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 Earth. This study was funded by the Human Health Countermeasures Element of the NASA Human Research Program.