NUTRITIONAL STATUS ASSESSMENT (SMO 016E)

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The Nutritional Status Assessment Supplemental Medical Objective was an experiment initiated to expand nominal pre- and postflight clinical nutrition testing, and to gain a better understanding of the time course of changes during flight. The primary activity of this effort was collecting blood and urine samples 5 times during flight for analysis after return to Earth. Samples were subjected to a battery of tests, including nutritional, physiological, general chemistry, and endocrinology indices.

These data provide a comprehensive survey of how nutritional status and related systems are affected by 4-6 months of space flight. Analyzing the data will help us to define nutritional requirements for long-duration missions, and better understand human adaptation to microgravity. This expanded set of measurements will also aid in the identification of nutritional countermeasures to counteract, for example, the deleterious effects of microgravity on bone and muscle and the effects of space radiation.

Findings to date include:

- **Vision.** Documented evidence that biochemical markers involved in folate-dependent one-carbon metabolism were altered in crew members who experienced vision-related issues during and after flight. In Earth-based populations, these same changes have been associated with increased risk of stroke, migraines, and cerebrovascular incidents. [1]
- **Exercise.** Documented that well-nourished (including both energy and vitamin D) crewmembers exercising with the advanced resistance exercise device returned from ISS with bone mineral densities virtually unchanged from preflight [2]. While these data are very promising, Nutrition SMO data documented that this protective effect of exercise is manifested through increased bone formation, and not decreased resorption [2].
- **Fish/Bone.** Documented a relationship between fish intake and bone loss in astronauts (that is, those who ate more fish lost less bone). [3]
- **Vitamin K.** Documented that in generally well-fed and otherwise healthy individuals, vitamin K status and bone vitamin K-dependent proteins are unaffected by space flight (and bed rest). [4]
- **Testosterone.** Documented that blood concentrations of testosterone were unchanged during flight, but a transient decline occurred after landing. [5]

Beyond these findings, data from the Nutrition SMO have contributed to the ISS Program by helping understand how and why the Urine Processing Assembly clogged with calcium sulfate precipitate [6]. Ground-based analytical testing have been published [7] to provide information to the scientific community.

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3. Zwart SR, Pierson D, Mehta S, Gonda S, Smith SM: **Capacity of omega-3 fatty acids or eicosapentaenoic acid to counteract weightlessness-induced bone loss by inhibiting NF-kappaB activation: from cells to bed rest to astronauts.** *J Bone Miner Res* 2010, **25:**1049-1057.
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6. Smith SM, McCoy T, Gazda D, Morgan JLL, Heer MA, Zwart SR: **Spaceflight calcium: Implications for astronaut health, spacecraft operations, and Earth.** *Nutrients* in press.
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