Skipping breakfast disrupts 'clock genes' that regulate body weight

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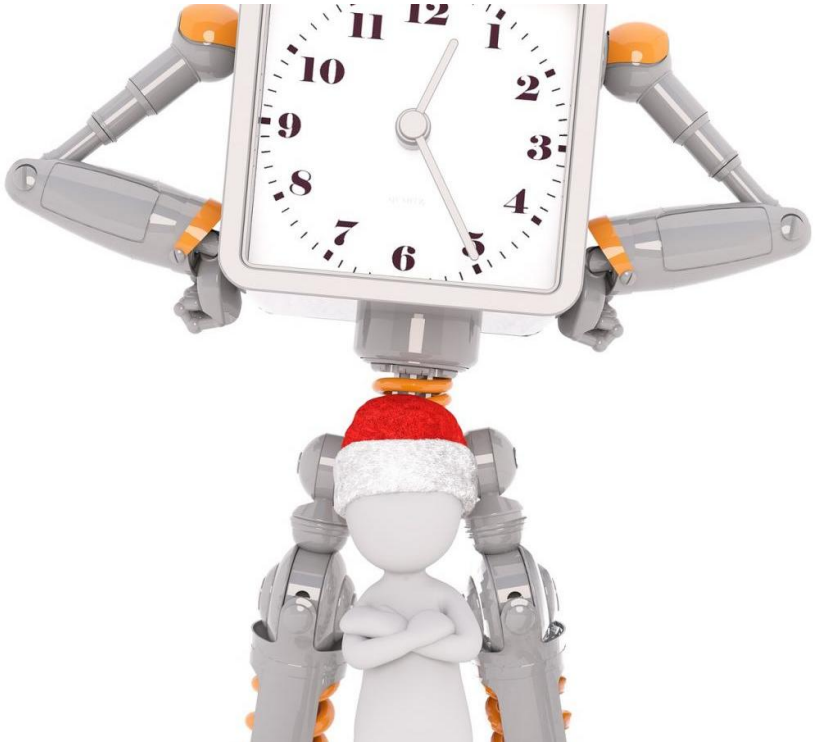

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Irregular eating habits such as skipping breakfast are often associated with obesity, type 2 diabetes, hypertension and cardiovascular disease, but the precise impact of meal times on the body's internal clock has been less clear.

A new Tel Aviv University study now pinpoints the effect of breakfast on the expression of "clock genes" that regulate the post-meal glucose and insulin responses of both healthy individuals and diabetics.

The importance of the body's internal clock and the impact of meal times on the body were the subject of this year's Nobel Prize for Medicine, awarded for the discovery of molecular mechanisms controlling our circadian rhythm.

This TAU study was led by Prof. Daniela Jakubowicz of TAU's Sackler Faculty of Medicine and Wolfson Medical Center's Diabetes Unit. It was conducted in collaboration with Prof. Julio Wainstein and Dr. Zohar Landau of TAU's Sackler Faculty of Medicine and the Wolfson Medical Center's Diabetes Unit; Prof. Itamar Raz and Prof. Oren Froy of The Hebrew University of Jerusalem; and Prof. Bo Ahrén of Lund University in Sweden. It was recently published in *Diabetes Care*.

"Our study shows that breakfast consumption triggers the proper cyclic clock gene expression leading to improved glycaemic control," Prof. Jakubowicz says. "The circadian clock gene not only regulates the circadian changes of glucose metabolism, but also regulates our body weight, blood pressure, endothelial function and atherosclerosis.

"Proper meal timing—such as consuming breakfast before 9:30 AM—could lead to an improvement of the entire metabolism of the body, facilitate weight loss, and delay complications associated with type 2 diabetes and other age-related disorders."

For the study, 18 healthy volunteers and 18 obese volunteers with diabetes took part in a test day featuring breakfast and lunch, and in a test day featuring only lunch. On both days, the researchers conducted blood tests on the participants to measure their postprandial clock gene expression, plasma glucose, insulin and intact glucagon-like peptide-1

(iGLP-1) and dipeptidyl peptidase IV (DPP-IV) plasma activity.

"Our study showed that breakfast consumption triggers the proper cyclic clock gene expression leading to improved glycaemic control," says Prof. Jakubowicz. "In both healthy individuals and in diabetics, breakfast consumption acutely improved the expression of specific clock genes linked to more efficient weight loss, and was associated with improved glucose and insulin levels after lunch."

In contrast, in test days featuring only lunch (when participants skipped breakfast), the clock genes related to weight loss were downregulated, leading to blood sugar spikes and poor insulin responses for the rest of the day, suggesting also that skipping breakfast leads to weight gain even without the incidence of overeating the rest of the day.

"The fact that we can change the gene's expression in just four hours is very impressive," says Prof. Jakubowicz. The researchers are currently conducting a long-term study comparing the effect of different meal timing schedules on the body's clock gene expression, glucose balance and weight loss over time.