UNIVERSITY HONORS PROGRAM

SENIOR PROJECT - APPROVAL

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PROJECT TITLE: The Formulation and Development of "GranSticks" a granola based stick for use in frozen dairy novelties

I have reviewed this completed senior honors thesis with this student and certify that it is a project commensurate with honors level undergraduate research in this field.

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Date: 4/28/04

Comments (Optional):

"The Formulation and Development of 'GranSticks,' a Granola-Based Cookie Stick for use in Frozen Dairy Novelties"

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Senior Honors Thesis
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Abstract

An innovative approach to frozen dairy novelties, GranSticks provide a replacement for traditional wooden sticks currently used in ice cream novelty bars. The formulation for GranSticks includes Litesse Ultra®, oats, sweetened condensed milk, peanuts, and flavorings. GranSticks meet market trends in that they combine indulgence and good nutrition. With only 60 calories, 1 mg of cholesterol, and no saturated fat, GranSticks are a healthy treat. Even the oats in GranSticks have been proven to reduce the risk of heart disease according to the FDA. After six phases of bench-top formulations, a sensory panel was conducted on the GranSticks. The sensory panel revealed that consumers from the University of Tennessee community like the overall idea of the product, as well as the flavor, texture, and appearance.

Introduction:

Innovations in ice cream have been flooding the market aiming to satisfy the consumer's current desire for comforting indulgence (Hutchison 2003). While seeking indulgence in frozen desserts, consumers are also becoming more aware of the importance of nutrition. NMI (2003) reported that two-thirds of Americans feel they are eating healthier than they did in previous years (Sloan 2003). The ice cream industry has attempted to create nutritious versions of their products, but have seen limited success. Products thus far have included low sugar, low fat, and no fat varieties. The quality of these products was so drastically different than their regular counterparts that consumer appeal was limited. This product targets the population (44%) which uses cholesterol, fiber, and saturated fat information when purchasing a product (Sloan 2003).

While the market is demanding nutritious alternatives to favorite treats, it is also demanding a high quality product. This trend can be seen by the explosion of premium ice creams including Godiva, Haagen-Dazs, and others. A marketing report indicated that the top category in ice cream sales for 2002 was premium (Hutchison 2003). By combining high quality standards, a nutritious list of ingredients, and an innovative design, GranSticks will excel in the current market.

Product Description:

GranSticks are nutritious, granola-based, cookie sticks used in frozen dairy novelties (Figure 1). The purpose of a GranStick is to replace the traditional wooden stick currently used in frozen novelties (Figure 2). GranSticks are 4.5 in. long, 0.38 in wide, and 0.25 in deep. Like their wooden counterparts, 3 in of the stick is inserted into the ice cream, and the remaining 1.5 in is exposed for the consumer to grip. The product is a light, golden brown color and has a medium-hard texture. Unlike a granola bar, GranSticks are uniform in texture because all ingredients are ground.

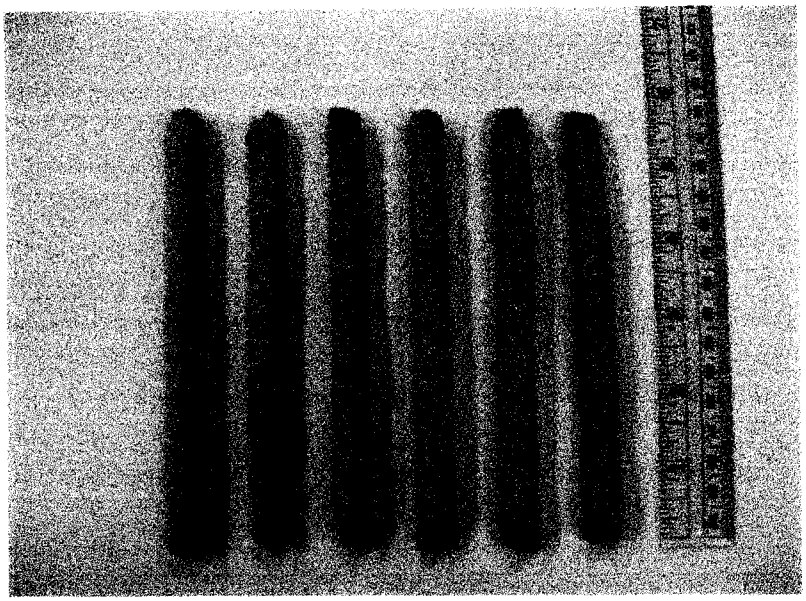

Figure 1. GranSticks

The key flavor notes found in GranSticks are almond and peanut. Designed to compliment a chocolate-covered ice cream bar, GranSticks are only moderately sweet. As a frozen product, GranSticks have slightly differing flavor characteristics depending on the temperature of the stick. The major flavor attribute of a completely frozen stick is almond, whereas, as the stick warms up, the peanut flavor becomes more pronounced. Since it is a component in a frozen novelty, the approximate temperature of the stick upon consumption will depend on individual freezer temperatures. Slight warming, however, may occur as the consumer holds the product during consumption.

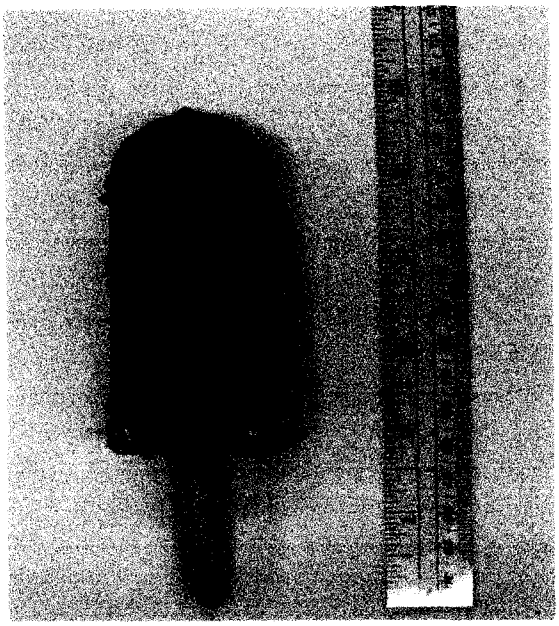

Figure 2. GranStick in ice cream bar.

Formulation and Development Criteria

The formula for GranSticks is included in Table 1. Although this formula is for the preparation of 20 GranSticks, batches were made with the same percentage of ingredients for both double and triple quantities. Doubling and tripling the formulation did not cause any changes; however, a true scale-up would likely require alterations.

Table 1. Formulation for 20 (5g) GranSticks.

Ingredient	Quantity (%)
Litesse Ultra	12
Quick Cooking Oats*	49
Peanuts*	20
Sugar*	12
Virginia Dare Vanilla Extract	4
Almond Extract*	3
Yellow Food Dye*	4 drops
Red Food Dye*	1 drop
Blue Food Dye*	1 drop

* A Kroger Brand Product

Development of the product required a total of 6 phases of prototypes (Appendix A). In the original phase, bench top prototypes used whole oats and

chopped peanuts. All of the ingredients were hand mixed, hand pressed, and baked in a 9 x 13" baking pan. After cooling, the sticks were removed from the pan and cut into desired thicknesses.

The chopped nuts and whole oats caused fracture points in the sticks, so in subsequent phases both the oats and peanuts were finely ground. Various ingredients like chocolate chips and coconut were tested. The coconut flakes caused fracture points in the stick, and the chocolate produced an unattractive appearance. Since the uniformity of the stick was difficult to maintain in the baking pan, extrusion technology was researched. To simulate extrusion techniques the sticks were prepared using a Ronco pasta machine with a 0.25 in "bread stick" die. Table 2 includes the methods for the final phase of GranStick development.

Table 2. Steps in preparation of GranSticks.

Step	Procedure
1.	Finely grind quick cooking oats and peanuts.
2.	Combine all dry ingredients (Table 1) in pasta machine and mix for 1 minute.
3.	Add liquid ingredients (Table 1) to pasta machine while mixing.
4.	Mix all ingredients for 3 minutes.
5.	Extrude mixture through 0.25 in circular die.
6.	Cut extruded material into 4.5 in pieces.
7.	Flatten and straighten sticks and place onto cookie sheet.
8.	Place into 350°F oven and bake for 15 minutes.
9.	Cool sticks and store in freezer (~5°F)

Litesse Ultra Functionality

Litesse Ultra is a key component in the formulation of GranSticks. Litesse Ultra was used to replace 50% of the sucrose. This replacement allowed for a reduction in carbohydrates and overall calories. The addition of Litesse Ultra also solved physical attribute problems. Original prototypes made without Litesse Ultra had significant cracking and spreading on the surface. Increasing fiber and reducing the amount of non-reducing sugars decreases the amount of surface cracking and spreading. Using Litesse Ultra as a replacement for 50% sucrose significantly decreased surface cracking and spreading (Figure 1).

Another function of Litesse Ultra was to increase fiber content. Oats were specifically used in this product due to the health benefits associated with their fiber content. The Litesse Ultra increased the overall fiber content, adding to the nutritious aspects of the stick.

Market Environment

Currently there are no other items on the market with the design of an edible stick. Various versions of ice cream sandwiches and ice cream cone novelties are abundant. From co-branded products to products touting a combination of flavors, the ice cream industry is experiencing much growth. By standing out with more than just a new flavor, but a new design, GranSticks have great market potential.

GranSticks also fit into the healthy frozen novelty niche. This is a growing sector, which has seen products ranging from low-carb to fat free varieties. The oats contained in GranSticks fall under FDA's recently approved health claim which states that "Diets low in saturated fat and cholesterol that include 3g of soluble fiber from whole oats per day may reduce the risk of heart disease," (Code of Federal Regulation Title 21). The oats and Litesse Ultra also contribute fiber to the product, which has been proven to reduce the risk of many chronic diseases.

With a patentable design, all regulatory approved ingredients, and a market looking for healthy, premium products, GranSticks have the potential to do extremely well.

Sensory Data

A consumer sensory panel was conducted on April 23, 2004 between 9:00 am and 12:00 pm at the University of Tennessee Sensory Laboratory. The demographics of panelists are included in Table 3. One hundred panelists were shown a picture with a brief description of a GranStick in ice cream (Figure 2). The panelists were asked to rate the overall concept of the product. Panelists

then received a frozen GranStick and were asked to evaluate the flavor, appearance and texture of the product. Panelists were also asked how likely they would be to buy the product.

Table 3. Demographics of 100 Panelists; 38% Male, 62% Female.

Percentage of Panelists	Age Group
61	20-29
11	30-39
16	40-49
10	50-59
2	60-69

Results of the test indicate positive approval of the product (Table 4).

Table 4. Mean scores for attributes of GranSticks as reported by 100 consumer panelists from the University of Tennessee community.

Attribute	Mean Score*
Concept	7.3 (Like Moderately-Like Very Much)
Appearance	7.0 (Like Moderately)
Flavor	6.9 (Like Slightly-Like Moderately)
Texture	6.3 (Like Slightly-Like Moderately)

*Mean scores based on a 9 point hedonic scale ranging from 1 (Dislike Extremely) to 9 (Like Extremely).

Panelists commented that the initial bite of the GranStick seemed hard because they were not certain what to expect. Many panelists also commented that they liked the almond flavor of the stick.

The mean score reported for panelists' intent to purchase the item was 3.5 based on a 5-point scale ranging from 1 as definitely unlikely and 5 as definitely likely. This is a positive score because it shows that consumers would fall in the range of maybe or maybe not likely and slightly likely to purchase the product. Table 5 indicates how often this set of panelists typically consumes frozen novelties.

Table 5. The frequency which panelists typically consume frozen novelties.

Frequency	Percentage of panelists
Never	4
Once every 6 months	14
Once every 2-3 months	17
Once a month	26
Every 2-3 weeks	15
Once a week	17
3 times a week	6
Every day	1

Overall, the sensory panel showed extremely positive attitudes concerning GranSticks.

Nutrition-Profile

Approximate nutritional analysis was based on the nutrition labels found on the packaging of each ingredient (Table 6).

Table 6. Approximate nutritional analysis for GranSticks

Nutrition Facts	
Serving Size 1 stick	
Calories 60	Calories from fat 19
Total Fat 2g	
Saturated Fat 0g	
Polyunsaturated Fat 0.5g	
Monounsaturated Fat 0.7g	
Cholesterol 1mg	
Sodium 16mg	
Total Carbohydrates 9g	
Dietary Fiber 1g	
Soluble 0.3g	
Insoluble 0.3g	
Sugars 4g	
Protein 2g	

The results indicate that the product contains low amounts of calories, fat, cholesterol, and carbohydrates. The product also contains 1 g of dietary fiber and 0 g of saturated fat. The majority of the fat content comes from the peanuts, and the 1 mg of cholesterol comes from the sweetened condensed milk.

It is important to note that these are strictly values for the stick, and that the values for the final product including the ice cream would be higher. The values for the final product, however, would be dependent on the type of ice cream (regular vs. low fat) used.

A nutrition fact, which separates this product form others on the market, is the fiber content. Typical frozen novelties do not include soluble or insoluble fiber. GranSticks contain both oats and Litesse Ultra, which contribute to the fiber content.

Shelf Life

Crude shelf-Life studies were performed on GranSticks using two methods. The first shelf-life study was performed with the stick by itself. GranSticks were held in a 5°F freezer for 2 months. The sticks did not show any differences in flavor or texture. A GranStick would likely last for up to a year without any major changes in texture, flavor, or appearance.

The second shelf-life study was conducted with GranSticks inserted into an ice cream bar. These sticks only lasted for 21 days in a 5°F freezer. The GranSticks absorbed moisture from the ice cream and became too soft to handle without breaking. In order to extend the shelf life of a GranStick in an ice cream bar, the product could be coated with a material that prevents moisture absorption or they could be held in a -40°F freezer where water molecules would not move.

Price/ Cost

The price of producing GranSticks will be minimal. All ingredients are normal, readily available items. The average price of a pack of 6 ice cream bars is approximately $2.30. Since GranSticks are a premium product, the price will likely be a little higher. In order to protect the GranSticks, the ice cream bars could be packaged in individual cardboard boxes as apposed to paper/plastic

wrappers. This would also increase the price of the product. Estimated market price of GranStick ice cream bars is $2.50.

References

Hutchison, Mark A. 2003. A Flavor-Inspired Renaissance for Dairy. Prepared Foods 46:39-44.

Sloan, A Elizabeth. 2003. What, When, and Where Americans Eat: 2003. Food Technology 57(8):48-66.

Methods and Results for 6 phases of bench top formulation of GranSticks

Phase 1

Method: Granola bars were prepared using flour, cinnamon, baking powder, salt, oats, crispy rice, peanuts, chocolate chips, butter, vanilla, honey, and an egg. These ingredients were mixed and then packed into a baking pan. The sticks were baked and, after cooling, were cut into sticks. These sticks were then placed into molds, filled with ice cream, and frozen.

Results: The phase 1 sticks were not attractive and were too crumbly and soft to support the ice cream. It was also difficult to produce a uniform product.

Phase 2

Method: Granola bars were prepared to resemble current market chewy granola bars. Formulation included oats, sweetened condensed milk, butter, coconut, almonds, and chocolate chips. Bars were hand mixed, pressed into a pan, baked, and cut.

Results: The phase 2 sticks were successful in resembling current market granola bars. These sticks were much more attractive, but the structure was still too fragile to support the ice cream.

Phase 3

Method: Sticks were extruded through a pasta machine to produce a more sturdy, uniform stick. Formulation included flour, cinnamon, baking powder, salt, oats, crispy rice, peanuts, chocolate chips, butter, vanilla, honey, and an egg. Sticks were baked and cooled.

Results: The phase 4 sticks flattened, spread, and were difficult to keep straight. The nuts caused fracture points in the sticks, and these sticks were also not appealing.

Phase 4

Method: The sticks were prepared using oats, sweetened condensed milk, honey, ground peanuts, and cinnamon. Batch 2 used granulated sugar instead of honey. The oats were increased in batches 2 and 3. Sticks were extruded and baked.

Results: Batch 2 of phase 4 was the most successful. Increasing the insoluble fiber with the oats decreased the amount of spreading, and using granulated sugar, a non-hygroscopic sugar, increased the sticks' crispness. Some of the whole oats caused fracture points.

Phase 5

Method: The formulation for batches 1-3 included oats, sweetened condensed milk, vanilla, ground peanuts, granulated sugar, and Litesse Ultra. Batches 2 and 3 used ground oats. All batches were extruded and baked.

Results: The ground oats increased the integrity of the stick, and the addition of Litesse Ultra, a bulking fiber compound, decreased spreading and increased strength.

Phase 6

Method: The sticks were prepared using ground oats, ground peanuts, Litesse Ultra, granulated sugar, vanilla and almond extract, and food coloring. The sticks were extruded, flattened, straightened, and baked.

Results: The phase 6 sticks had a uniform color, shape, and texture, and the appearance was attractive.