Types of athletic training affect how brain communicates with muscles

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Using endurance training or strength and resistance training not only prepares an athlete for different types of sports, they can also change the way the brain and muscles communicate with each other.

A University of Kansas study shows that the communication between the brain and quadriceps muscles of people who take part in endurance training, such as running long distances, is different than those who regularly took part in resistance training and those who were sedentary. The findings may offer clues to the type of physical activity humans are most naturally suited to.

Trent Herda, assistant professor of health, sport and exercise sciences, and Michael Trevino, a doctoral student, conducted studies in which they measured muscle responses of five people who regularly run long distances, five who regularly lift weights and five sedentary individuals who regularly do neither. The studies have been published in the *Journal of Sports Sciences and Muscle and Nerve*.

Among the findings, Herda and Trevino showed that the quadriceps muscle fibers of the endurance trainers were able to fire more rapidly.

"The communication between the brains and their muscles was slightly different than the resistance trainers and sedentary individuals," Herda said of endurance trainers. "This information also suggested that resistance trainers and those who are sedentary were more likely to fatigue sooner, among other things."

Survey participants were 15 healthy volunteers. The endurance trainers had consistently taken part in a structured running program for at least three years prior to the study and ran an average of 61 miles a week and did not take part in resistance training. The resistance trainers had consistently taken part in a weight-training program for at least four years prior to the study. They took part in resistance training four to eight hours per week and reported doing at least one repetition of a back squat of twice their body mass. One reported doing a squat of 1.5 times his or her body weight, but none engaged in aerobic activity such as swimming, jogging or cycling. The sedentary participants did not take part in any structured physical exercise for three years prior to the study.

Participants wore mechanomyographic and electromyographic electrode sensors on their quadriceps muscle and extended their leg while seated. The researchers measured submaximal contraction and total force by having participants extend their leg, then exert more force, attempting to achieve from 40 to 70 percent of total force, which they could see represented in real time on a computer screen.

While it is not immediately clear why the communication between the brain and muscle was different as a result of different types of exercise as evidenced by the difference in rates of muscle fibers firing, Herda said it offers leads for new means of research into neuromechanical differences in muscle function, muscle performance , muscle stiffness and other areas. It also provides several clues into the type of exercise humans are more naturally built for. While not claiming that one type of exercise or sport is superior to another, Herda said the findings suggest that the human body's neuromuscular system may be more naturally inclined to adapt to aerobic exercise than resistance training for strength as the communication between the brain and muscles was similar between resistance training and sedentary individuals.

Provided by University of Kansas