

# Comparative effects of intermittent versus continuous energy restriction on metabolism following matched weight-loss

<b>Submission date</b> 29/11/2016	<b>Recruitment status</b> No longer recruiting	<input type="checkbox"/> Prospectively registered
<b>Registration date</b> 05/12/2016	<b>Overall study status</b> Completed	<input type="checkbox"/> Protocol
<b>Last Edited</b> 24/01/2019	<b>Condition category</b> Nutritional, Metabolic, Endocrine	<input type="checkbox"/> Statistical analysis plan
		<input checked="" type="checkbox"/> Results
		<input type="checkbox"/> Individual participant data

## Plain English summary of protocol

### Background and study aims

Intermittent (stop-start) energy (calorie) restriction, such as the 5:2 diet, has received considerable interest of late as a potential alternative to the conventional continuous energy restriction approach to weight-loss. Whilst there have been many studies demonstrating the efficacy of intermittent energy restriction as a viable means of weight-loss, little is known regarding its effects on blood sugar and fat breakdown after meals (postprandial glucose and fat metabolism). This is important because impairment to sugar and fat breakdown are important risk factors for type 2 diabetes and cardiovascular disease (e.g. heart disease, stroke). The aim of the study is therefore to compare the effects of intermittent and continuous energy restriction on postprandial glucose and fat metabolism. In addition, the study will compare changes in body composition (e.g. waist circumference and body fat), fuel utilisation (fat and glucose oxidation), resting calorie expenditure, eating behaviour and sleep quality with both diets.

### Who can participate?

Healthy, weight-stable overweight/obese adults without significant medical conditions.

### What does the study involve?

Participants are randomly allocated to one of two groups. Those in the first group take part in intermittent energy restriction. This involves two days per week of very low energy intake (about 600 calories/day) through using commercially available meal replacement products (Lighterlife) and five days of healthy eating with no calorie restriction. Those in the second group take part in continuous energy restriction. This involves limiting daily intake to 600 calorie /day, following current best practice guidelines. At the start of the study and after participants have lost 5% of weight (as opposed to fixed duration of time), blood samples are taken 6 hours after drinking a test drink (chocolate milkshake) containing carbohydrate and fat to measure postprandial glucose and fat metabolism. In addition, resting calorie expenditure (the amount of calories expended maintaining essential body functions whilst at complete rest) is assessed using indirect calorimetry, which involves placing a plastic hood over the head which samples the amount of oxygen breathed in, is measured and participants undergo a Flanker task, which is a

computer based cognitive task designed to assess distraction to sweet/savoury foods. Finally, participants complete a range of questionnaires to assess changes in sleep quality, eating behaviour and mood. Weight of participants is tracked regularly during the study.

What are the possible benefits and risks of participating?

Participants benefit from intensive dietary support by registered dietitian and weight-loss guidance. In addition, if they lose weight then this is beneficial to their general health. The intermittent diet carries a risk of increased hunger, lethargy (sluggishness), insufficient fluid intake/dehydration due to the very low calorie nature of the intervention. Other risks include pain and bruising when blood samples are taken.

Where is the study run from?

Surrey Clinical Research Centre, Guildford (UK)

When is study starting and how long is it expected to run for?

May 2015 to August 2016

Who is funding the study?

LighterLife (UK)

Who is the main contact?

Dr Denise Robertson

## Contact information

**Type(s)**

Scientific

**Contact name**

Dr Denise Robertson

**Contact details**

Senior Lecturer in Nutritional Physiology

Leggett Building

Faculty of Health and Medical Sciences

University of Surrey

Guildford

United Kingdom

GU2 7WG

## Additional identifiers

**Protocol serial number**

EC/2014/140/FHMS

## Study information

**Scientific Title**

Comparative effects of intermittent versus continuous energy restriction on postprandial glucose and lipid metabolism following matched weight-loss

## **Study objectives**

The relative reduction (improvement) in incremental triacylglycerol responses will be greater following weight-loss via intermittent energy restriction.

## **Ethics approval required**

Old ethics approval format

## **Ethics approval(s)**

University of Surrey Ethics Committee, 29/01/2015, ref: UEC/2014/140/FHMS

## **Study design**

Single-centre randomised parallel trial

## **Primary study design**

Interventional

## **Study type(s)**

Other

## **Health condition(s) or problem(s) studied**

Weight-loss

## **Interventions**

Participants are randomised to one of two groups:

Intermittent energy restriction (IER): The study utilises a commercially available IER diet by LighterLife (Essex, UK). On two consecutive days of the week, participants consume four LighterLife Food Packs (2638kJ: 38%, 36% and 26% of total energy as carbohydrate, protein and fat respectively) which delivers approximately 25% of their estimated euenergetic needs. Meal replacement products are provided by study team. On the remaining five days of the week ("feed days"), participants self-select food intake but are asked to aim to consume an euenergetic diet compliant with healthy eating guidelines.

Continuous energy restriction (CER): Participants assigned to the CER diet consume a daily hypoenergetic diet of 2510kJ below their estimated energy requirements compliant with NICE obesity guidelines. Diets are not provided but are self-selected by participants.

In both groups, energy requirements are calculated using the Henry equations for BMR multiplied by an appropriate physical activity factor.

Metabolic and anthropometric assessments are conducted before and after participants attained a 5% weight-loss (as opposed to fixed duration of time). Weight tracked regularly over the course of the study.

## **Intervention Type**

Behavioural

## **Primary outcome(s)**

1. 6-hour postprandial glucose (glucose, insulin, c-peptide) to a liquid mixed test meal is measured before and after attainment of 5% weight-loss

2. Lipid responses (triacylglycerol, non-esterified fatty acids) to a liquid mixed test meal is measured before and after attainment of 5% weight-loss

### **Key secondary outcome(s)**

All outcomes are measured before and after 5% weight-loss:

1. Body composition is assessed via tape measure and bioimpedance
2. Rate of weight-loss
3. Fasting substrate utilisation is assessed via indirect calorimetry (respiratory quotient)
4. Postprandial substrate utilisation is assessed via serial blood sampling (3-hydroxybutyrate) for 6 hours after a liquid mixed test meal (400ml Fortisip, Nutricia, Trowbridge, UK: 2510kJ, 74g carbohydrate, 24g protein and 23g fat)
5. Fasting cardiometabolic risk markers (glucose, insulin, lipid profiles)
6. Resting energy expenditure (indirect calorimetry)
7. Sleep quality is measured using the Pittsburgh sleep quality index and Epworth sleep scale
8. Eating behaviour is measured using the Dutch eating behaviour questionnaire
9. Mood is measured using the positive affect negative affect scale
10. Self-efficacy is measured using a self-efficacy questionnaire
11. Hedonic food preference is measured using the Flanker psychometric task and power of food scale

### **Completion date**

29/08/2016

## **Eligibility**

### **Key inclusion criteria**

1. Overweight and obese participants (BMI  $\geq 25$  kg/m<sup>2</sup>)
2. Aged 18 to 65 years
3. Weight-stable ( $\pm 2$  kg) over the preceding three months
4. No significant medical history
5. To control for the potential influence of the menstrual cycle between visits, female participants were either post-menopausal or taking oral contraceptives

### **Participant type(s)**

Other

### **Healthy volunteers allowed**

No

### **Age group**

Adult

### **Lower age limit**

18 years

### **Sex**

All

### **Key exclusion criteria**

Individuals not meeting the inclusion criteria.

**Date of first enrolment**

01/05/2015

**Date of final enrolment**

05/05/2016

## Locations

**Countries of recruitment**

United Kingdom

England

**Study participating centre****Surrey Clinical Research Centre**

University of Surrey

Guildford

United Kingdom

GU2 7WG

## Sponsor information

**Organisation**

Lighterlife UK Ltd

**ROR**

<https://ror.org/00drp2z27>

## Funder(s)

**Funder type**

Industry

**Funder Name**

LighterLife

**Alternative Name(s)****Funding Body Type**

Private sector organisation

**Funding Body Subtype**

For-profit companies (industry)

**Location**

United Kingdom

## Results and Publications

### Individual participant data (IPD) sharing plan

#### IPD sharing plan summary

Available on request

#### Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Results article</a>	results	01/03/2018	24/01/2019	Yes	No