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Cheek muscles hold up better than leg muscles in space

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It is well known that muscles need resistance (gravity) to maintain optimal health, and when they do not have this resistance, they deteriorate. A new report published in the July 2015 issue of *The FASEB Journal*, however, suggests that this might not be true for all muscles, offering hope that there may be ways to preserve muscle mass and strength for individuals in low-resistance environments, whether it be the microgravity of space, extended periods in a hospital bed, or a 9-5 job behind a desk.

"Maintaining muscle mass and good muscle repair is key to all areas of our lives: successful aging, combatting devastating diseases like muscular dystrophy, as well as generalized health and well-being to improve quality of life," said Elizabeth Barton, Ph.D., a researcher involved in the work from the College of Health and Human Performance, Applied Physiology and Kinesiology at the University of Florida in Gainesville, Florida. "Figuring out these pathways may lead to strategies that can enhance training effects for healthy individuals, and also to therapeutics that can counter the loss of functional muscle in genetic diseases or aging. Clearly, the 'use it or lose it' rule has broader impact than on muscle alone."

To make their discovery, Barton and colleagues used two groups of mice. The first group (space mice) rode on the STS-135 Space Shuttle for two weeks, and the other group (Earth mice) remained on the ground. In space, the mice's leg muscles experienced no load due to gravitational weightlessness. However, because of chewing, the cheek

muscles of the space mice were still used. Upon muscle measurement of both groups, the researchers found that the leg muscles of the space mice lost mass but their cheek muscles did not (when compared to the Earth mice). Further, the cellular signals that control the size of muscles were very different between the muscle groups of the space mice, suggesting that the cheek muscles regulate their mass in a different way than leg muscles. With this information, the researchers took their work a step further and switched the space mice to a liquid diet, which relieved the cheek muscles of any load (resistance) and then tested how the signals changed. Only part, but not all, of the muscle signals changed similarly to the way that the leg muscles did in space, leaving these muscles relatively robust and healthy. This suggests that different muscles have different "set-points" for regulating muscle mass.

"Research like this will help humans go farther into space than ever before, but the most profound impact will be here on the ground," said Gerald Weissmann, M.D., Editor-in-Chief of *The FASEB Journal*. "The process that causes astronauts' muscles to waste away in space is the same as that which causes inactive people to lose muscle mass on earth. Muscles like those in the cheek may serve as a guide to preserving other muscles, not only against microgravity in space, but also inactivity on Earth."

More information: Anastassios Philippou, Fabio C. Minozzo, Janelle M. Spinazzola, Lucas R. Smith, Hanqin Lei, Dilson E. Rassier, and Elisabeth R. Barton. Masticatory muscles of mouse do not undergo atrophy in space. *FASEB J.* July 2015 29:2769-2779; DOI: 10.1096/fj.14-267336

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