

## Men and Women in Space: Bone Loss and Kidney Stone Risk after Long-Duration Space Flight

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Bone loss on Earth is more prevalent in women than men, leading to the assumption that women may be at greater risk from bone loss during flight. Until recently, the number of women having flown long-duration missions was too small to allow any type of statistical analysis. We report here data from 42 astronauts on long-duration missions to the International Space Station, 33 men and 9 women. Bone mineral density (dual-energy X-ray absorptiometry), bone biochemistry (from blood and urine samples), and renal stone risk factors were evaluated before and after flight. Data were analyzed in two groups, based on available resistance exercise equipment. The response of bone mineral density to flight was the same for men and women, and the typical decrease in bone mineral density (whole body and/or regional) after flight was not observed for either sex for those using an Advanced Resistive Exercise Device. Bone biochemistry, specifically markers of formation and resorption, generally responded similarly in male and female astronauts. The response of urinary supersaturation risk to space flight was not significantly different between men and women, although risks were typically increased after flight in both groups and risks were generally greater in men than in women before and after flight. Overall, the bone and renal stone responses of men and women to space flight were not different. Funded by the NASA Human Research Program.

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