
**2014 Nutrition Risk Standing Review Panel
Status Review**

Statement of Task for:
Risk Factor of Inadequate Nutrition

Comments to the Human Research Program, Chief Scientist

2014 Nutrition Risk Standing Review Panel (SRP) Status Review WebEx/teleconference
Participants:

SRP Members:

Bruce Bistran, M.D., Ph.D. (chair) – Harvard Medical School
Roger Fielding, Ph.D. – Jean Mayer USDA Human Nutrition Research Center for Aging
David Heber, M.D., Ph.D. – University of California, Los Angeles
Marc Hellerstein, M.D., Ph.D. – University of California, Berkeley
Gordon Jensen, M.D., Ph.D. – Pennsylvania State University

NASA Johnson Space Center (JSC):

Pam Baskin
David Baumann
Ronita Cromwell, Ph.D.
Grace Douglas, Ph.D.
Vickie Kloeris
Peter Norsk, M.D., dr. med.
Michele Perchonok, Ph.D.
Mark Shelhamer, Sc.D.
LaRona Smith
Scott Smith, Ph.D.
Susan Steinberg, Ph.D.
Sara Zwart, Ph.D.

NASA Headquarters (HQ):

Stephen Davison, Ph.D.
Bruce Hather, Ph.D.

National Space Biomedical Research Institute (NSBRI):

Dorit Donoviel, Ph.D.

NASA Research and Education Support Services (NRESS):

Tiffin Ross-Shepard

On December 2, 2014, the Nutrition Risk SRP, participants from the JSC, HQ, the NSBRI, and NRESS participated in a WebEx/teleconference. The purpose of the call (as stated in the Statement of Task) was to allow the SRP members to:

1. Receive an update by the Human Research Program (HRP) Chief Scientist or Deputy Chief Scientist on the status of NASA's current and future exploration plans and the impact these will have on the HRP.
2. Receive an update on any changes within the HRP since the 2013 SRP meeting.
3. Receive an update by the Element or Project Scientist(s) on progress since the 2013 SRP meeting.
4. Participate in a discussion with the HRP Chief Scientist, Deputy Chief Scientist, and the Element regarding possible topics to be addressed at the next SRP meeting.

Based on the presentations and the discussion during the WebEx/teleconference, the SRP would like to relay the following information to Dr. Shelhamer, the HRP Chief Scientist.

1. The SRP thought the teleconference was very informative and all SRP members were impressed with the quality of research that is being conducted.
2. The SRP thinks the HRP and more specifically the nutrition portfolio (the Risk of Inadequate Nutrition) has continued to explore important areas of concern regarding spaceflight originally garnered from near Earth orbit with the intent to expand into deep spaceflight in the future.
3. The principal issues brought up during the status review were the exploration of visual issues related presumably to intracranial hypertension which has been associated with folic acid single nucleotide polymorphisms (SNP's), the anorexia and related body mass loss with prolonged spaceflight, effects of spaceflight on vitamin D metabolism and supplementation, optimal protein, calcium, and sodium intakes, and anabolic and catabolic effects of spaceflight on bone metabolism. The nutrition portfolio led by Dr. Scott Smith has diligently investigated the most pressing issues above in a comprehensive manner. Below are some suggestions that the SRP thinks might be of some value to these important endeavors:
 - a. There is continued support from the SRP for examining the underlying causes of the "flight-induced" vision changes and possible underlying nutritional mechanisms. The SRP also suggests examining lutein status non-invasively. Lutein status can be tested non-invasively using Raman spectroscopy. Lutein is the primary antioxidant in the macula and in the brain and it appears to be concentrated there by specific transport proteins. For example, while lutein is only 28% of carotenoids in the blood, it comprises 58% of carotenoids in the brain. The SRP thinks this work may complement the one-carbon metabolism study. It may be that the two are related with the one-carbon metabolism difference setting up a susceptibility to oxidation and the lutein reflecting the oxidative damage. In any case, lutein supplementation with foods is simple as spinach contains 6 mg per 100 g.

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- b. The potential for personalized countermeasures targeting the increased risk for visual disturbance associated with the GG polymorphism and altered one-carbon metabolism is particularly intriguing.
 - c. The SRP thinks that work on gut microbiome changes and implications for nutritional status during spaceflight would represent an important new interdisciplinary area. Research on the microbiome is expanding with work showing an important influence of probiotics and prebiotic fibers. This should be a major area of interdisciplinary research.
 - d. The Integrated Nutrition Project on the use of functional foods to mitigate bone loss on the International Space Station (ISS) remains of considerable interest to the SRP. Hopefully the project will achieve the same objectives through the operational effort that has recently been prescribed. The cytokine findings that were presented during the status review are consistent with ongoing inflammation in spaceflight. Stress, sleep disturbance, and behavioral issues may well be contributing factors. Anti-inflammatory nutritional countermeasures may prove efficacious.
 - e. The SRP thinks the loss of weight as fat vs. lean should be further examined based on baseline lean body mass and protein intake. It may be that there is a relationship there. The idea that carbohydrate and protein are both fine and that calories is all that matters is not supported by the scientific literature (Dr. Hellerstein has developed methods for studying these issues using stable isotopes).
 - f. The SRP thinks further assessment of protein requirements and the pattern of diurnal protein intake still warrant further study with respect to spaceflight given the inflammatory burden and well described chronic low energy intake.