Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 2 *Dairy Research (1984-2014)*

Article 317

1996

Probiotic frozen yogurt containing high protein and calcium

M.S. Forbes

I.J. Jeon

Karen A. Schmidt

Probiotic frozen yogurt containing high protein and calcium

Abstract

A new frozen yogurt manufacturing procedure that is easily adaptable to the current practices of the frozen yogurt industry has been developed with probiotic culture and ultrafiltrated milk. The ultrafiltrated milk was heated to 185 degrees F for 35 min to obtain a desirable gel structure when fermented with the traditional yogurt culture of Streptococcus thermophilus and Lactobacillus bulgaricus. Probiotic cultures (Bifidobacterium and Lactobacillus spp.) were added to the yogurt mix just before freezing. The yogurt mix was frozen to an 85% overrun and hardened at -20 degrees F. The frozen product contained viable culture organisms at greater than or equal to 107 cells per gram and was stable for 6 mo. The frozen yogurt also contained twice the amount of protein, three times as much calcium, and nearly one-third less lactose than similar commercial products. The new product had excellent flavor, body, texture, and overall quality.; Dairy Day, 1996, Kansas State University, Manhattan, KS, 1996;

Keywords

Dairy Day, 1996; Kansas Agricultural Experiment Station contribution; no. 97-115-S; Report of progress (Kansas Agricultural Experiment Station and Cooperative Extension Service); 771; Frozen yogurt; Ultrafiltrated milk; Probiotic bacteria

PROBIOTIC FROZEN YOGURT CONTAINING HIGH PROTEIN AND CALCIUM

M. S. Forbes, I. J. Jeon, and K. A. Schmidt

Summary

A new frozen yogurt manufacturing procedure that is easily adaptable to the current practices of the frozen yogurt industry has been developed with probiotic culture and ultrafiltrated milk. The ultrafiltrated milk was heated to 185 degrees F for 35 min to obtain a desirable gel structure when fermented with the traditional yogurt culture of *Streptococcus thermophilus* and *Lactobacillus bulgaricus*. Probiotic cultures (*Bifidobacterium* and *Lactobacillus* spp.) were added to the yogurt mix just before freezing. The yogurt mix was frozen to an 85% overrun and hardened at -20 degrees F. The frozen product contained viable culture organisms at greater than or equal to 10^7 cells per gram and was stable for 6 mo. The frozen yogurt also contained twice the amount of protein, three times as much calcium, and nearly one-third less lactose than similar commercial products. The new product had excellent flavor, body, texture, and overall quality.

(Key Words: Frozen Yogurt, Ultrafiltrated Milk, Probiotic Bacteria.)

Introduction

The evolution of frozen yogurt has covered a span of over 25 yr, and the product has grown into a multimillion dollar segment of the dairy industry. Future sales of frozen yogurt are predicted to grow at an annual rate of 3.7% through 1998. Although the early years of frozen yogurt production resulted in a product that did not meet consumer expectations relative to flavor and body/texture, progress has been made and several higher quality products are now on the market. However, over this quarter century, very little progress has been made in the creation of a standard of identity for frozen yogurt. Thus, great variation still exists in quality and definition (cultured vs. uncultured). Consequently, consumers are looking for a frozen yogurt that is healthy, nutritious, and good-tasting, and, at the same time, is representative of what is expected in a frozen yogurt.

According to the standard of identity recommended by the International Ice Cream Association, frozen yogurt should have high levels (greater than or equal to 10^7 cells/g) of viable lactic acid bacteria and a titratable acidity of at least 0.3% (as lactic acid) in the finished product. Our objective was to develop a new type of frozen yogurt that meets not only the recommended standard but also contains a high level of probiotic bacteria and calcium. To achieve this objective, we utilized ultrafiltrated milk and probiotic lactic acid bacteria cultures. Our specific objectives were to: 1) formulate a frozen yogurt with ultrafiltrated milk that contains high contents of protein and calcium but low lactose; 2) optimize a manufacturing procedure that can be adapted easily to the frozen yogurt industry; and 3) maintain a combined population of probiotic bacteria and traditional yogurt cultures of at least 10^7 cells per gram in the finished product.

Procedures

Skim milk was ultrafiltered to a solids level of 20% using an Abcor Model 1/1 Sanitary Pilot Ultrafiltration Unit. The ultrafiltrated milk was adjusted to 4% milkfat by adding cream. Part of the milk was cultured with yogurt bacteria until a titratable acidity of 1.3% was reached. The yogurt was then homogenized (1700 psi, 108 degrees F) and cooled to 35 degrees F. The other part of the ultrafiltrated milk was adjusted with cream and

solids (nonfat dry milk, cane and corn sugars, and stabilizer) to create a base mix. The mix was pasteurized at 185 degrees F for 30 min, cooled to 165 degrees F, homogenized at 1700 psi, and further cooled to 35 degrees F. Then the fermented portion of ultrafiltrated milk (15%) was blended with 85% base mix to attain a total solids content of 36%. Probiotic bacteria cultures (*Bifidobacterium bifidum* and *Lactobacillus acidophilus*) were added at the same time as flavoring material (vanilla) and color (caramel). After mixing for 15 min, the yogurt mix was frozen in a continuous freezer to an overrun content of 85% and immediately placed in a hardening room (-20 degrees F for 24 hr). The frozen yogurt samples were tempered to 40 degrees F for 24 hr before evaluation of chemical, physical, microbiological, and sensory characteristics.

Results and Discussion

When ultrafiltrated milk was fermented with yogurt culture, a strong lumpy gel was formed, which was overcome by heat treatment. Heating the milk at 185 degrees F for 35 min before fermentation was found to be essential for giving a "blendable" (smooth, peanut butter-like) gel structure. Fermentation of the ultrafiltrated milk to a titratable acidity of 1.3% was sufficient to attain a recommended acidity (.3%) in the yogurt mix when the two portions (fermented and base mix) were blended in a 15:85 ratio. The use of the traditional yogurt cultures to ferment the culture portion and addition of *B. bifidum* and *L. acidophilus* to the mix immediately before freezing are unique in this process.

The probiotic culture organisms added were stable in the finished product at acceptable levels (greater than or equal to 10^7 cells/g) for up to 6 mo. Use of ultrafiltrated milk in the manufacture of the product resulted in a high protein, high calcium, frozen yogurt. Protein level in the product averaged 9.32%, representing approximately a 100% increase over average commercial products in the same fat category. Calcium content (.35%) was approximately threefold higher than that for similar commercial products. Lactose content (2.3%) was 39% lower than the average of selected commercial samples. Sensory analyses indicated that the product possessed positive attributes when compared to commercial samples. For overall flavor, our yogurt samples scored a mean of 8 on a 10-point scale, whereas commercial sample means ranged from 6.0 to 7.1. In body and texture, our samples scored the highest (8.1), with commercial samples scoring as low as 5.2. Our samples had a mean value of 8.2 for overall quality, whereas the commercial samples ranged from 5.7 to 7.0. Individually, no heavily criticized defects were detected in any of our samples. These sensory results suggest that our product should be highly acceptable to consumers.

Frozen yogurt attributes such as high protein, high calcium, and the presence of a high level of probiotic bacteria can be very desirable to consumers. In addition, the reduced lactose level of the product, as well as potential high activity of the enzyme lactase from probiotic organisms, also may be attractive to individuals who have lactose intolerance or maldigestion problems.