Obesity creates wimpy rats

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(Medical Xpress) -- Obesity appears to impair normal muscle function in rats, an observation that could have significant implications for humans, according to Penn State researchers.

"Our findings demonstrate that obesity involves more than accumulating excess fat and carrying excess weight," said Rudolf J. Schilder, American Physiological Society postdoctoral fellow in physiological genomics, Penn State College of Medicine. "We show that, during the development of obesity, skeletal muscles fail to adjust their molecular composition appropriately to the increasing body weight. Consequently, the muscles of obese mammals are not properly 'tuned' to the higher body weight they carry."

Schilder and his colleagues examined whether normal mammalian skeletal muscle perceives the amount of weight it is carrying, and whether it makes physiological adjustments to compensate for more or less weight. They theorized that this ability of muscle may be affected in obesity, as obese mammals typically suffer from reduced mobility and muscle function.

The study, published in a recent issue of the Journal of Experimental Biology, used both healthy and genetically obese rats to determine how the expression of troponin T -- a gene that codes for a protein essential to muscle function -- varied as rats gained weight.

The research shows that the regulation of troponin T expression in a way appropriate for given body weights is impaired in obese rats.

"These results may explain why muscle strength and locomotion are impaired in obese humans, and hence perhaps why it is so difficult to lose excess weight and recover from obesity," said Schilder.

The researchers first demonstrated that troponin T expression varied with body weight during normal growth. Then they artificially increased the body weight of one group of rats by 30 percent using a custom-made weighted vest. Externally applied weight caused a shift in the muscle troponin T expression, matching that of animals whose actual body weight was 30 percent higher. In contrast, troponin T expression did not respond to a similar increase in body weight in the obese rats.

Troponin T expression was examined in the muscles from a total of 68 rats. Nine were genetically obese, 19 were weight loaded and the rest of the rats served as controls. The weight-loaded rats wore the vests for five days.

"Our study is likely to stimulate a quest to determine the pathways and mechanisms that sense body weight and control muscle molecular composition, as this could ultimately provide new therapeutic approaches to alleviate these obesity-associated problems," said Schilder.

Also working on this research were Scot R. Kimball, professor of cellular and molecular physiology; Leonard S. Jefferson, Evan Pugh Professor of cellular and molecular physiology and chair, both at Penn State College of Medicine; and James H. Marden, professor of biology, Penn State Eberly College of Science.

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