METABOLIC SYNDROME

The benefits of time-restricted eating

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The metabolic syndrome is a group of concomitant conditions, including abdominal obesity, elevated blood pressure and hyperglycaemia, which increase a person's risk for cardiovascular diseases and type 2 diabetes mellitus. Lifestyle interventions, such as reducing calorie intake and exercising, are the first treatment for the metabolic syndrome but are often difficult to adhere to.

Time-restricted eating (TRE) is a dietary intervention that aims to ensure people maintain a regular daily cycle of feeding and fasting. Studies in rodents suggest that food timing rather than calorie content underlies the beneficial effects of TRE.

"It is difficult for many people to count calories," explains Pam Taub, one of the corresponding authors of the study. "TRE has given new hope to those involved in treating obesity and metabolic diseases, but it is rarely tested on people who have been diagnosed with metabolic diseases." Therefore, it was unclear whether patients that are on medications for one or several symptoms of the metabolic syndrome can safely implement TRE and derive additional benefits from it.

To address these questions the researchers recruited 19 patients who had at least three symptoms of the metabolic syndrome for a 12-week TRE intervention. The participants selected a daily, 10-hour window in which to consume all of their calories and used the myCircadianClock app, developed by co-corresponding author Satchin Panda, to log calorie intake. They also wore a wrist activity monitor and a continuous glucose monitor for 2 weeks to track activity and intestinal glucose levels, respectively.

The researchers observed that study participants adapted to the TRE schedule by moderately shifting meal timing rather than skipping meals and that timing of calorie intake became more regular over the course of the study.

Participants lost body weight and experienced improvements in LDL-cholesterol levels, blood pressure and blood glucose values. In addition, none of the participants reported adverse effects while they reduced calorie intake. "Even patients who were already on statins and anti-hypertensive medications further reduced LDL-cholesterol and blood pressure," reports Taub. The authors note that the metabolic improvements could not be explained solely by changes in weight.

"Future studies should combine nutritional quality and/or quantity with the timing of eating to test their relative contributions to health," concludes Panda.

Anna Kriebs, Associate Editor, Nature Communications

ORIGINAL ARTICLE Wilkinson, M. J. et al. Ten-hour time-restricted eating reduces weight, blood pressure, and atherogenic lipids in patients with metabolic syndrome. *Cell Metab.* https://doi.org/10.1016/j.cmet.2019.11.004 (2019)

CIRCADIAN RHYTHMS

Sex differences in circadian misalignment

Circadian misalignment is the mistiming of the sleep–wake cycle and the fasting–eating cycle with the internal circadian system. Individuals who work shifts and those who are frequently exposed to jet lag are at an increased risk of circadian misalignment.

Research has identified differences between the circadian organization and metabolism of women and men. Now, Jingyi Qian, Frank Scheer and colleagues have shown that the mechanisms by which circadian misalignment affects metabolism differ between women and men.

"We performed a laboratory-based human study, which had a randomized cross-over design, with two 8-day protocols that included either circadian alignment or circadian misalignment conditions," explains Scheer. "More specifically, in the circadian misalignment protocol we implemented a rapid 12 h shift of the behavioural and/or environmental cycle for 3 test days to simulate night shifts." The approach adopted by Scheer and colleagues enabled them to comprehensively examine 24 h profiles of energy balance-related measures under controlled conditions.

The team found that in women, circadian misalignment results in changes in energy balance primarily through changes in energy homeostatic mechanism. In men, however, changes in energy balance are mediated by hedonic appetite. "Specifically, we found that women showed a decrease in the satiety hormone leptin and an increase in the hunger hormone ghrelin during the waking hours, which might cause them to overeat under circadian misalignment," explains Qian. "Men, on the other hand,

DIABETES

Gut microbiome influences exercise response

Lifestyle interventions, such as exercise, are known to be very effective at preventing type 2 diabetes mellitus. However, individuals respond very differently to lifestyle interventions, and the mechanisms underlying this heterogeneity are unclear. New research now suggests that the gut microbiota could be involved in the response to exercise.

The researchers recruited 39 Chinese men with prediabetes and randomly assigned them to a 12-week, high-intensity exercise intervention or a sedentary control arm. Faecal samples were taken before and after the intervention. Participants in the exercise arm all experienced improvements in metabolic parameters (such as insulin sensitivity). However, a wide range in the degree of response was observed, with 14 men being classified as responders and 6 as non-responders.

Next, shotgun metagenome sequencing was performed on the faecal samples. Exercise-induced alterations in the gut microbiome differed between responders and non-responders. "In responders, the microbiome after exercise helps to break down amino acids that promote insulin resistance," explain authors Michael Tse, Gianni Panagiotou and Aimin Xu. "But in non-responders, a different microbiome composition post-exercise leads to the breakdown of substances that promote insulin sensitivity."

In addition, the researchers transplanted faecal microbiota from the human participants to obese mice. "When transplanting the participants' gut microbiota into mice, blood sugar levels drop in animals that receive