Medical Xpress

Study identifies molecular response of muscle to different types of exercise

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Exercise in the future could be customized for individuals based on genomics, according to a study by Arizona State University (ASU) and the Translational Genomics Research Institute (TGen), an affiliate of City of Hope.

For years, scientists have studied the effects of different types of exercise on the human body, but never before at this level of molecular precision, according to the TGen-ASU study published in the *Journal of Applied Physiology*.

"We hope to leverage these findings into more precise exercise recommendations in the future—ones that are tailored to an individual not only based on their physiological needs but also based on their molecular response to exercise," said Dr. Matt Huentelman, professor in TGen's Neurogenomics Division, and one of the study's senior authors.

This study begins to characterize some of the molecular changes that happen in muscle tissue following different types of exercise, specifically resistance exercise (lifting weights), versus that of aerobic exercise (in this study, cycling).

Researchers used advanced technology—whole-transcriptome RNA sequencing—to identify genes that were affected uniquely by each type of exercise. Muscle samples were obtained from six men, ages 27-30, before their exercises, and again at 1 hour and 4 hours following both weight lifting and cycling.

The study found 48 unique genes following aerobic exercise, and 348 unique genes following weight lifting, that were "differentially expressed," meaning the exercises made the genes more powerful or less powerful, like a dimmer switch on a chandelier.

"These data show that different exercises elicit unique molecular activity in skeletal muscle," said Dr. Jared Dickinson, an assistant professor in the ASU College of Health Solutions, and the study's lead author. "These findings support the need for additional research that better identifies how exercise strategies can be used to target specific molecular responses in the muscle tissue, which could have implications for those that suffer from abnormalities in muscle."

By better understanding the unique molecular processes stimulated by different types of exercise, the researchers hope to find better ways to promote muscle health. They also maintain that this research could lead to more effective exercise interventions that target abnormalities associated with specific muscle dysfunctions.

A very important aspect of the study was the use of RNA sequencing, which provided: a broader range of analysis, especially for genes expressed at low levels; increased specificity; and the ability to identify novel genes that otherwise might not be detected through lesser technologies.

The study also found that aerobic exercise increased expression of one specific gene associated with greater oxygen capacity. The ESRRG gene improved endurance, enhanced development of blood vessels and was also important in improving function of mitochondria, the powerhouse of cells.

Midwestern University and Purdue University also contributed to this study—Transcriptome response of human skeletal muscle to divergent

exercise stimuli—which was published March 15 in the *Journal of Applied Physiology*.

TGen, ASU and Midwestern University funded this study.

More information: Jared M. Dickinson et al, Transcriptome response of human skeletal muscle to divergent exercise stimuli, *Journal of Applied Physiology* (2018). DOI: 10.1152/japplphysiol.00014.2018

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