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**THE STABILITY OF VITAMIN FORTIFIED COCOA BEVERAGE POWDER**

**QUARTERMASTER FOOD AND CONTAINER INSTITUTE FOR THE ARMED FORCES**  
*Quartermaster Research and Development Command*  
*Quartermaster Corps, U. S. Army*  
**August 1957**

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**THE STABILITY OF VITAMIN FORTIFIED COCOA BEVERAGE POWDER**

**Termination Report**

**Part 2**

**Project:** Simplified Food Logistics

**Subtask:** Development of Menus for Meals Consisting of  
Precooked Dehydrated Foods

**Work Phase:** Evaluation of Nutritional Properties of  
Precooked Dehydrated Foods

**QUARTERMASTER FOOD AND CONTAINER INSTITUTE FOR THE ARMED FORCES**  
**Nutrition Branch, Food Laboratories**

**August 1957**

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## ABSTRACT

Cocoa beverage powder fortified with thiamine, ascorbic acid, and improved forms of vitamin A palmitate has been reevaluated after storage. Samples were packed in rigid and flexible containers for storage at 70° and 100° F. Analyses for palatability and vitamin content were made initially and after six and twelve months.

No significant change took place during storage in the vitamin content of cocoa beverage powder. During reconstitution of the beverage powder, there was no loss of vitamin A or thiamin and only 16 % loss of ascorbic acid. No further vitamin loss occurred while the beverage simmered.

Although palatability ratings on the reconstituted beverage declined with time, the slight decline was not considered great enough to make the product unacceptable.

## INTRODUCTION

A previous study on the stability of fortified cocoa beverage powder indicated that samples of reconstituted powder containing vitamin A acetate had an unsatisfactory flavor. On the other hand, samples fortified with thiamine, ascorbic acid, and vitamin A palmitate were not found to decrease in palatability ratings. The results also indicated that no significant change took place during storage in ascorbic acid or thiamine content of the fortified cocoa beverage powder. Therefore, recommendation was made to amend the existing specification for this product to include fortification with thiamine as well as ascorbic acid (1).

Since there is a real need for additional vitamin-A supplemented carriers in packaged rations, another study was begun to reevaluate the stability of cocoa beverage powder with improved forms of vitamin A palmitate in the presence of thiamine and ascorbic acid.

## EXPERIMENTAL

Cocoa beverage powder was prepared by a commercial firm in accordance with Military Specification (MIL-C-3031) and fortified by the Nutrition Branch. The procedure employed for the addition of the vitamins to the cocoa beverage powder has been described previously (1). As usual, the fortification in one serving (1.5 ounces) supplied one-half the daily recommended allowance of the National Research Council plus an overage to compensate for losses during mixing. The plan of fortification (Table 1) utilized four individual improved brands of vitamin A palmitate for palatability tests and a composite of these brands for vitamin analyses in the presence of thiamine and ascorbic acid. A sample supplemented only with thiamine and ascorbic acid was included as a control. Samples were packed in aluminum foil kraft envelopes (2 ounces) and in cans (4 ounces) under vacuum for storage at 70° and 100° F.

Analyses were made initially and after six and twelve months' storage on those samples stored at 100° F. in flexible containers. Samples stored in rigid containers were to be examined only if samples in flexible containers were found to be unsatisfactory; samples stored at 70° F. were to be examined only if samples at 100° F. were found to be unsatisfactory. Palatability was determined on reconstituted beverage powder by a panel using a nine-point quality scale. Thiamine was measured by the fluorometric method, ascorbic acid by reduction of 2,6-dichlorophenolindophenol, and vitamin A by the Carr-Price reaction (2).

An additional study was made to determine vitamin losses after preparation and simmering. For this purpose, samples were analyzed for vitamin content prior to reconstitution, after reconstitution with water at 180° F., and after being held between 175°-200° F. for 15, 30, or 60 minutes.

## RESULTS AND DISCUSSION

Results of palatability tests are given in Table 2. Twenty judgments were obtained on each sample using a nine-point scale ranging from extremely poor to excellent. Initially, only one sample differed from the other samples. This difference was attributed to the brand of vitamin A palmitate present in the sample, since the remaining variables were constant. However, after six months' storage, this sample was as good or better than the samples containing the other brands of vitamin A which declined slightly from their initial ratings. By the end of the storage period, only the control maintained its original rating as a decline in ratings was obtained on samples fortified with vitamin A. Although cocoa samples containing vitamin A were less preferred to samples without vitamin A, no appreciable difference in preference ratings was obtained among samples with vitamin A, indicating no brand difference. In addition, the slight deterioration which occurred with time was not considered to be great enough to make the product unacceptable.

A summary of vitamin analyses is given in Table 3. It is apparent that no major change took place during storage in the ascorbic acid, thiamine or vitamin A content of fortified cocoa beverage powder. These results are in agreement with those reported previously. (1).

The vitamin losses encountered in cocoa beverage powder during reconstitution and after simmering are given in Table 4. The results obtained indicate only 16% destruction of ascorbic acid during reconstitution and no appreciable change in the vitamin A or thiamine content. After simmering of the beverage for as long as one hour, no further change in vitamin content took place. Since no loss took place in the vitamin A content of the beverage after simmering for 30 or 60 minutes, the apparent "loss" after 15 minutes of simmering is obviously in error.

## RECOMMENDATIONS

On the basis of the results presented above, it is recommended that the specification for cocoa beverage powder include the addition of vitamin A to this product at the level of 2500 units per 1.5 ounce. The vitamin A shall be a concentrate of vitamin A ester (palmitate). The ingredients shall be of edible quality. It shall be refined so that when introduced into the product at the required level, it will impart no fishy or other objectionable odor or taste to the product.

## ACKNOWLEDGMENT

The appreciation of the Nutrition Branch is extended to the General Products Section, Applications Engineering Branch, for the procurement of the cocoa beverage powder; to the Container Laboratories for assistance in packing samples; and to the Acceptance Branch for palability tests.

## LITERATURE CITED

1. The stability of vitamin fortified cocoa beverage powder. Quartermaster Food and Container Institute, Termination Report, Part 1. October 1955.
2. Methods of Vitamin Assay, Assn. Vit. Chem., 2nd Ed. (1951), Interscience Publishers, Inc.

Table 1

Plan for Fortification of Cocoa Beverage Powder

Sample Code	Vitamin A I.U./1.5 oz.	Thiamine mg./1.5 oz.	Ascorbic Acid mg./1.5 oz.
A	None	0.9	45
B	2,750 <sup>1</sup>	0.9	45
C	2,750 <sup>2</sup>	0.9	45
D	2,750 <sup>3</sup>	0.9	45
E	2,750 <sup>4</sup>	0.9	45
F	2,750 <sup>5</sup>	0.9	45

1 = Distillation Products Industries

2 = Hoffman-La Roche, Inc.

3 = Merck and Company, Inc.

4 = Charles Pfizer and Company, Inc.

5 = Composite of brands 1-4

**Table 2**  
**Mean Preference Ratings of Vitamin Fortified Cocoa Beverage**  
**Powder after Storage in Flexible Packages at 100° F.**

Code	Fortification Added	Hedonic Rating		
		Initial	6 mos.	12 mos.
A	Thiamine, Ascorbic Acid	6.9	6.9	6.8
B	Vitamin A <sup>1</sup> , Thiamine, Ascorbic Acid	7.1	6.3	6.0
C	Vitamin A <sup>2</sup> , Thiamine, Ascorbic Acid	5.5	6.7	5.7
D	Vitamin A <sup>3</sup> , Thiamine, Ascorbic Acid	6.6	6.1	5.9
E	Vitamin A <sup>4</sup> , Thiamine, Ascorbic Acid	6.9	6.2	6.2

1 = Distillation Products Industries

2 = Hoffman-La Roche, Inc.

3 = Merck and Company, Inc.

4 = Charles Pfizer and Company

Table 3

Vitamin Content of Fortified Cocoa Beverage Powder after Storage in Flexible Packages at 100° F.

<u>Code</u>	<u>Fortification</u>	<u>Initial</u> <u>Per Gm.</u>	<u>6 Mos.</u> <u>Per Gm.</u>	<u>%R</u>	<u>12 Mos.</u> <u>Per Gm.</u>	<u>%R</u>
<u>Ascorbic Acid</u> <sup>1</sup>						
		mg.	mg.		mg.	
A	Ascorbic Acid, Thiamine	1.16	1.03	89	1.02	88
F	Ascorbic Acid, Thiamine, Vitamin A	1.28	1.03	80	1.05	82
<u>Thiamine</u>						
		mg.	mg.		mg.	
A	Thiamine, Ascorbic Acid	0.017	0.016	94	0.016	94
F	Thiamine, Ascorbic Acid	0.018	0.016	89	0.017	94
<u>Vitamin A</u>						
		I.U.	I.U.		I.U.	
F	Vitamin A, Thiamine, Ascorbic Acid	49.2	54.4	111	48.0	97

1 = Reduced



Table 4

Vitamin Retention during Reconstitution and Simmering of  
Cocoa Beverage Powder

	Vitamin A	Thiamine Percent	Ascorbic Acid
Immediately following reconstitution	97	108	84
After simmering			
15 minutes	84	97	96
30 minutes	104	97	100
60 minutes	100	97	100