

Development of a High Protein Dairy Snack Based on German-Style *Quark* Cheese

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Summary

Current consumer trends highlight the need for developing convenient and ready-to-eat snack foods that render health benefits when consumed. Rising popularity of protein-enriched foods and beverages have led to increasing awareness among consumers of health benefits related to a dairy-rich diet. The vast majority of people have adopted this lifestyle, spotting the protein's importance in delivering vital nutrients for health and maintenance of the body, curbing hunger, sustaining a slow release of energy, and speeding the metabolism. Innovation is the key driver for the dairy snack market. The primary objective of this project was to develop an American-sourced predominantly dairy (>51%) snack which meets both the current snacking trends and REAL® Seal requirement. The research also focused on assessing the acceptance of a dairy snack ("Quick-Quark") formulated with German-style quark cheese. An acceptance test with consumers using a 9-point hedonic and a "just-about-right" scale showed that flavor, mouthfeel, and texture attributes were within the liking rate of consumers. Furthermore, the higher protein content in the Quick-Quark gives this product an added value that may have a great influence on consumers' preference.

Introduction

The World Health Organization recommends the formulation of innovative products that represent healthy and nutritious choices for consumers. Currently, consumers prefer foods with health benefits and at the same time, convenience for consumption, storage, and handling. Indeed, ready-to-use products are highly appreciated for their convenience. In general, snack sales are rising, and rising demand for dairy snacks in emerging countries coupled with the launch of new snack variants has resulted in increased demand for global dairy snacks. Dairy snacks such as yogurt and milk protein drinks increase consumers' reported energy levels. Additionally, dairy snacks may provide health benefits to the consumers and provide taste, convenience, and affordable price, the most influential factors driving demand for dairy-based snacking.

The idea of Quick-Quark was conceptualized based on Dairy Management Inc./ National Dairy Council® (DMI/NDC) consumer and marketplace insights. According to the report, 56% of snacking was based on daily sustenance, long-term wellness, and health management; 49% of snacking was based on enjoyment, craving, and comfort; and 34% was based on physical and mental performance demands. Additionally, 96% of consumers chose snacks based on product taste. The new statistics of the market show

a changing mindset of the consumers that diets rich in full-fat dairy are healthier than the low- and reduced-fat dairy products. Additionally, according to the Information Resources, Inc. (IRI) Snacking Report, 64% of consumers state they sometimes have a beverage as a snack. Thus, Quick-Quark could bridge the gap between meals or even replace meals for some, while providing required energy with comfort flavors as a drinkable, indulgent high protein dairy-based snack.

Product Description

Quark is a snowy white-colored and creamy unripened cheese tracing its origin to German-speaking, Slavic, northern and eastern European countries. It has a very subtle taste with a smooth, relatively light, and soft texture. Currently, there is no standard of identity of quark as per FDA regulations. Traditionally, quark is made with mesophilic bacteria and requires a lower fermentation temperature and longer fermentation time than the thermophilic yogurt bacteria. Fermentation continues until the pH reaches ~4.6, which causes coagulation of the casein proteins. Generally, quark is classified as a fresh acid-set cheese, though in some countries it is traditionally considered a distinct fermented milk product. It is soft, white, and un-aged with no added salt.

Quick-Quark™ Creamy German-Style Drinkable Quark is a REAL® Grab 'N' Go convenient and healthy dairy snack produced for the United States market, which offers today's snacking consumers a nutrient-dense indulgent moment (Figure 1). This snack is predominantly (90% of weight in the finished product) made with dairy ingredients, including whole milk, cream, milk protein concentrates (MPC), and sweetened condensed milk. Quick-Quark offers a “superfood-blend” açai blueberry flavor and a piña colada flavor, both made with real fruits. Quick-Quark is packed in a flexible, lightweight spout pouch. Each 150-gram serving of Quick-Quark provides 200 to 220 calories and is an excellent source of dairy protein (14 grams or 28% of recommended daily value [DV]) and calcium (30% DV).

Drinkable quark meets consumers' demands for “on-the-go,” “minimally processed,” and “inherent nutrients,” as a “clean label” REAL-Seal product with live cultures that does not contain any artificial preservatives, flavors, or colors. According to the U.S. Food and Drug Administration's (FDA) Industrial Guidance, Quick-Quark is a healthy snack, as each serving contains a good amount of vitamin D (10% DV) and calcium, both of which are nutrients of public health concern (the product also inherently contains 4.5 grams of saturated fat). Though the body of the spout-pouches are covered to reduce light exposure, the bottom of the package is transparent, which provides consumers the ability to observe the real fruit puree and attractive color of Quick-Quark. Resealable caps and slim-fit design of flexible pouches are a perfect fit for grab-and-go at convenience, grocery, foodservice, and other retail stores.

Feasibility of Production and Process Description

Industrial processing of Quick-Quark (Figure 2) is organized in three main steps: 1) preparation of dairy ingredient mixture for fermentation, which includes hydration of MPC and standardization, homogenization, heat treatment/pasteurization, and cooling of the quark mixture; 2) fermentation process using mesophilic culture; and 3) centrifugation/harvesting quark, cooling, addition of other ingredients (fruits, sugar, and sweetened condensed milk), and packaging. Each manufacturing step influences

the final product quality. In order to obtain the desired mixture for fermentation, quark base preparation involves mainly fat and protein content standardization. Protein standardization aims at increasing protein content in order to improve functional properties of quark. In collaboration with a commercial manufacturer, calcium-reduced MPC is used in the process to further improve stability during storage. The cream is also added before fermentation to improve flavor and mouthfeel, and as an alternative, it can also be added post-fermentation to reduce fat loss during centrifugation.

One of the most important requirements of Quick-Quark's production is to control the temperature at every stage, so the final product is safe and enjoyable. Indeed, heat treatment at 185°F contributes to an improved quark texture by causing whey protein denaturation and its interaction with casein, resulting in decreased gel syneresis and increased gel firmness. A plate heat exchanger with a tubular holding zone is used that was designed to accurately cool the mixture to fermentation temperature (86°F).

The final pH and acidification rate are key factors to influence the quality of quark. Post-standardization, quark mixture is acidified to pH ~4.6 through long set incubation (10-12 h) using mesophilic cultures (*Streptococcus lactis* subspecies *lactis* and *cremoris*) to obtain the quark base. Fermentation is terminated by rapid cooling when the final pH reaches 4.6. Final texture and consistency of quality are critical for consumer acceptance for a drinkable product. The texture is influenced by factors such as mixture composition, starter cultures, and processing conditions. Additional ingredients including sweetened condensed milk, fruits, natural flavors, and colors are added and mixed into the quark base before aseptic filling, packaging, and labeling. All equipment used for milk storage, mixture preparation, fermentation, cooling, centrifugation, and holding of products is designed to allow clean-in-place procedures commonly used in the dairy industry. After the addition of pasteurized fruit puree and other ingredients, Quick-Quark is aseptically filled into polyethylene terephthalate-nylon-linear low-density polyethylene multi-layered flexible stand-up spout-top pouches with low-density polyethylene screw caps. Product shelf life is estimated as 30 days under refrigerated conditions. Figure 3 demonstrates several stages of making drinkable quark on the benchtop, and the photograph of the product is shown in Figure 4.

Sensory Evaluation

Sensory evaluation for Quick-Quark prototypes was tested in two stages. First, a preliminary study was conducted to test the concept of a drinkable quark snack using a consumer focus group (n = 12, 5 male and 7 female, ages 20 to 56). Each panelist evaluated three products: plain, fruit-flavored (Tropical Explosion, which included strawberry, pineapple, and mango), and fun flavor (Dulce de Leche). The focus group liked the concept of Quick-Quark. However, they suggested the flavors were not appealing. In the second stage, final formulations (both Açai Blueberry and Piña Colada flavors) were served in a random order to a consumer panel (n = 50, 19 male and 31 female, ages 17 to 55). In both stages, demographic questions were included, in addition to 9-point hedonic scales (1 = extremely dislike and 9 = extremely like) on product attributes and packaging prototype.

Additionally, a 9-point just-about-right (JAR) scale on sweetness level and questions regarding purchasing intention were added to the second stage. Quick-Quark received

very positive feedback (between 6.22 and 7.68 for all attributes) in both studies (preliminary sensory data not shown; Figure 5 shows the consumer panel results). Consumers described Quick-Quark in the open-ended questions as “smooth” and “creamy” texture and mouthfeel, “great” and “not too acidic” flavor, “very nice” aroma, and they described the packaging concept as “easy to use,” “on the go,” “about the right size for a snack,” and “fulfills my need.” Even though the label and nutritional information were not provided to the consumer panel, on average, consumers were willing to pay a premium of \$2.82 per pouch against a \$0.75 to \$0.93 ingredient and packaging cost. Some consumers were extremely excited after they realized the product was quark and each 150-gram pouch contain 14 grams of dairy protein along with Açai or Piña Colada flavors. More than once we heard, “Why is this product not in the market right now,” and “When will this product be available?”

Conclusions

The idea of Quick-Quark was conceptualized based on the DMI/NDC consumer and marketplace insights. While considering the market screening and the convenience as a snack, the group decided to design a high-protein Grab ‘N’ Go drinkable quark with a clean label using whole milk, cream, and milk protein concentrate in two flavors (Açai Blueberry and Piña Colada). Quick-Quark is a competent snack due to its high nutrition, ease to consume, and popular flavors. The group was able to complete the development process by methodically evaluating the production process. Sensory evaluation panels deemed the product acceptable or better, suggesting Quick-Quark has potential to be a profitable dairy product.



Figure 1. Nutritional label for the (A) Açai-Blueberry and (B) Piña Colada Quick-Quark.

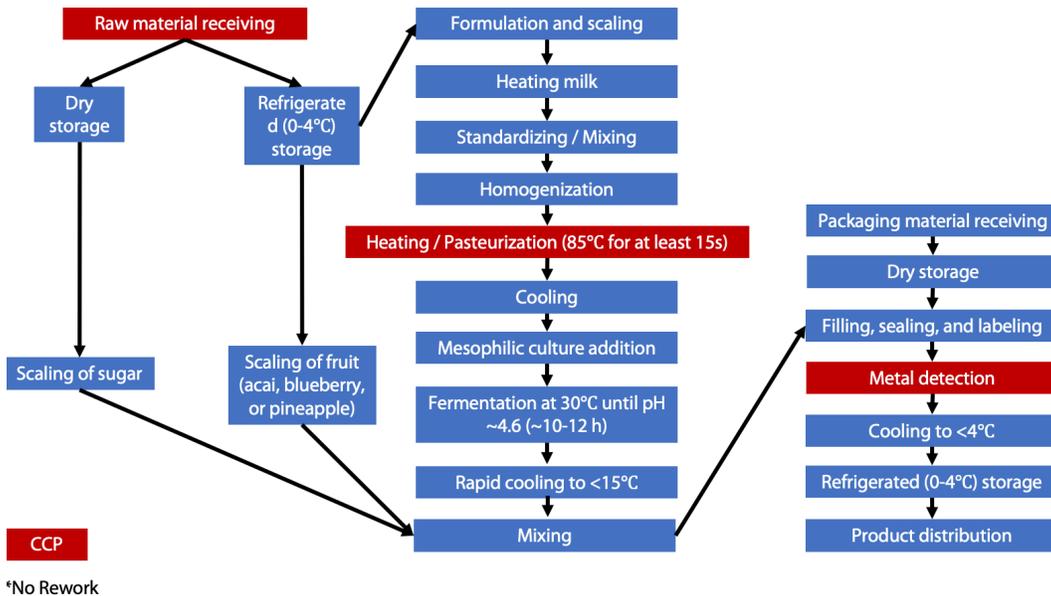


Figure 2. Industrial manufacturing flow chart of Quick-Quark.

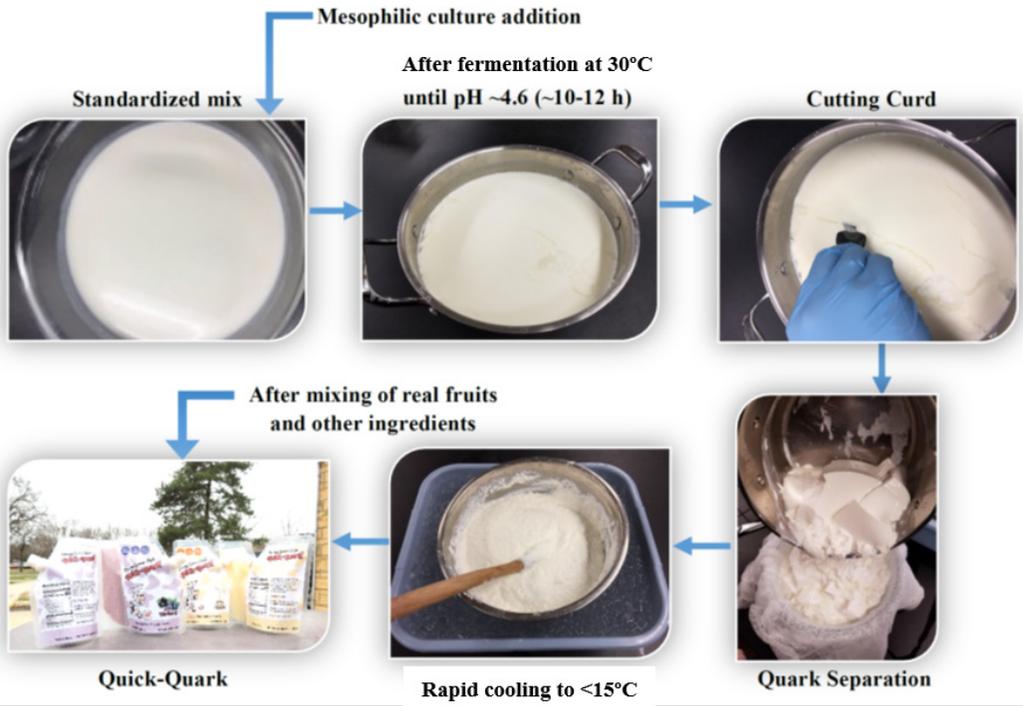


Figure 3. Preparation of quark base for the Quick-Quark.



Figure 4. Photograph of the Quick-Quark products.

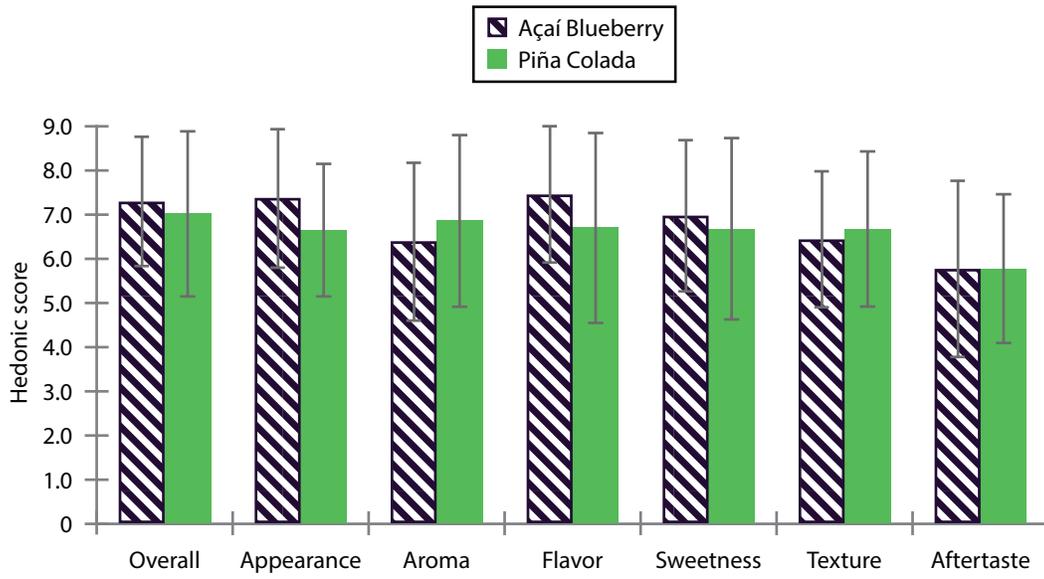


Figure 5. Sensory analysis results for the Quick-Quark products.