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Nutrition Research: Basis for Station Requirements

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Prior to the Shuttle program, all understanding of nutritional needs in space came from Skylab metabolic research. Because Shuttle flights were short, most less than 14 days, research focused on major nutritional issues: energy (calories), protein and amino acids, water and electrolytes, with some more general physiology studies that related to iron and calcium. Using stable isotope tracer studies and diet intake records, we found that astronauts typically did not consume adequate calories to meet energy expenditure. To monitor energy and nutrient intake status and provide feedback to the flight surgeon and the astronauts, the International Space Station (ISS) program implemented a weekly food frequency questionnaire and routine body mass measurements. Other Shuttle investigations found that protein turnover was higher during flight, suggesting there was increased protein degradation and probably concurrent increase in protein synthesis, and this occurred even in cases of adequate protein and caloric intake. These results may partially explain some of the loss of leg muscle mass. Fluid and electrolyte flight studies demonstrated that water intake, like energy intake, was lower than required. However, sodium intakes were elevated during flight and likely related to other concerns such as calcium turnover and other health-related issues. NASA is making efforts to have tasty foods with much lower salt levels to reduce sodium intake and to promote fluid intake on orbit. Red blood cell studies conducted on the Shuttle found decreased erythropoiesis and increased serum ferritin levels. Given that the diet is high in iron there may be iron storage health concerns, especially related to the role of iron in oxidative damage, complicated by the stress and radiation. The Shuttle nutrition research led to new monitoring and research on ISS. These data will be valuable for future NASA and commercial crewed missions.

Educational Objectives:

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