Dietary and Urinary Sulfur can Predict Changes in Bone Metabolism During Space Flight
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Mitigating space flight-induced bone loss is critical for space exploration, and diet can
play a major role in this effort. Previous ground-based studies provide evidence that dietary
composition can influence bone resorption during bed rest. In this study we examined the role of
dietary intake patterns as one factor that can influence bone mineral loss in astronauts during
space flight. Crew members were asked to consume, for 4 days at a time, prescribed menus with
either a low (0.3-0.6 g/mEq) or high (1.0-1.3 g/mEq) ratio of animal protein to potassium
(APro:K). Menus were developed for each crewmember, and were designed to meet both crew
preferences and study constraints. Intakes of energy, total protein, calcium, and sodium were
held relatively constant between the two diets. The order of the menus was randomized, and
crews completed each set (low and high) once before and twice during space flight, for a total of
6 controlled diet sessions. One inflight session and three postflight sessions (R+30, R+180,
R+365) monitored typical dietary intake. As of this writing, data are available from 14 crew
members. The final three subjects’ inflight samples are awaiting return from the International
Space Station via Space-X. On the last day of each of the 4-d controlled diet sessions, 24-h urine
samples were collected, along with a fasting blood sample on the morning of the 5th day.
Preliminary analyses show that urinary excretion of sulfate (normalized to lean body mass) is a
significant predictor of urinary n-telopeptide (NTX). Dietary sulfate (normalized to lean body
mass) is also a significant predictor of urinary NTX. The results from this study, will be
important to better understand diet and bone interrelationships during space flight as well as on
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