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INFORMATION CIRCULAR: Spaceflight and Risk of Cardiac.

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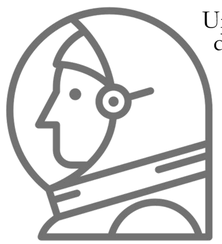

Risk of Cardiac in Spaceflight

Consult reports *and evidence of human research of NASA "Human Research Roadmap":*

- https://humanresearchroadmap.nasa.gov/explore/

1 Age → 2 Sex → 3 Genetics → 4 Oxidative Stress → 5 Mental Stress

Heart rhythm disturbances have been seen among astronauts. Most of these have been related to cardiovascular disease, but it is not clear whether this was due to pre-existing conditions or effects of space flight.

Future long-distance space missions will be associated with significant exposures to ionizing radiation, and the health risks of these radiation exposures during manned missions need to be assessed.

While astronauts in the International Space Station are somewhat protected from exposure to space radiation due to the earth's magnetosphere, future long-distance space travel (beyond low-Earth orbit) will be accompanied by exposure to higher cumulative doses of space radiation, and short-term and long-term health risks need to be assessed.

The concern of adverse cardiovascular effects of exposure to space radiation is relatively new, and studies on the cardiovascular effects in animal models of space radiation exposure are not yet abundant.

The decrease in the cardiovascular balance that occurs in space flights includes the decrease of circulating blood volume.

Changes increase the risk of cardiovascular disease, with decreased internal and external carotid artery compliance, decreased heart ventricular mass, alterations in blood pressure, and increased processes Inflammatory in the atherosclerotic layers of the arteries by ionizing radiation exposure.

Whole-body exposure of rats to iron ions at doses of 0.5 and 1 Gy (Doses of ionizing radiation are indicated in Gray "1 Gy equals 1 Joule of absorbed energy per kilogram of mass, e.g., tissue") induced long-term indications of endothelial dysfunction and increased aortic stiffness. It is difficult to assess the effects of ionizing radiation on atherosclerosis when using regular rodent models, due to the low prevalence of atherosclerosis in these animals.

The microvasculature also plays an important role in normal organ function, degenerative tissue effects, and tissue injury from ionizing radiation. Exposure of cells or tissues to ionizing radiation causes DNA damage, which has long been considered as the primary cause of cellular injury and cell death.

Reduced Cardiac Mass

- **Radiation**
- **ư- Gravity**
- **Adaptation to weightlessness**

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

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

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Reduced Cardiac Mass :

Multiple investigators have also reported decreased cardiac mass, particularly in the left ventricle, following chronic exposure to simulated spaceflight. with the magnitude of cardiac atrophy associated with the duration of exposure. Additionally, results from a small number of women suggest that sex does not affect the magnitude or time course of cardiac atrophy.

Currently no published reports exist regarding the effects of long-duration spaceflight on cardiac mass and volume.

Credits: NASA

Koichi Wakata, Expedition 38 Flight Engineer (FE), performs ultrasound data collection for the Cardio Ox experiment, in the Columbus Module. Photo was taken during Expedition 38.
Credits: NASA

NASA Sonographer David Martin simulates brachial artery ultrasound measures like those performed in the laboratory and performed by crew members aboard the International Space Station during the Cardio Ox investigation.
Credits: Andrea Dunn

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None stated by the authors
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