

Insulin boost restores muscle growth in elderly

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When most people think of insulin, they think of diabetes — a disease that arises when, for one reason or another, insulin can't do the critical job of helping the body process sugar. But the hormone has another, less well-known function. It's also necessary for muscle growth, increasing blood flow through muscle tissue, encouraging nutrients to disperse from blood vessels and itself serving as a biochemical signal to boost muscle protein synthesis and cell proliferation.

Recently, scientists have recognized that loss of responsiveness to insulin plays a major role in the loss of physical strength that occurs as people grow older. Now, University of Texas Medical Branch at Galveston researchers have demonstrated that by increasing insulin levels above the normal range in elderly test subjects, they can restore the impaired muscle-building process responsible for age-related physical weakness.

"Insulin is normally secreted during food intake," said Dr. Elena Volpi, senior author of a paper on the study published in the September issue of *Diabetologia*. "When you give insulin intravenously and increase the blood insulin levels to the same amount produced after a meal, you see that in young people it stimulates protein synthesis and <u>muscle growth</u>, while in older people it really doesn't. But when we gave seniors double the insulin they would normally produce after eating, their muscles were stimulated like those of young people."

Volpi and her co-authors — postdoctoral fellows Satoshi Fujita and Kyle Timmerman, graduate student Erin Glynn and Professor Blake B.



Rasmussen — worked with 14 elderly volunteers to examine the response of thigh muscle to the two different blood insulin levels, established by infusion into the thigh's main artery. Blood samples taken from catheters inserted in the femoral artery and vein of each subject enabled the researchers to calculate blood flow and muscle protein synthesis, and <u>muscle biopsies</u> allowed them to measure levels of signaling molecules involved in muscle protein growth.

All the data pointed in the same direction, showing that a blood insulin level double that produced by a typical meal seems to turn back the clock on elderly thigh muscle.

"While we had called this 'insulin resistance' in the past, we didn't really have evidence that you can get an elderly person's muscle to grow if you give it a lot more insulin, which is what we needed to truly say this is <u>insulin resistance</u>," Volpi said. At the same time, she said, the phenomenon is also quite different from the insulin resistance seen in diabetes. "These were older subjects with perfect glucose tolerance," she said. "So what we have identified is a novel kind of insulin resistance that's not related to sugar control."

Instead, Volpi said, the UTMB researchers attribute this new kind of insulin resistance to age-related changes in the vascular system — in particular, changes in the endothelium, the single-cell-thick layer that lines blood vessels. The endothelium controls blood flow by increasing or decreasing the diameter of capillaries (the smallest blood vessels), and regulates the release of oxygen, nutrients, water and other blood-borne cargo through the capillary walls and into muscles and other body tissues. "Having a capillary dilation induced by insulin is important, because it exposes more muscle to the nutrients and hormones and everything flows better and gets stored away better," Volpi said. "But in even healthy older people, this dilation response doesn't work, because they have this endothelial dysfunction."



The UTMB researchers are now testing whether using drugs to dilate muscle <u>blood vessels</u> during insulin exposure can improve muscle growth in older people. "Preliminary data suggest that this treatment may be effective, but these data are not yet published," Volpi said. "On the other hand, in a paper we published two years ago in Diabetes, we showed that a single bout of aerobic exercise — a staple of diabetes treatment — may also improve muscle growth in response to <u>insulin</u> in older nondiabetic people."

Source: University of Texas Medical Branch at Galveston (<u>news</u> : <u>web</u>)

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