Mitigating HZE radiation-induced deficits in marrow-derived mesenchymal progenitor cells and skeletal structure

Ruth K. Globus¹, Ann-Sofie Schreurs¹, Yasaman Shirazi-Fard¹, Masahiro Terada¹, Joshua Alwood¹; Bernard Halloran² and Candice Tahimic¹. ¹NASA Ames Research Center, Moffett Field, CA and ²University of California, San Francisco, CA

PROBLEM
Future long-duration space exploration beyond the earth’s magnetosphere will increase human exposure to space radiation and associated risks to skeletal health.

We showed previously that a diet supplemented with Dried Plum (DP) prevents short term bone loss caused by total body irradiation (Schreurs et al. Scientific Reports, 2016 Feb 11;6:21343).

HYPOTHESIS
DP diet mitigates persistent, damaging effects of HZE radiation on bone structure and marrow-derived osteoprogenitors and stem cells.

BACKGROUN
Bone remodeling: a balance between bone resorption by osteoclasts and bone formation by osteoblasts.

RESULTS
DP reduced expression of pro-osteoclastogenic cytokines 1d after TBI (¹³⁷Cs)

DP reduced serum oxidative stress marker (serum TBARS) 11d days after TBI (¹³⁷Cs)

DP prevented damage to marrow-derived osteoprogenitors 30d after TBI (⁵⁶Fe)

SUMMARY/CONCLUSIONS
• DP diet fully protected radiation-induced bone loss from low LET or high LET radiation
  -relevance for spaceflight and radiotherapy
• Possible mechanisms for DP radioprotective effects: mitigate early increase in pro-osteoclast cytokines
  -reduce oxidative damage, in bone and systemically
  -prevent damage to osteoprogenitors and mesenchymal stem cells

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