

# FOOD FORTIFICATION STABILITY STUDY

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## Abstract

NASA has established the goal of traveling beyond low-Earth orbit and extending manned exploration to Mars. The length of proposed Mars missions and the lack of resupply missions increases the importance of nutritional content in the food system, which will need a five-year shelf life. The purpose of this research is to assess the stability of vitamin supplementation in traditionally processed spaceflight foods. It is expected that commercially available fortification nutrients will remain stable through a long duration exploration mission at sufficient levels if compatible formulation, processing, and storage temperatures are achieved.

Five vitamins (vitamin E, vitamin K, pantothenic acid, folic acid, and thiamin) were blended into a vitamin premix (DSM, Freeport, TX) such that the vitamin concentration per serving equaled 25% of the recommended daily intake after two years of ambient storage. Four freeze-dried foods (Scrambled Eggs, Italian Vegetables, Potatoes Au Gratin, Noodles and Chicken) and four thermostabilized foods (Curry Sauce with Vegetables, Chicken Noodle Soup, Grilled Pork Chop, Rice with Butter) were produced, with and without the vitamin premix, to assess the impact of the added fortification on color and taste and to determine the stability of supplemental vitamins in spaceflight foods.

The addition of fortification to spaceflight foods did not greatly alter the organoleptic properties of most products. In most cases, overall acceptability scores remained above 6.0 (minimum acceptable score) following six months and one year of low-temperature storage. Likewise, the color of fortified products appears to be preserved over one year of storage. The only exceptions were Grilled pork Chop and Chicken Noodle Soup whose individual components appeared to degrade rapidly over one year of storage. Finally, most vitamins appeared to be stable during long-term storage. The only exception was thiamin, which degraded rapidly during the first year of storage at 35°C. It was previously believed that the imprecise method of fortification would prove problematic for nutrient quantification; however, this was only an issue in stored samples of Grilled Pork Chop, Italian Vegetables and Curry Sauce with Vegetables. Year two data may further reveal the extent to which this is a problem, as well as identify overall quality changes over time.