Exercise slows ageing by release of betaine, scientists say

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A team of scientists has found that betaine – a compound naturally occurring in the kidneys during long-term exercise – can slow down the ageing process.



By looking at the key molecular pathways that help to reshape the physiology of the human body and delay ageing through exercise, they revealed that betaine acts as a core messenger in this process. It prevents inflammation and the ageing of multiple organs by targeting and inhibiting an enzyme called TBK1.

The findings not only shed light on the mechanism behind the anti-ageing effects of exercise, but also suggest possible antiageing strategies by simulating exercise, according to the joint team from the Chinese Academy of Sciences' Institute of Zoology and Beijing Institute of Genomics.

Led by Liu Guanghui and Qu Jing from the zoology institute and Zhang Weiqi from the genomics institute, the researchers reported their findings in the journal Cell. Nutrition, exercise, sleep and stress management are widely considered the four pillars of health, including by institutions such as the World Health Organization.

Much research has shown that exercise can powerfully influence the ageing process. However, the Chinese researchers noted the fundamental molecular mechanisms between exercise and longevity remained poorly understood, as did other questions such as how various exercise patterns differed in their beneficial effects on health.

To solve this puzzle, they launched a study in 2019 to investigate the effects of exercise on health in both mice and humans. By 2023, they had made progress, having systematically analysed the cellular and molecular responses of 14 organ tissues to long-term aerobic exercise in young and aged mice.

Building on these findings, the researchers continued their study with human participants.

In this phase, 13 healthy male volunteers were recruited.

The participants were required to run 5km in 40 minutes and then take up long-term regular exercise for 25 days.

After that, the researchers collected blood and faecal samples from the participants at various intervals, as well as health examination data.

They later used a range of analytical methods, including plasma proteomics analysis, to study the samples and establish a research framework.

The six-year research project identified the kidney as “the key responsive organ” for exercise and found that betaine, its product of metabolism, serves as the core molecular messenger for slowing ageing. Even more significant for real-life applications, the team discovered that supplementing this compound “can precisely mimic the benefits of long-term exercise”, according to the authors.

In experiments on aged mice, the team found that oral administration of betaine could extend their healthy lifespan, significantly improving functional indicators such as metabolic capacity, kidney function and motor coordination, while also reducing depressive behaviour and lifting cognitive function.

The team pointed out that betaine’s efficacy at low doses and its good safety profile “offer a potential anti-ageing strategy for the elderly”, who were unable to undertake long-term intense exercise.

Furthermore, they said the study pioneered a new research paradigm capable of “translating complex physiological effects into quantifiable, actionable chemical language”, opening up a new avenue for future ageing intervention studies.