

## Meal timing is a possible predictor of weight loss effectiveness

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Energy intake and expenditure are not the only factors known to influence the success of a dietary intervention in obesity. Led by Professor M. Garaulet from University of Murcia in Spain, researchers from Spain and North America performed a large-scale prospective study to see whether timing of meals could predict weight-loss effectiveness in humans. The study revealed that early eaters lost more weight, and at a higher rate, than volunteers who ate later. At the same time, biomarkers related to obesity and weight loss remained similar between the groups. Based on these findings, researchers concluded that timing of food intake may influence the success of a weight loss therapy.

Finding the most efficient way to tackle obesity has troubled scientists for decades. Physiological, psychological, genetic and environmental factors have to be taken into consideration when developing an effective method for weight loss. Current programs mostly rely on keeping the balance between the calorie intake and expenditure. However, recent studies revealed that the timing of feeding may affect weight management in animals, thereby linking the energy regulation to a circadian clock.

The circadian clock is a 24 hour cycle, crucial for the physiological processes of all living organisms. Studies in animals have shown that rhythmic feeding supports and synchronises the circadian system, while abnormal food intake disrupts the well-tuned cycle. The CLOCK genes, involved in regulation of circadian rhythm, are well characterised. Some of them are also found in the adipose (fat) tissues of animals and humans. These genes follow a daily rhythmic pattern and instruct the adipose tissue to either accumulate or mobilise fat at the proper time. Variations in clock genes (known as single nucleotide polymorphisms, or SNPs) have been shown to be linked to obesity and weight loss. The time of feeding, therefore, particularly for high-energy content meals, may play a role in the development of obesity, and that is what the researchers from several universities and institutes in Spain and North America studied.

The researchers addressed the issue of meal timing in weight loss programs by performing a study in 420 Spaniards who were living with obesity or overweight – both males and females. Dietary intake was assessed in all volunteers at the start of the study, and it was monitored during the entire 20-week-long intervention period. Individuals taking part in the study attended therapy sessions once a week. The treatment was based on four factors: dietetic treatment based on the Mediterranean diet, nutritional education, physical activity, and cognitive-behavioural therapy. In the Mediterranean population, the main, most caloric meal (40% of total daily energy intake) is ingested at lunch time. Based on the daily dietary-records documented by the volunteers, they were divided into two groups. There were those that consumed their main meal before 3pm (early eaters, 51%) or after 3pm (late eaters, 49%).

A wide range of biomarkers were monitored throughout the study. They included obesity and metabolic syndrome parameters, such as weight, height, total body fat and body fat distribution, as well as the levels of the appetite hormones leptin and ghrelin. Plasma concentrations of glucose, cholesterol, triglycerides and lipoproteins were also assessed. To determine the energy expenditure, volunteers were asked to record their activity levels, and complete morningness/eveningness and sleep duration questionnaires to

assess the daily patterns. The morningness/eveningness questionnaire is meant to assess if a person's peak sleepiness and alertness is in the morning or in the evening. Finally, to study the CLOCK gene polymorphisms, DNA was isolated from blood samples. At the beginning of the study, no differences were found in age, gender distribution, obesity-related parameters and metabolic syndrome characteristics between the early and late lunch eaters except for HOMA. This is an index of insulin resistance used for assessing the risk of diabetes, which was significantly higher in the late eaters.

Following 20 weeks of the intervention, although both groups lost weight, late lunch eaters lost significantly less weight (7.7 kilograms on average) than early lunch eaters (9.9 kilograms on average). It was also observed that late eaters showed a slower rate of weight loss after five weeks of the treatment and this difference was maintained during the remaining period of the study. Furthermore, for one of the CLOCK genes the allele associated with obesity was significantly more frequent in late eaters. Other biomarkers (including estimated energy expenditure, plasma concentrations of leptin, ghrelin, glucose and lipids, along with sleep duration) did not differ significantly between the groups. The differences in weight loss between the groups came as a surprise to the researchers, since there were no significant differences in total energy intake or energy expenditure between late and early eaters. This indicates the timing of food intake as a critical factor.

This study is the first prospective longitudinal study showing that weight loss effectiveness can be affected by timing of food intake. It has shown that early eaters lost more weight than late eaters. Although further research is required, this may lead to the development of novel therapeutic strategies for weight loss and obesity that, in addition to caloric intake and energy expenditure, would take into consideration the timing of food intake.

For further information, please see:

[Garaulet M, Gómez-Abellán P, Albuquerque-Béjar JJ, et al. \(2013\). Timing of food intake predicts weight loss effectiveness. International Journal of Obesity 37:604-611. Doi:10.1038/ijo.2012.229](#)