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Quality of hermetically packaged nonfat dry milk in long-term storage
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ABSTRACT
Twenty samples of regular and instant nonfat dry milk (NFDM) packaged in No. 10 cans and stored for 10 years were evaluated for sensory and nutritional quality. Linear regression indicated that age and oxygen level (only 8 samples with ≤0.25% oxygen) were the best predictors of sensory quality. Twenty-year old sample with 4.0% oxygen was significantly different from fresh samples. There were no significant differences between regular and instant NFDM. Availability of tryptophan, lysine, and reported that the milk had an unacceptable flavor and odor. Sensory data was analyzed using a mixed model repeated measures analysis of variance (PROC MIXED) (SAS Institute Inc., 2004). Significant differences were determined using a Tukey-Kramer multiple comparison test. Sensory quality was highly correlated with % of residual oxygen (r=0.92) each sample in an emergency situation decreased with age. The willingness of panelists to drink the sample with 20.9% oxygen in a sealed metal canister in a basement for 20 years to fresh NFDM and found that the stored milk had an unacceptable flavor and odor.

INTRODUCTION
Over the past few decades, nonfat dry milk (NFDM) has been packaged for long-term storage in No. 10 cans under reduced oxygen and stored in residential locations for use in an emergency. Sensory and nutritional quality were measured at extended periods of time (from 3.5 years to >10 years) to compare sensory and nutritional quality between regular and instant NFDM. Available tryptophan, lysine, and did not deteriorate with age. Nutritional quality remains fairly stable. The sensory quality of NFDM during long-term storage in residential storage, while nutritional quality remains fairly stable. Studies have shown that when severe conditions in residential storage would likely be acceptable to the users in an emergency situation. The data shows that the sensory quality of NFDM stored up to 29 years at non-ambient temperatures in hermetically sealed cans does not necessarily reflect the nutrient content for vitamins B12 and B1.

RESULTS

Headspace Oxygen, Seams, Water Activity, and Color

Headspace oxygen (Figure 1) ranged from 0.06%–29.0%. Also measured was the oxygen removal treatment (lignin, carbon dioxide, or oxygen absorbers). Only 6 of the 20 samples had ≤0.25% headspace oxygen. The sample with 20.9% oxygen had poor can seams, whereas the other samples can seams sufficient enough to create a hermetic seal. Sensory analysis indicated that age and oxygen level explained 78% of the variation in flavor and overall acceptability. However, a 22-year-old sample with low oxygen was not significantly different from fresh samples in flavor and overall acceptability.

Sensory Storage-Life

Figure 4 shows sensory results for aroma, flavor and overall acceptability. Aroma scores ranged from 4.3 to 5.6. Flavor scores ranged from 3.9 to 4.3. Overall acceptability scores were closely aligned with flavor scores, with a range of 3.9 to 4.2. Those samples which scored lower in aroma also scored lower in flavor and overall acceptability. Sensory scores for overall acceptability were highly correlated with those of panelists who would drink (r=0.85) and use (r=0.85) each sample in an emergency situation (data not shown). Nutritional Quality

Chinali (Figure 6) ranged from 2.7 to 4.0 μg/g riboflavin. Figure 7 shows data from 12.9-20.0 μg/g. Unlike Mercurio and Tadjalli (1979) who found significant losses of vitamins B12 and B12 in NFDM stored for 20 years in a sealed metal canister in a basement, our data shows that the vitamins were fairly stable and did not deteriorate with age or in an emergency situation (Figure 8) varied from 1.4-2.6 mg/g. NFDM and did not deteriorate with age. Nutritional quality remains fairly stable. There was a general decline in sensory quality of NFDM during long-term storage in residential storage, while nutritional quality remains fairly stable. Sensory and nutritional attributes, the quality of NFDM currently stored in No. 10 cans at non-ambient

CONCLUSIONS

There was no significant difference in sensory quality of NFDM during long-term storage in residential storage, while nutritional quality remains fairly stable. Studies have shown that when severe conditions in residential storage would likely be acceptable to the users in an emergency situation. The data shows that the sensory quality of NFDM stored up to 29 years at non-ambient temperatures in hermetically sealed cans does not necessarily reflect the nutrient content for vitamins B12 and B12.

HUMAN ETHICAL COMMITTEE

All animals used in this study were in accordance with the Guide for the Care and Use of Laboratory Animals (INMM, 1996).

REFERENCES

Hayashi R, Ishihara T, and Morikawa N. 1985. Chemical and nutritional attributes of hermetically packaged nonfat dry milk in long-term storage. In: Sensory Quality of hermetically packaged nonfat dry milk in long-term storage. M.A. Lloyd (michelle_lloyd@byu.edu), L.V. Ogden, and O.A. Pike Department of Nutrition, Dietetics and Food Science Brigham Young University Provo, UT 84602

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