may impact on metabolic responses [3]. For example, performing PA in the late evening may not maintain optimal circadian system health as compared to morning [4]. Evidence from animal studies indicate that eating patterns may impact on metabolic responses to food exist [5]. Limited studies in humans suggest that eating patterns may have an influence on overweight/obesity even after controlling for total energy intake and total PA [6] and that timing of eating may have important impacts of weight management [7-10]. However, more human studies are needed to determine whether timing of food intake significantly influences weight regulation [4] and whilst some studies consider total PA, data on timing of PA is largely absent.

Objectives of the research project:
The primary aim of this research will be to assess the impact of timing of eating and PA on weight management and other health outcomes. Although the final design of the research programme will be dependent on the strengths and interests of the doctoral student, it is anticipated that the project will comprise the following key elements which will address the following specific research objectives will be considered:

**Objective 1:** Conduct a systematic review to investigate the relationship between timing of eating and PA on health outcomes (including weight management)
*Measure of achievement:* Published paper reporting the outcomes of Objective 1.

**Objective 2:** Conduct a cross-sectional evaluation of timing of eating occasions and PA on health outcomes (body weight)
*Measure of achievement:* Published paper reporting the outcomes of Objective 2.

**Objective 3:** To design and undertake an intervention aimed at improving health outcomes (weight management, metabolic risk factors) through manipulating timing of eating and physical activity in overweight/obese individuals
*Measure of achievement:* Published protocol paper and published paper reporting the outcomes of Objective 3.
**Objective 4:** Dissemination of project outcomes and continued development of networks for multidisciplinary research in relation to public health interventions with Centres of Excellence nationally and internationally.

**Measure of achievement:** Evidence of presentations and published abstracts at various national and international conferences.

The successful candidate will avail of collaborative support from Ulster University’s Biomedical Science Research Institute and the Sport and Exercise Science Research Institute. The supervisory team has considerable experience in relation to the development, implementation and evaluation of lifestyle interventions. Given that the target population of study (overweight/obese adults) the PA of choice used in the proposed research work will be brisk walking (accumulated bouts versus continuous) and timing of eating will consider (breakfast versus evening meal with respect to provision of the majority of total daily energy intake). The outcomes of this PhD project will be to provide a better understanding of the impact of eating occasions and PA on weight management and other health outcomes; such issues of obesity continue to represent a major impact on population health and achieving greater understanding in relation to maximising public health intervention efforts are needed.

**Methods to be used:**
The final design of the research programme will be dependent on the strengths and interests of the doctoral student, but we propose to use a mixed-methods approach to addressing the research question. Possible steps to achieving the stated objectives are outlined below:

**Objective 1:** A systematic review will be conducted to investigate the relationship between timing of eating and PA on health outcomes (including weight management). The findings of this review will form the basis of a published paper and will inform the cross-sectional (objective 2) and intervention study (objective 3).

**Objective 2:** A cross-sectional evaluation of timing of eating occasions and PA on health outcomes (body weight). This will involve recruitment of a convenient sample of 120 healthy overweight/obese participants (60 males/60 females) with the aim of recruiting equal numbers of ‘breakfast consumers’ and breakfast skippers’. Data collected will include anthropometry (height, weight, BMI and body fatness), dietary data (collected by food intake diary to include details on timing of eating occasions), objective PA (accelerometry to match food intake information). Data will be assessed to consider the impact of eating occasions on body weight and to get an insight on PA activity of this group; it is anticipated that the majority of participants recruited may not be achieving recommended PA levels. The findings of this revaluation will inform the basis of a published paper and will inform the intervention study (objective 3).

**Objective 3:** Depending on the findings from the systematic review (objective 1) and cross-sectional study (objective 2) an intervention will be developed to consider the impact of timing of eating and timing of PA on energy expenditure. Healthy overweight/obese individuals will be recruited to participate in a randomised cross-over intervention during which total energy intake and total physical activity will be maintained but timing of eating (possibly breakfast versus evening meal) and PA (possibly brisk walking completed in accumulated bouts versus continuous) will be manipulated. Health outcomes will be monitored and the findings of the study will inform a published paper.

**Objective 4:** The successful candidate will be involved in the dissemination of the findings nationally and internationally (objective 4) which in turn will enhance the development of networks for multidisciplinary research and the impact of the research in relation to positive benefits for public health.

**Skills required of applicant:**
- Sound knowledge of nutrition, exercise science or related discipline
• Excellent written and oral communication skills
• Excellent interpersonal skills (particularly in recruiting and retaining study participants)
• Willingness to learn new skills and techniques
• Ability to work as part of a team
• Ability to work on own initiative and to complete a project within a specified time
• Excellent organisational skills and record keeping
• Sound statistical analysis skills

References: