Accelerated Shelf Life Studies and Micronutrient Stability of Food Aid Products: Implications for the Humanitarian Supply Chain

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INTRODUCTION & METHODS

Food aid products can be exposed to conditions throughout the humanitarian supply chain (e.g., sustained exposure to high levels of heat and humidity) that can potentially affect or degrade products, including nutritional properties, taste, odor and packaging integrity and appearance. For these reasons, understanding how products behave through the supply chain is critical to ensure that optimum nutrition and quality are delivered to food aid consumers. Shelf life trials are a vital part of product research and development and introduction of new/upgraded food aid products, to determine how product nutrients and characteristics are maintained throughout the supply chain. They can also be used to determine the shelf life implications of new or modified packaging or combinations of ingredient and packaging parameters. Studying product and packaging performance in real time would require a 2-3 year period of observation under storage conditions. Accelerated shelf life studies are designed to mimic real time conditions found in the humanitarian supply chain in a fraction of the time for a cost-effective, efficient alternative to real time studies.

Aim: Determine the vitamin and mineral stability and integrity of four recently updated versions of specialized nutritious food products over their intended shelf lives: Corn-Soy Whey Blend (CSWB), Super Cereal Plus (SC Plus), Corn Soy Blend Plus (CSBP) - all fortified blended flours (FBFs) - and Ready-to-Use Supplementary Food (RUSF).

Methods: Samples were analyzed for Vitamin A content, Iron content, peroxide levels and organoleptic properties (appearance, odor, taste, packaging appearance). Testing followed standard certified procedures used in the food industry. Products were stored at 40 degrees Centigrade (104 degrees Fahrenheit) and 75 percent relative humidity for a period of 26 weeks to mimic 26 months in real time. The products were sampled and tested seven times.

RESULTS

Vitamin A and Minerals: As expected, Vitamin A levels degraded substantially in all FBFs and remained stable in the lipid-based RUSF. Iron levels varied among the FBFs, mostly as expected, due partially to differing intrinsic micronutrient levels in the raw ingredients. Peroxide levels remained below the maximum permitted in all products.

Organoleptic characteristics: FBFs all developed a slight grainy odor over time. Three of the four showed sparse black flecks at various times, likely due to dark germ color and heat processing of the corn. These changes did not compromise taste or fitness for consumption. RUSF odor, appearance, texture remained stable and normal.

Packaging: There were no changes in packaging for any of the products.

Packaging of Products Tested

Corn Soy Whey Blend **25 kg**
Corn Soy Blend Plus **25 kg**

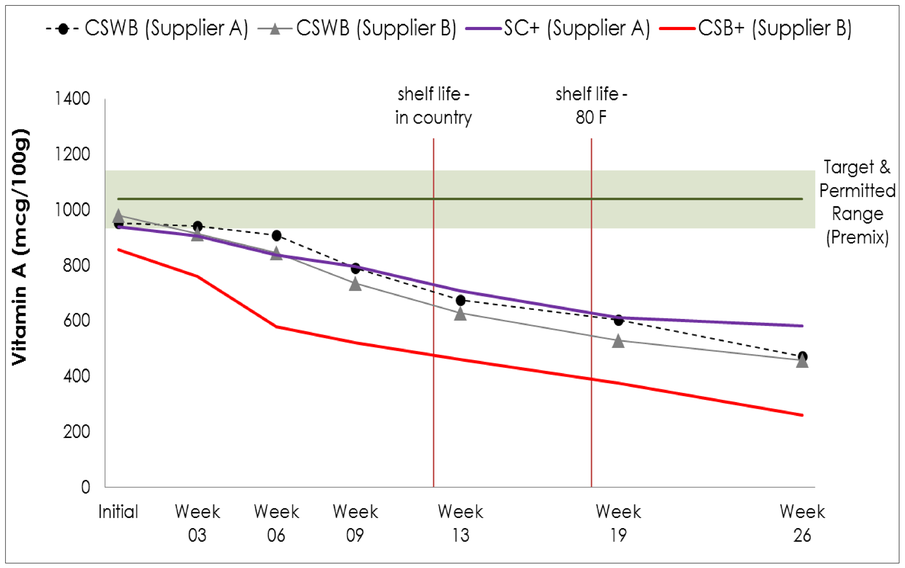
Super Cereal Plus **1.22 kg**

RUSF **92 g**

Vitamin A Targets and Permitted Ranges: Fortified Blended Foods

Parameters		CSWB	SC *Plus*	CSBP
Vitamin A	**Target**	1039	1038	1038
(mcg/100g)	**[Range]**	[935-1143]	[880-1300]	[880-1300]

Vitamin A Performance in Fortified Blended Foods



DISCUSSION AND RECOMMENDATIONS

Vitamin A deficiency is a common public health issue around the world and among humanitarian assistance target populations. Fat-soluble Vitamin A degrades in FBFs over time and, therefore, is more effectively delivered in lipid-based products such as RUSF, but the higher cost of these products can be prohibitive for programing.

Shelf life studies are crucial to verify the stability and integrity of food aid products. These findings highlight the role that intrinsic values of raw ingredients play in establishing FBF specifications. Advances in ingredients and micronutrient technology can have a significant impact on shelf life duration and organoleptic properties through the supply chain. Packaging advances that better protect food aid products and, in particular, micronutrient content, will ensure consumers receive food aid products that deliver micronutrient.

For these reasons, innovations to optimize Vitamin A delivery and other food aid product characteristics are essential, e.g., 1) protective packaging to improve shelf life stability and product integrity; 2) micronutrient chemical forms more suitable to improve bioavailability; 3) determining the most appropriate Vitamin A delivery mechanism to optimize shelf life in the humanitarian supply chain.

Accelerated shelf life studies are industry standard for new product development and should be adopted and become standard for all new or upgraded food aid products. Shelf life protocols and conditions should be harmonized among aid organizations working on product development for comparable data and results. In particular, heat and humidity levels should be increased to more accurately reflect the conditions in the humanitarian supply chain. Industry should be engaged in packaging material and ingredient form innovation for food aid products. Humanitarian supply chain optimization models, which typically consider speed and cost of delivery, should also consider including measures of food product exposure to damaging conditions. This work, with USAID, is part of the Tufts University Food Aid Quality Review (FAQR) Project.

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