Inherited predisposition for higher muscle strength may protect against common morbidities

April 12 2024

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A study conducted at the Faculty of Sport and Health Sciences at the University of Jyväskylä showed that a genetic predisposition for higher

muscle strength predicts a longer lifespan and a lower risk for developing common diseases. This is the most comprehensive international study to date on hereditary muscle strength and its relationship to morbidity. The genome and health data of more than 340,000 Finns were used in the research.

Muscle strength, especially hand grip strength, can indicate an individual's physiological resources to protect against age-related diseases and disabilities, as well as their ability to cope with them. Age-related loss of muscle strength is individual and influenced not only by lifestyle but also by genetics.

The study, published in *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences*, revealed that individuals with a genetic predisposition for higher muscle strength have a slightly lower risk for common noncommunicable diseases and premature mortality. However, it did not predict better survival after acute adverse health events compared to the time before illness onset.

"It seems that a genetic predisposition for higher muscle strength reflects more on an individual's intrinsic ability to resist and protect oneself against pathological changes that occur during aging than the ability to recover or completely bounce back after severe adversity," says doctoral researcher Päivi Herranen from the Faculty of Sport and Health Sciences.

Utilizing a unique study population

Muscle strength is a multifactorial trait influenced by lifestyle and environmental factors but also by numerous genetic variants, each with a very small effect on muscle strength. In this study, the genetic predisposition for muscle strength was defined by constructing a polygenic score for muscle strength, which summarizes the effects of

hundreds of thousands of genetic variants into a single score.

The polygenic score makes it possible to compare participants with an exceptionally high or low genetic predisposition for muscle strength, and to investigate associations with inherited muscle strength and other phenotypes, in this case, common diseases.

"In this study, we were able to utilize both genetic information and health outcomes from over 340,000 Finnish men and women," Herranen explains.

"To our knowledge, this is the first study to investigate the association between a genetic predisposition for muscle strength and various diseases on this scale."

Further research on the effects of lifestyles still needed

Information about the genetic predisposition for muscle strength could be used alongside traditional risk assessment in identifying individuals who are at particularly high risk of common diseases and health adversities. However, further research on the topic is still needed.

"Based on these results, we cannot say how lifestyle factors, such as physical activity, modify an individual's intrinsic ability to resist diseases and whether their impact on health differs among individuals due to genetics," Herranen notes.

The study utilized the internationally unique FinnGen dataset, compiled through the collaboration of Finnish biobanks. The dataset consisted of 342,443 Finns who had given their consent and provided a biobank sample. The participants were aged 40 to 108 years, and 53% of them

were women.

The diagnoses selected for the study were based on the leading causes of death and the most significant noncommunicable diseases in Finland. Selected diagnoses included the most common cardiometabolic and pulmonary diseases, musculoskeletal and connective tissue diseases, falls and fractures, mental health and cognitive disorders, cancers, as well as overall mortality and mortality from cardiovascular diseases.

The study is the second publication of Herranen's doctoral thesis, which investigates how genetics and environmental factors affect biological aging, particularly the weakening of muscle strength and functional capacity with age.

The research is part of the GenActive project. The project is led by Assistant Professor and Academy Research Fellow Elina Sillanpää. The research was conducted in collaboration with the Gerontology Research Center (GEREC), the Institute for Molecular Medicine Finland (FIMM), and the FinnGen research project.

More information: Päivi Herranen et al, Genome-Wide Polygenic Score for Muscle Strength Predicts Risk for Common Diseases and Lifespan: A Prospective Cohort Study, *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* (2024). DOI: 10.1093/gerona/glae064

Provided by University of Jyväskylä