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5-María Virginia Pinzón Fernández
6-Nelson Adolfo López Garzón

INFORMATION CIRCULAR: Spaceflight and osteoporosis.

About the authors:

1. Medical Student- Universidad de Cauca - School of Health Sciences - Department of Physiological Sciences - Corporación Del Laboratorio al Campo (DLC)- Grupo de Investigación en Salud (GIS) Popayán – Colombia.
2. Medical Student- Universidad Nacional de Colombia - School of Health Sciences - Department of Physiological Sciences - Corporación Del Laboratorio al Campo (DLC)- Grupo de Investigación en Salud (GIS) Popayán – Colombia.
3. Nursing Student- Universidad de Cauca - School of Health Sciences - Department of Physiological Sciences - Grupo de Investigación en Salud (GIS) Popayán – Colombia.
4. Doctor-Universidad Javeriana- Department of Physiological Sciences - Grupo de Investigación en Salud (GIS) - Popayán – Colombia.
5. Bacteriologist- Associate Professor- PhD candidate in medical anthropology; School of Health Sciences - internal medicine department - Grupo de Investigación en Salud (GIS) Popayán – Colombia.
6. Internal Medicine - Nuclear cardiologist; - Associate Professor- PhD candidate- School of Health Sciences - internal medicine department - Grupo de Investigación en Salud (GIS) Popayán – Colombia

Spaceflight osteopenia refers to the characteristic bone loss that occurs during spaceflight. **Astronauts** lose an average of more than **1%** bone mass per month spent in space.

Furthermore, the skeleton is composed of 2 types of bone: cortical bone (also known as compact bone) and cancellous bone (also known as trabecular bone or "spongy" bone). Eighty percent of the skeletal mass is composed of cortical bone, and the remaining 20% is cancellous bone.

Risk Of Early Onset Osteoporosis Due To Spaceflight

Osteoporosis results from gradual loss of bone density, so that the skeleton becomes weaker and more *susceptible to fractures*. Like patients with osteoporosis, astronauts who spend longer periods of time in space also experience bone loss, but at a much faster rate.

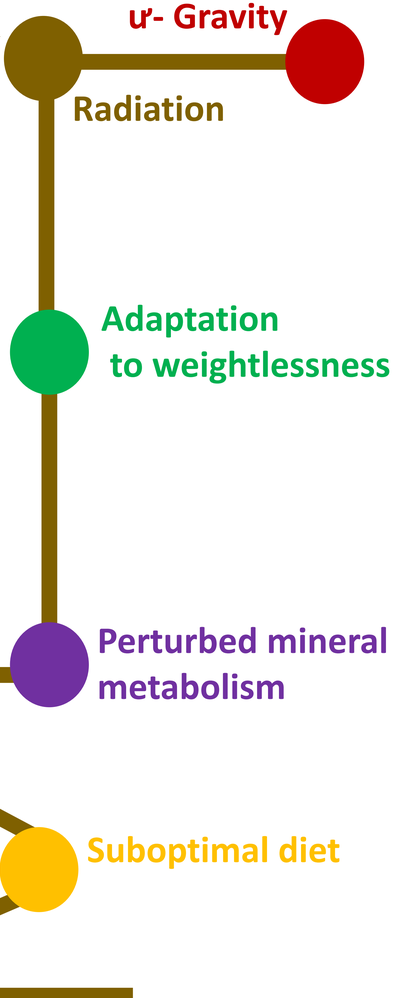
They typically experience bone loss in the lower halves of their bodies, particularly in the vertebrae (spine) and the leg bones. The proximal femoral bone (thigh bone) loses **1.5** percent of its mass per month, or roughly **10** percent over a six-month stay in space, with the recovery after returning to Earth taking at least three or four years.

Currently, the *measurement of areal bone mineral density* (aBMD) is used at NASA to evaluate the effects of spaceflight on the skeletal health of astronauts.

Notably, there are precipitous declines in aBMD with losses **>10 %** detected in the hip and spine in some astronauts following a typical 6-month mission in space. How those percentage changes in aBMD relate to *fracture risk* in the younger-aged astronaut is unknown.

Risk factors that could be contributing to this bone loss

An astronaut performing exercise in the International Space Station.
Credits: JAXA/NASA



There is concern that during long duration flights, excessive bone loss and the associated increase in serum calcium ion levels will interfere with execution of mission tasks and result in irreversible skeletal damage.

After a 3—4 month trip into space, it takes about 2–3 years to regain lost bone density.

Conflicts of interests
None stated by the authors
Financing
None stated by the authors.

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Credits: NASA

Astronauts take bisphosphonate once a week to prevent bone loss in space.
Credits: JAXA/NASA

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Recommended Reading: *NASA (Laurie J. Abadie, Charles W. Lloyd, Mark J. Shelhamer, NASA Human Research Program) - see link:* https://www.nasa.gov/hrp/bodyinspace

Consult reports *and evidence of human research of NASA "Human Research Roadmap":*
- https://humanresearchroadmap.nasa.gov/explore/