Research discovers links among poor sleep, high blood pressure, gut microbiome

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Anne M. Fink, assistant professor, UIC College of Nursing's Department of Biobehavioral Nursing Science. Credit: Mark Mershon/University of Illinois Chicago

In the first study of its kind, University of Illinois Chicago researchers

have found associations among disrupted sleep, elevated blood pressure and changes in the gut microbiome.

The research aimed to determine whether a 28-day period of disrupted sleep changed the microbiota in rats. The gut microbiota refers to the collection of microorganisms living in the intestines. The researchers also sought to identify biological features associated with undesirable arterial blood pressure changes.

The results were published in *Physiological Genomics*.

Using rats, the researcher disrupted their sleep periods. Rats are nocturnal, so the experiments were designed to interfere with their daytime sleep periods.

Telemetry transmitters measured the rats' brain activity, blood pressure and heart rate. Fecal matter also was analyzed to examine changes in the microbial content.

The research idea was generated by several of the paper's authors who are or have been health care providers with night-shift schedules.

"When rats had an abnormal sleep schedule, an increase in blood pressure developed—the blood pressure remained elevated even when they could return to normal sleep. This suggests that dysfunctional sleep impairs the body for a sustained period," Maki said.

Katherine A. Maki of UIC College of Nursing's Department of Biobehavioral Nursing Science. Credit: Mark Mershon/University of Illinois Chicago

Undesirable changes also were found in the gut microbiome—the genetic material of all bacteria living in the colon.

Contrary to her initial hypothesis, Maki found that the gut microbiome changes did not happen immediately, but instead took a week to show unfavorable responses such as an imbalance among different types of bacteria including an increase in microbes associated with inflammation.

"When the sleep disruption stopped, everything did not come back to normal immediately," Maki said. "This research shows a very complex system with the presence of multiple pathological factors."

This was initial research, and studies will continue to examine pathways involving the gut microbiome and metabolites produced by gut bacteria. The researchers will see exactly how sleep characteristics are changed and how long blood pressure and gut microbiome alterations persist. Researchers will then determine how this information translates to humans.

"We hope to find an intervention that can help people who are at risk for cardiovascular disease because of their work and sleep schedules. People will always have responsibilities that interrupt their sleep. We want to be able to reduce their risk by targeting the microbiome with new therapies or dietary changes," Fink said.

More information: Katherine A. Maki et al, Sleep fragmentation increases blood pressure and is associated with alterations in the gut microbiome and fecal metabolome in rats, *Physiological Genomics* (2020). DOI: 10.1152/physiolgenomics.00039.2020

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