Fiscal Year:	FY 2015	**Task Last Updated:**	FY 06/12/2015
PI Name:	Xiao, Hang Ph.D.		
Project Title:	Vitamins B1 and K Degradation in Spaceflight Foods: Establishment of Prediction Models and Prevention Strategies		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	01003-9282	**Congressional District:**	1
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2013 HERO NNJ13ZSA002N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	08/11/2014	**End Date:**	08/10/2017
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	3	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Douglas, Grace	**Contact Phone:**	
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Decker, Eric Ph.D. (University of Massachusetts, Amherst) He, Lili Ph.D. (University of Massachusetts, Amherst) Liu, Anna Ph.D. (University of Massachusetts, Amherst) McClements, David Ph.D. (University of Massachusetts, Amherst) Peleg, Micha D.Sc. (University of Massachusetts, Amherst)		
Grant/Contract No.:	NNX14AP32G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	1. Overall Objective and Hypothesis: Currently, shelf stable foods that do not require refrigeration or freezing are the sole source of nutrition for the spaceflight crew. It is therefore crucial that these foods provide adequate nutrition to support the crew throughout the shelf life of the product. However, knowledge is currently lacking on the degradation kinetics of essential vitamins (e.g., vitamins B1 and K) during the processing and storage of spaceflight foods. To address this critical knowledge gap, this project aims to measure vitamins B1 and K degradation kinetics and use this information to establish robust computational models that are user friendly to predict vitamin stability in spaceflight foods during processing and five-years of storage. Our central hypothesis is that: (i) Based on a systematic investigation of the degradation kinetics of vitamins B1 and K, computational models can be developed to predict vitamin degradation during processing and storage of spaceflight foods. Our main approach is therefore to identify the influence of food processing, food matrix composition, and storage conditions and other factors on the degradation kinetics of vitamins B1 and K, and then to use this knowledge to establish robust models and guiding principles to predict and prevent degradation of these vitamins. 2. Specific Aims & Approaches: Aim 1. Determine the degradation kinetics of vitamins B1 and K in spaceflight foods. The representative spaceflight foods will be produced and stored under appropriate conditions for 2 years, and the degradation kinetics of vitamins B1 and K will be systematically determined. Aim 2. Develop robust computational models to predict degradation of vitamins B1 and K in spaceflight foods. Mathematical models will be developed to simulate and predict the degradation of vitamins B1 and K in spaceflight foods, and their robustness will be assessed and validated. The results will be analyzed based on the nature of different spaceflight foods to develop guiding principles on how to minimize vitamin degradation in spaceflight foods.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	A considerable amount of research has been conducted on the stability of essential vitamins including vitamins B1 and K in different food systems. However, a detailed understanding is lacking on the degradation of essential vitamins under the unique conditions experienced by spaceflight foods.The significance of this research is that it will provide fundamental knowledge that is currently lacking about the role of food processing, food matrix characteristics, and storage conditions on the degradation kinetics of vitamins B1 and K in spaceflight foods. A particularly innovative aspect of the project is that it utilizes robust mathematical modeling to simulate and predict degradation kinetics of essential vitamins, and also to help develop guiding principles to stabilize these vitamins in spaceflight foods. Successful completion of this project will provide critical information that can be used to produce more nutritious shelf-stable spaceflight foods to better maintain health & wellness of spaceflight crew.
Task Progress:	In order to obtained accurate stability data on vitamins, we have successfully validated methods for detection and quantification of vitamins B1 and K using different food materials such as raw and roasted cashews. We have further developed mathematical modeling systems to use endpoint method to determine the kinetics parameters of vitamin degradation. Our newly developed modeling system greatly simplified the calculation procedure. The modeling system has been validated with published data on nutrient degradation. Two peer-reviewed journal articles have been published in high impact journals in the related field.
Bibliography Type:	Description: (Last Updated: 09/02/2019)
Abstracts for Journals and Proceedings	Xiao H, Peleg M, Decker E, McClements DJ. "Vitamins B1 and K degradation in spaceflight foods: establishment of prediction models and prevention strategies." Presented at the 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. , Jan-2015
Articles in Peer-reviewed Journals	Peleg M, Kim AD, Normand MD. "Predicting anthocyanins' isothermal and non-isothermal degradation with the endpoints method." Food Chemistry. 2015 Nov 15;187:537-44. Epub 2015 Apr 25. http://dx.doi.org/10.1016/j.foodchem.2015.04.091 ; PubMed PMID: 25977061 , Nov-2015
Articles in Peer-reviewed Journals	Peleg M, Normand MD, Kim AD. "Estimating thermal degradation kinetics parameters from the endpoints of non-isothermal heat processes or storage." Food Research International. 2014 Dec;66:313–24. http://dx.doi.org/10.1016/j.foodres.2014.10.003 , Dec-2014