

## **Parallel Session RTD Line 3 / Diet and weight gain prevention: observation perspective**

### **Lecture 3: Dietary and behavioural differences between weight-discordant twins**

**Kirsi Pietiläinen**

**Obesity Research Unit and Finnish Twin Cohort Study University of Helsinki, Finland**

#### **Abstract**

Background: Data documenting that the intake of food and unhealthy food in particular would be larger in obese subjects than in non-obese subjects have been conflicting. This may arise from questionable reliability of food collection data, low energy needs of the obese because of low physical activity (PA), or genetic factors underlying the susceptibility to gain weight with similar levels of positive energy balance. To this end, we studied dietary and behavioral differences in obesity-discordant monozygotic (MZ) twins matched for genetic background, with the aim 1) to increase validity of behavior data by co-twin assessments and objective measures of energy intake and expenditure (doubly-labeled water) and 2) to study whole body and adipose tissue metabolism associated with the lifestyle in acquired obesity.

Methods and Procedures: Rare MZ pairs discordant for obesity ( $n=14$ , BMI difference  $5.2 \pm 1.8$  kg/m<sup>2</sup>) and weight-concordant MZ control pairs ( $n=10$ ,  $1.0 \pm 0.7$  kg/m<sup>2</sup>), identified through a population-based registry of 24-28-y-old twins ( $n=658$  MZ pairs), completed 3-day food and PA diaries and eating behavior questionnaires. Each twin was asked to compare his/her own eating and PA patterns with the co-twin's behavior by structured questionnaires. Accuracy of energy intake and expenditure was validated by doubly-labeled water. Body composition was measured by DEXA, MRI and spectroscopy, and insulin sensitivity by the euglycemic clamp technique. Transcript profiling of abdominal subcutaneous adipose tissue was done by Affymetrix Chip arrays and lipidomics and fatty acid measurements in serum and adipose tissue by ultra-performance liquid chromatography coupled to mass spectrometry and gas chromatography.

Results: Non-obese co-twins consistently reported that their obese twin siblings ate more food overall (fatty foods and snacks), consumed less healthy foods and exercised less than the non-obese do. However, no differences in energy intake ( $9.6 \pm 1.0$  MJ/d vs.  $9.8 \pm 1.1$  MJ/d, respectively) in the food diaries or in daily activity level ( $2.0 \pm 0.1$  vs.  $2.1 \pm 0.1$ , respectively) (classes 1-8) in the PA diaries were found between obese and non-obese co-twins. A considerable underreporting of energy intake was observed in the obese ( $3.2$  MJ/d, 25% of total energy expenditure,  $p=0.023$ ) but not in the non-obese co-twins ( $0.8$  MJ/d, 8% of total energy expenditure). Adipose tissue compositions of lipids and fatty acids revealed significant differences between the obese and non-obese co-twins. Obesity-induced worsening of the lipidomics and fatty acid profiles in the adipose tissue was independent of genetic effects, and was associated with lower polyunsaturated fat intake, reduced whole body insulin sensitivity and adipose tissue inflammation.

Discussion: MZ twin pairs discordant for obesity offer a unique opportunity to investigate the contribution of eating and PA habits to body weight independent of genetic effects. Obesity-related changes in eating and PA behavior may be overseen in food and PA diaries due to considerable misreporting especially by the obese subjects. Lifestyle is very important in inducing significant alterations to adipose tissue and whole body metabolism, independent of genetic effects.