Researchers find potential cause of heart risks for shift workers

March 3 2009

Even a few days of circadian misalignment can have negative effects, researchers found. Image: Justin Ide

(PhysOrg.com) -- Harvard researchers from Brigham and Women's Hospital (BWH) and colleagues have identified the potential cause of the increased risk for cardiovascular and metabolic disease in shift workers.

The researchers found that misalignment between the internal biological clock and the sleep/wake and fasting/feeding cycles, known as circadian misalignment, resulted in hormonal and metabolic changes that, if chronically maintained, could explain the increased risk for obesity, high blood pressure, diabetes, and cardiovascular disease frequently found among shift workers. These findings appeared in today's online early edition of Proceedings *of the National Academy of Sciences*.

“There is convincing evidence for an increased risk of cardiovascular and metabolic complications associated with shift work, but the underlying mechanisms were largely unknown,” said Frank Scheer, a neuroscientist in BWH’s Division of Sleep Medicine, associate director of the Medical Chronobiology Program at BWH, a Harvard Medical School instructor in medicine, and lead author of the paper. “We studied the influence of circadian misalignment, typical of shift work, on physiological pathways involved in glucose metabolism, the regulation of body weight, and cardiovascular function as a possible mechanism.”

Ten healthy volunteer subjects underwent a 10-day laboratory stay where they slept and ate at all hours of the day and night, achieved by living on recurring 28-hour “days.” Their daily activities and meals were carefully controlled. Alterations in blood pressure, blood glucose, sleep quality, and hormones like leptin, insulin, and cortisol were analyzed throughout the 10 days.

“Knowing that the hormone leptin - which helps control appetite and satiety - rises and falls based on circadian rhythms, we wanted to find out if leptin levels were low in individuals who had shifted their behavioral rhythms, such as being awake at night,” explained Christos Mantzoros, clinical research overseer of the Department of Endocrinology, Diabetes and Metabolism at Beth Israel Deaconess Medical Center (BIDMC) and associate professor of medicine at Harvard Medical School. The researchers did find reduced leptin levels during circadian misalignment, which can increase appetite and may decrease activity levels, potentially contributing to obesity and cardiovascular problems.

“Study participants showed the largest deviations from normal hormone levels when their sleep/wake cycles were shifted by approximately 12 hours, while they were sleeping during standard daylight hours and waking at night,” said Steven Shea, director of the Sleep Disorders

Research Program at BWH and associate professor of medicine at Harvard Medical School. “Abnormal levels of these hormones may lead to increased health risks common in shift workers.”

Scheer also noted that circadian misalignment caused three patients with no history of diabetes to show post-meal glucose levels typical of those with pre-diabetes. “This suggests that in some otherwise healthy people, irregular sleep patterns could increase the risk for the development of diabetes.

“These findings do not apply only to those performing shift work, but may also have implications for people suffering from circadian rhythm sleep disorders, including advanced and delayed sleep phase syndrome and many blind people experiencing circadian misalignment due to the absence of resetting their body clock by light,” explained Scheer. “In addition, because these changes were observed within just a few days of misalignment, circadian misalignment may even temporarily affect millions of international travelers each year.”

Provided by Harvard University