High-fat diet impairs muscle health before impacting function

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(PhysOrg.com) -- Skeletal muscle plays a critical role in regulating blood sugar levels in the body. But few studies have comprehensively examined how obesity caused by a high-fat diet affects the health of muscle in adolescents who are pre-diabetic.

In a paper published tomorrow in the scientific journal *PLoS One,* a team of McMaster University researchers report that the health of young adult muscle declines during the pre-diabetic state, which is when blood sugar levels are higher than normal but lower than during Type 2 diabetes. The researchers found that during this period significant impairments occur in the muscle, even though it appears to be functioning normally.

"Based on the way the muscles performed, you would think that they're still healthy," said Thomas Hawke, an associate professor of pathology and molecular medicine of the Michael G. DeGroote School of Medicine at McMaster University. "But the fact is the muscle is not healthy. It's undergone a lot of pathological changes."

Hawke led a team of researchers at McMaster and York universities in using mice to examine how a high-fat diet, leading to obesity, affected the form and function of skeletal muscle. The researchers found the high-fat diet resulted in insulin resistance, large increases in fat mass and weight gain. But it also led to initial adaptations in the muscle.

"What our results tell us is that, initially, skeletal muscle appears to respond positively to the high-fat diet. By changing the size or type of its

muscle fibres, the muscle adapts to the high-fat diet by saying 'Let's burn more of this fuel,' " Hawke said.

"But with continued high-fat feeding, we're giving the muscle more fuel than it can handle. So, even though it has made these initial, positive changes, continued high-fat feeding is more than the muscle can cope with. That's when a downward spiral starts."

The researchers also discovered that not all muscles responded in the same way to obesity. Some adapted by changing their fibre type, while others altered the size of their fibres. But, in all cases analyzed, a high-fat diet decreased the ability of skeletal muscle to use fat or glucose as fuel.

When the researchers looked at function, and examined the maximum effort the muscles could generate, they discovered no difference between the high-fat diet group and the control group which was eating a diet significantly lower in fat. However, if the muscles were fatigued and then were required to work, the high-fat diet group didn't recover as quickly as the control group.

"What this suggests is that the muscle is trying to maintain function despite all the negative changes that have resulted," Hawke said. "When we stress the muscle a bit though, such as fatiguing it, there are some hints toward functional impairment, but overall the muscle has coped well, functionally anyways."

The authors concluded that early therapeutic interventions in obese, pre-diabetic youth are needed prior to significant long-term effects on the growth and function of their muscles.

Source: McMaster University (news : web)