

Chrononutrition: Timing of meals matters for your health

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Most people have engaged in late-night eating at some point—whether it's with ice cream before bedtime or pizza while studying for an exam.

But if you think those late-night indulgences are just an innocent way to curb your pesky, post-dinner hunger pangs, think again.

For decades, if not centuries, parents and even philosophers have cautioned against late-night eating, noting that this pattern could lead to [health problems](#), including obesity. But until recently, few scientific studies have comprehensively explored the link between meal timing and [health](#).

Today, researchers have transformed this age-old advice to eat at the right time of day for optimal health into the relatively new and rapidly emerging field of chrononutrition, the science of how [circadian rhythms](#) (the body's 24-hour cycles), nutrition, and health all interact. A better understanding of these interrelationships could play a key role in preventing or treating obesity, heart disease, [high blood pressure](#), diabetes, and other cardiometabolic conditions that have now been linked, at least in part, to eating late.

"We're excited about the growing field of chrononutrition, which has the potential to create new approaches for fighting many chronic conditions, including [heart disease](#), a leading cause of death," said Marishka Brown, Ph.D., director of NHLBI's National Center on Sleep Disorders Research. "New findings in this field could potentially lead to personally tailored interventions that improve health and quality of life, but more studies are needed."

Nour Makarem, Ph.D., an assistant professor of epidemiology at Columbia University's Mailman School of Public Health in New York City and a researcher in the field, agrees, noting that chrononutrition is a concept whose time has come.

"The rise in cardiometabolic disease has paralleled a shift in lifestyle characterized by later timing of meals, significant nighttime eating, and

erratic eating patterns in adults," Makarem said during a recent two-day NHLBI workshop on the topic. "We need to pay more attention to when, not just what, we eat."

Early studies

One of the earliest and best-known studies in chrononutrition was conducted in 2009. They found that mice fed a high-fat diet during the day, when they would normally sleep, gained significantly more weight than mice fed the same [high-fat diet](#) during the night, when they would normally be awake. The study suggested that modifying feeding time might be a viable strategy to prevent weight gain.

Studies in humans soon followed that echoed these animal findings. In 2013, an observational [study](#) tracked 420 people with obesity who attended different nutritional clinics in Spain to lose weight. That study found that people who ate lunch late (after 3 p.m.) lost less weight during treatment than those who ate early (before 3 p.m.), after adjusting for other factors such as age, appetite hormones, energy intake and expenditure, and sleep duration.

Recent studies have begun to unravel some of the complex biological mechanisms linking late eating to chronic disease. In 2019, for example, researchers conducted a small [clinical trial](#) showing that eating during the nighttime—like many shift workers do—can increase [blood glucose levels](#), while eating only during the daytime might prevent the higher glucose levels now linked to shift work. High glucose levels can be a sign of diabetes.

Knowledge gaps

In addition to changes in [glucose metabolism](#), researchers have found

that the type of food eaten, appetite hormones, [genetic differences](#), exercise, and light exposure all appear to play a role in the health effects of late eating. Additional factors under study include age, sex, race, and whether you tend to be a morning or evening person (also known as chronotype).

"If we can unpeel this multilayered onion called chrononutrition, I think there is great promise that exciting new interventions will emerge from this field," said Frank A.J.L. Scheer, Ph.D., professor of medicine at Harvard Medical School and director of the Medical Chronobiology Program at Brigham & Women's Hospital in Boston.

But many gaps remain. They include a poor understanding of why nutrients consumed later in the day are used differently than at earlier times of the day, limited knowledge about circadian biomarkers and genes, and a poor understanding of the cultural and psychological factors that drive people to eat across the day/night cycle. Researchers are even trying to determine how to define late eating, as one person's late eating may not be the same as another's. These and other areas are now the subjects of a growing number of discussions and studies.

Future

As researchers work to get critical questions answered, they say they have their sights on potential interventions that might include personalized nutrition eating plans based on an individual's unique genetic makeup, or new drugs that counteract the negative health effects of late-night eating. Scientists say that to advance knowledge in this area of personalized nutrition, a large clinical trial will be needed.

For now, the researchers say, the familiar mantra, "Eat breakfast like a king, lunch like a prince, and dinner like a pauper," may carry some wise health advice. Getting more exercise, eating heart-healthy foods, and

getting sufficient and high-quality sleep can help, too, they say.

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