

Too much light at night may lead to obesity, study finds

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Persistent exposure to light at night may lead to weight gain, even without changing physical activity or eating more food, according to new research in mice.

Researchers found that mice exposed to a relatively dim [light](#) at [night](#) over eight weeks had a [body mass](#) gain that was about 50 percent more than other mice that lived in a standard light-dark cycle.

"Although there were no differences in activity levels or daily consumption of food, the mice that lived with light at night were getting fatter than the others," said Laura Fonken, lead author of the study and a doctoral student in neuroscience at Ohio State University.

The study appears this week in the online early edition of the [Proceedings of the National Academy of Sciences](#).

If the mice are not less active or eating more, what's causing the bigger [weight gain](#)? Results suggest that mice living with light at night eat at times they normally wouldn't.

In one study, mice exposed to light at night – but that had food availability restricted to normal eating times – gained no more weight than did mice in a normal light-dark cycle.

"Something about light at night was making the mice in our study want to eat at the wrong times to properly metabolize their food," said Randy

Nelson, co-author of the study and professor of neuroscience and psychology at Ohio State.

If these results are confirmed in humans, it would suggest that late-night eating might be a particular risk factor for obesity, Nelson said.

In one study, mice were housed in one of three conditions: 24 hours of constant light, a standard light-dark cycle (16 hours of light at 150 lux, 8 hours of dark), or 16 hours of daylight and 8 hours of dim light (about 5 lux of light).

The researchers measured how much food the mice ate each day. They also measured how much they moved around their cages each day through an infrared beam crossing system. Body mass was calculated each week.

Results showed that, compared to mice in the standard light-dark cycle, those in dim light at night showed significantly higher increases in body mass, beginning in the first week of the study and continuing throughout.

By the end of the experiment, light-at-night mice had gained about 12 grams of body mass, compared to 8 grams for those in the standard light-dark cycle. (Mice in constant bright light also gained more than those in the standard light-dark cycle, but Nelson said the dim light-at-night mice were better comparisons to the light exposure that humans generally get.)

The dim light-at-night mice also showed higher levels of epididymal fat, and impaired glucose tolerance – a marker of pre-diabetes.

Although the dim light-at-night mice didn't eat more than others, they did change when they ate, results showed. These mice are nocturnal, so they would normally eat substantially more food at night. However, the dim light-at-night mice ate 55 percent of their food during the daylight

hours, compared to only 36 percent in the mice living in a standard light-dark cycle.

Since the timing of eating seemed significant, the researchers did a second study, similar to the first, with one important difference: instead of having food freely available at all times, food availability was restricted to either the times when mice would normally be active or when they would normally be at rest.

In this experiment, mice exposed to the dim light at night did not have a greater gain in body mass than did the others when their food was restricted to times when they normally would be active.

"When we restricted their food intake to times when they would normally eat, we didn't see the weight gain," Fonken said. "This further adds to the evidence that the timing of eating is critical to weight gain."

The findings showed that levels of corticosterone, a stress hormone, were not significantly different in dim light-at-night mice compared to those living in a standard light-dark cycle.

That's important because corticosterone has been linked to changes in metabolism, Fonken said. This shows there doesn't have to be changes in corticosterone levels to have changes in metabolism in the mice.

So how does light at night lead to changes in metabolism? The researchers believe the light could disrupt levels of the hormone melatonin, which is involved in metabolism. In addition, it may disrupt the expression of clock genes, which help control when animals feed and when they are active.

Overall, the findings show another possible reason for the obesity epidemic in Western countries.

"Light at night is an environmental factor that may be contributing to the obesity epidemic in ways that people don't expect," Nelson said.

"Societal obesity is correlated with a number of factors including the extent of light exposure at night."

For example, researchers have identified prolonged computer use and television viewing as obesity risk factors, but have focused on how they are associated with a lack of physical activity.

"It may be that people who use the computer and watch the TV a lot at night may be eating at the wrong times, disrupting their metabolism," Nelson said. "Clearly, maintaining body weight requires keeping caloric intake low and [physical activity](#) high, but this environmental factor may explain why some people who maintain good energy balance still gain weight."

Provided by The Ohio State University

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