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Working the night shift burns less energy and increases risk of weight gain

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Image credit: ORNL

People who work the night shift are likely burning less energy during a 24-hour period than those on a normal schedule, increasing their risk for weight gain and obesity, according to a new study led by the University of Colorado Boulder.

Researchers have known that people who work, and therefore eat, at night when their bodies are biologically prepared to sleep are prone to put on pounds. But the reasons have not been clear.

For the new study, published in the *Proceedings of the National Academy of Sciences*, fourteen healthy adults spent six days at the University of Colorado Hospital's Clinical and Translational Research Center. For the

first two days, the participants followed a normal schedule sleeping at night and staying awake during the day. They then transitioned to a three-day shift work schedule when their routines were reversed.

"When people are on a shift work-type schedule, their daily energy expenditure is reduced and unless they were to reduce their food intake, this by itself could lead to weight gain," said Kenneth Wright, director of CU-Boulder's Sleep and Chronobiology Laboratory and senior author of the paper.

During the experiment, participants' meals were carefully controlled, and they were given the amount of food they would normally need to eat at home to maintain their current weight. When the participants transitioned to the shift work schedule, the timing of their meals changed but the total amount of calories remained the same.

The participants also were given the same eight-hour sleep opportunity regardless of whether those hours were scheduled during the day or night.

The researchers found that total daily energy used by participants decreased when they were put on a shift work schedule. The reduction is probably linked to the mismatch between the person's activities and their circadian clocks, Wright said. Humans have evolved to be awake—and eat—when it's light outside and sleep when it's dark. In large part, the human circadian clock is set by exposure to sunlight.

People's circadian clocks can shift over time—even radically—with the use of artificial lights if they aren't exposed to the sun. But because shift workers typically switch back to a daytime schedule on their days off, their biological clocks don't flip to fit their night shift schedules.

"Shift work goes against our fundamental biology," said Wright, also an

associate professor of integrative physiology. "Shift work requires our biological day to occur at night and our biological night to occur during the day and that's very difficult to achieve because the sun is such a powerful cue. We can have some change in our clock—a couple of hours—but then on days off, it goes right back. Shift workers never adapt."

The research team was surprised to find that the study participants burned more fat when they slept during the day compared to when they slept at night. It's not clear why this happens, but Wright said it's possible the extra fat-burning is triggered by the transition day between a daytime schedule and a nighttime schedule.

On that day shift workers often take an afternoon nap to prepare for the first nightshift, but in total, they are typically awake more hours than usual and, therefore, burn more energy. The need to meet the extra demand for energy may cause the body to begin burning fat, Wright said.

Further research is needed to determine if the fat-burning phenomenon would happen among actual shift workers, whose diet is not being strictly controlled, Wright said. For example, shift workers may eat more calories on the transition day—an option not available to study participants—which could eliminate the need for the body to start burning fat. Still the findings suggest that shift workers may be prone not only to gaining weight, but also to a changing composition of fat and muscle mass in their bodies.

Wright cautions that even though participants initially burned more fat, this would not lead to weight loss because in total, the energy expenditure over the three days of shift work was lower.

Wright said more work is needed before specific recommendations can

be made for how to improve the health of shift workers but the new study provides a starting point.

"What we can say is that it's perhaps even more important to have a healthy diet for shift workers as well as a healthy amount of physical activity," he said.

More information: Impact of circadian misalignment on energy metabolism during simulated nightshift work, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1412021111

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