

Half a year in space causes astronauts to lose bone permanently, equivalent to 10 years on Earth

New research suggests that long-duration space missions can have permanent effects on astronauts' health, particularly on their skeletal systems.

In 2021, NASA astronaut Mark Vande Hei broke the record for the longest solo spaceflight in NASA history. He spent 355 days, nearly 12 months, on the International Space Station.

Former Russian cosmonaut Valeri Poliyakov holds the world record for the longest spaceflight. Poliyakov spent more than 14 months aboard the Mir space station. He spent a total of 22 months in space during his career.

But new research suggests that long-duration space missions can have permanent effects on astronauts' health, particularly on their skeletal systems.

Bone is a living tissue, it is constantly renewing and improving itself. However, without the influence of gravity, bone will lose its strength.



On Earth, gravity places a constant load on the skeletal system, keeping bones strong and maintaining bone density to support the body's weight. In the weightless environment of space, bones no longer have to support the body against gravity, so osteoclast production decreases.

This causes an imbalance between the formation of new bone cells and the removal of old ones. The problem is more severe in weight-bearing bones, causing a decrease in bone density.

Leigh Gabel, an exercise scientist at the University of Calgary, and her team decided to follow 17 astronauts to learn about the effects of zero gravity on the skeletal system.

The 14 male and three female astronauts involved in the experiment had an average age of 47 and all spent between four and seven months in space. The team measured the 3D bone structure of the astronauts' legs and arms using HR-pQCT (high-resolution peripheral quantitative computed tomography). The information was measured at four time points – before the spaceflight, immediately after the astronauts returned from space, then six months later, and then one year later.

The results showed that astronauts who spent less than six months in space regained bone strength within a year of returning to Earth. However, astronauts who spent more than six months in space had permanent bone loss in their shin bones. The amount of bone loss was equivalent to a decade of aging on Earth.

"With long-duration missions, bone loss will be greater and astronauts will have major problems recovering," said physiologist Laurence Vico. The results of this study are especially important because they are related to the mission to conquer Mars, which can last up to 21 months.

"We really hope that astronauts will reach a plateau, where they stop losing bone after a period of time," said graduate student Steven Boyd.

In addition to Gabel and his colleagues' group, NASA is leading several other research groups aimed at understanding the effects of a year in space on the human body's internal systems.

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