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Quality attributes of dried milk products packaged for long-term storage

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ABSTRACT

There is a market for dehydrated foods, such as nonfat dry milk (NFDM), that are packaged for long-term storage for use in natural disasters or other emergencies. This research was designed to determine the nutritional quality of dried milk products packaged in No. 10 cans for long-term storage.

INTRODUCTION

Many studies have evaluated the quality of NFDM stored for up to one year (Driscoll, 1985; Henry, 1987; Driscoll, 1985; Obiz就像, 1995). The industry standard for shelf-life of NFDM milk is 18-24 months, but some studies have shown that NFDM can last much longer under proper conditions (Henry, 1947; Driscoll, 1985). Various manufacturers of dried milk products have packaged product in No. 10 cans in a reduced oxygen environment to lengthen shelf-life. The objective of this research was to determine the variation in quality between 10 brands of dried milk products packaged for long-term storage.

METHODLOGY

Sample

Ten brands of dried milk products (5 instant NFDM, 3 regular NFDM, and 2 whey beverages) packaged in No. 10 cans were obtained from retail distribution. Each manufacturer was represented in 5 different products. Product codes indicated the samples were less than 1 year old, except brand J (2 years), and brands A and C (unknown).

Headspace Oxygen and Water Activity

Headspace oxygen was measured using the 3000 Series Headspace Oxygen Analyzer (Shimadzu Scientific Instruments, Wilton, CT). Water activity was measured using an Aquapak CX-2 (Aquila Devices Inc., Pullman, WA).

Can Seam Evaluation

Can seams were evaluated by using an SeamMate System (Owensville, OH) to measure the following seam dimensions: thickness, height, body cover, cross fold, and overlap. Seam tightness was checked using a scale of 0-100. The seams were given an overall rating of excellent, good, fair, or poor by an independent evaulator.

Sensory Analysis

Sensory analysis was conducted at the BYU Sensory Laboratory using standard protocols. A panel of 50 evaluators evaluated aroma, flavor, and overall acceptability using a 9-point hedonic scale.

Vitamin Determination

Vitamin analyses were conducted using an Agilent Model 1100 high performance liquid chromatograph (Agilent Technologies, Palo Alto, CA) equipped with a C18 reverse phase column (Phenomenex, Inc., Torrence, CA) and a fluorescent detector (Agilent 6545). The vitamin analyses were conducted using the method for vitamin A, vitamin D, and vitamin B12 (Givens, 2000). Determinations were carried out under subdued light.

Data Analysis

Significance was determined for significance using Statistical Analysis System software (SAS Institute, 1989). A mixed model analysis of variance (PROC MIXED) with Fisher's LSD was used for the water activity and vitamin data. Significant differences were defined as p<0.05.

RESULTS

Headspace Oxygen, Seams, and Water Activity

Headspace oxygen (Fig. 1) varied widely from brand to brand, influenced by oxygen removal method and can seam quality (Fig. 2). Cans with higher than expected oxygen levels also had poor seams. Oxygen absorbers reduced the headspace oxygen better than a nitrogen flush, as long as the seams were hermetic.

The water activity varied from 0.14-0.28 (Fig.3), but all values were in a typical range, corresponding to 3%-5% moisture (Walstra, 1999).

Sensory Results

There were significant differences in aroma, flavor, and overall acceptability between the samples (Fig. 4). The brand that scored highest in overall acceptability had a poor can seam, suggesting that quality would not last over an extended storage time.

Regular NFDM samples had a mean flavor score significantly higher than the instant NFDM, but there were no significant differences in overall acceptability (Fig. 5). The whey beverages scored significantly lower than the other samples in flavor and overall acceptability.

Vitamin Content

Thiamin content (Fig. 6) was not significantly different between brands, with the exception of one of the whey beverages, which was extremely high at 17.0 μg/g. The other samples were closer to the USDA Nutrient Database value of 4.13 μg/g.

Riboflavin content (Fig. 7) varied between the brands, from 7.0-15.5 μg/g, which was somewhat lower than the the USDA Nutrient Database value of 17.43 μg/g.

All of the products claimed to have been fortified with vitamin A, yet it was detected in only 4 of the brands (Fig. 8). Those brands containing vitamin A were near or at the target fortification level of 2500-3000 IU/L quart.

CONCLUSIONS

There is wide variation in sensory and nutritional quality of dried milk products available at the retail level packaged in cans for long-term storage.

Good manufacturing practices must be observed to optimize product quality. Providing information about the sensory and vitamin attributes on product labels may help consumers purchase dried milk products.

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