Women appear to be more resilient to body clock disruptions than men, says new research

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Credit: AI-generated image (disclaimer)

You might not know it, but we all have a clock ticking away inside us. This circadian clock operates on roughly a 24-hour cycle. It influences when we sleep, wake and eat, among other things.

However, our body clock can sometimes go awry, resulting in what scientists call "circadian misalignment." One of the most common causes is shift work. Think of nurses, police officers, factory workers and many others who toil while the rest of us sleep. This work pattern forces them to be active when their body clock is telling them to sleep, and vice versa.

Studies have suggested that this constant battle against the body's natural rhythm can lead to health problems, including metabolic syndrome. This is a cluster of conditions, such as high blood pressure and blood sugar levels, that occur together and increase a person's risk of heart disease and stroke.

Now, a new study suggests women may be less vulnerable to the health consequences of circadian misalignment than men.

Mouse models

In the first part of this study, researchers from the University of Pennsylvania investigated how circadian misalignment affects male and female mice. They manipulated the mice's environment to disrupt their usual night-day cycles, similar to the disruption faced by human shift workers.

Female mice proved surprisingly resilient to these changes. Even under the stress of a high-fat diet—a scenario that typically causes health issues—the female mice kept to their regular patterns of daily activity. Male mice, on the other hand, found it more difficult to adapt, and the time they ran in their wheels became less consistent.

As well as observing the activity of the mice, the researchers studied the effect of circadian misalignment on the functioning of genes in the mice's livers. While our body has a central clock in the brain, each of our

organs, including the liver, has its own set of "clock" genes that follow the rhythm set by this master clock.

In both male and female mice, the primary clock genes in the liver—the ones that form the core of this local timekeeping system—remained active even when the mice's sleep-wake schedules were disrupted.

However, the disruption had a different effect on a broader set of genes in the liver. These genes follow a rhythmic pattern under the control of the primary clock genes, and are essential for maintaining a healthy metabolism. In male mice, the rhythmic activity of these liver genes was almost entirely lost. But in female mice, many of these genes continued their cyclical activity despite the sleep-wake disruption.

The researchers also examined the mice's gut bacteria, or "microbiome." Interestingly, the male mice showed a significant increase in certain bacteria often seen in people with diabetes. However, similar to the liver genes, the female mice's microbiome didn't seem to change much.

This all suggests that female mice were more resilient to circadian misalignment than male mice.

It's important to note that translating findings from mice to humans isn't always straightforward. Mice aren't tiny humans—there are many differences between our species. For example, while mice also have a circadian rhythm, they're nocturnal. Still, we can often learn a lot about human health by looking at what happens in mice, and glean valuable directions for research in humans.

Replicating the results in people

To see if these findings could be applied to humans, the researchers turned to the UK Biobank, a large collection of health data. They studied

data including health records and information from wearable devices from more than 90,000 people with a history of shift work.

Their observations in mice appeared to hold true for humans. In particular, while both sexes had a higher incidence of metabolic syndrome compared with people who didn't do shift work, the occurrence was substantially greater in male shift workers compared with female shift workers, when looking at people who did the same kind of job.

As in the mouse models, women seemed to possess a stronger internal rhythm, potentially providing them with a degree of protection against the detrimental effects of circadian misalignment.

Why does it matter?

The idea that men and women might respond differently to circadian misalignment could have significant implications, not just for shift workers but for everyone.

Take, for instance, "social jetlag." This is what happens when we stay up late on weekends and then struggle to wake up early on Monday. This abrupt shift in our sleep schedule is a type of circadian misalignment, and can affect our health over time.

Notably, the idea that men and women might have different internal clocks isn't entirely new. About ten years ago, scientists found the daily rhythms of body temperature and sleep hormones are set to an earlier time in women compared with men. Previous research has also indicated that men may be more susceptible to high blood pressure and diabetes as a consequence of shift work.

But this new study adds more detail to our understanding of these

differences. The findings may eventually lead us to better strategies to manage the negative effects of circadian misalignment, such as designing healthier shift work schedules. But for now, it's clear that our body clocks matter, and respecting these rhythms is an essential part of taking care of our health.

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