

# **Food Product Development Project**

NFSC 320L:03

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## **Abstract**

For our product we wanted to make a food that was both healthy and delicious. We also wanted to choose a product that was unique and fun to make each week. We tossed around a few ideas- quiche, pizza, muffins, cinnamon rolls, and more- until Michelle brought in the recipe for her mom's famous carrot cake and we almost instantly knew it was the one. This recipe included pineapple as well as coconut and seemed like the perfect recipe that we could make even more nutritious and tasty. We noticed right away, for instance, that it called for all purpose flour and used vegetable oil. We had all kinds of other ideas as well so we knew we had a good product to work with. Our original idea was to tweak the recipe a tad bit to make cake pops but our final product was the mini carrot cake cupcake. We had a fun recipe to work with so finding changes to make for greater health content while holding onto the delicious factor wasn't too difficult. The changes we made each week improved the cupcakes more and more and we ended up with something we craved eating every Tuesday morning and that we were proud to show off on the consumer testing day. What we've created would be a perfect snack for someone wanting something sweet but healthy and it also is pretty clean. We are extremely satisfied with our final product and think it belongs on shelves in grocery stores already.

## **Introduction and Literature Review**

The rationale for our product is: We love carrot cake and we wanted a wholesome option. Our objective is: To create a snack that is healthy, sweet, convenient, and delicious for those with a sweet tooth. Our nutrition claim is: To make a snack that is a good source of fiber. This project was a significant way for us, as blossoming nutrition students, to really get into the process of improving a recipe. The process involved learning, making mistakes, thought, and effort. What we did for many weeks is not that different from the food labs at large companies like Betty Crocker or Pillsbury. We brainstormed, measured, tested, experimented, and more with the different aspects of food science to work on and improve a product. We had to find ways to make our product healthier without altering flavor, texture, consistency, appearance, and more. This took a bit of research. It was a great experience for us to learn about this process in a hands-on way.

We were aware that Americans do not consume nearly enough fiber and we felt it would be a good goal to improve the fiber content of our cupcakes. We looked into this in journal articles via the Meriam Library ReSearch Station. The first article we found was titled "Health Benefits of Dietary Fiber." Here we learned that Americans consume less than half of the fiber that is recommended in their diets, in both adults and children. Introducing more fiber-rich foods into the diet at an earlier age can promote the continuation of a healthier diet down the road into adulthood. Consuming a diet rich in fiber goes hand in hand with a varied diet. This means that by including more fiber we naturally include more fruits and vegetables and other foods that are nutrient-dense, helping in ways beyond fiber content. We also tend to have a reduced risk of many unwanted diseases and conditions. The article titled "Liking and Consumption of High-fiber Snacks in Preschool-age Children" discusses the concept again of a diet rich in fiber being one that is linked to better diet quality and lowered risk for chronic diseases. In this study 41 preschool children age 2-5 years were given high-fiber snack foods to test whether or not they liked them. The study didn't show a significant difference between those who liked the snacks and those who didn't but we took this to mean that there are many ways snacks can incorporate fiber and making them more enjoyable is important so that children will eat more of these snacks. This gives us more motivation to make fiber-containing snacks more appealing to taste and appearance. The third article we looked at was titled "Whole Grain and Fiber Consumption Are Associated with Lower Body Weight Measures in US Adults: National Health and Nutrition Examination Survey 1999-2004." A study was conducted with adults to determine whether whole grain consumption was linked to lower prevalence of overweight/obesity, BMI, and waist circumference. Positive results were shown that adults age 19-50 years of age and 51+ who consumed an average of 0.63 and 0.77 servings of whole grains per day showed a lower percentage of overweight/obesity, smaller waist circumference, and lower BMI. This supports our choice to use wheat flour instead of all purpose flour. These three articles gave us good insight as to why the inclusion of fiber was important in our product.

## **Materials and Methods**

The first week the independent variables were flavors of frosting for the carrot cake balls. One was to be white chocolate and the other we had cream cheese. The dependent variables were to use white chocolate to coat half of the recipe and cream cheese to coat the other half. Unfortunately we did not have enough time to freeze the balls and they fell apart when trying to coat. They were also too sweet since the middle of the balls was our cake mixed with frosting, and then they were also coated with more frosting or our melted chocolate. We are going to continue from this week on making mini carrot cupcakes, which are a healthier choice since they are slightly smaller than the cake balls and will have less frosting.

The second week our independent variables were all purpose flour and whole-wheat flour. The dependent variables were choosing to make half of the recipe with all-purpose flour and the other half with whole-wheat flour. We chose to try whole-wheat flour so that we would be closer to meeting our claim of a good source of fiber.

The third week our independent variables were oil vs. oil and applesauce. The dependent variables were to use the whole amount of oil for sample one and use half the amount of oil, and replace the other half with homemade applesauce for sample two. We chose to try to cut some of the oil to slowly make the cupcakes a little healthier and also to reduce some of the oily look to the cupcakes.

The fourth week our independent variables were oil and applesauce vs. applesauce. The dependent variables were using the half oil half applesauce from the week before for sample one, and then omit all oil and only use applesauce for sample two. We did this to further reduce the fat content of the cupcakes.

The fifth week our independent variables were the texture of the cupcakes. The dependent variables were making sample one as we had the week before, and making sample two with blended pineapple and applesauce. We chose to alter the texture because the cupcakes are so small and the chunks of pineapple are so large that they can overpower the flavor in some bites.

The sixth week our independent variables were the frosting. So far we had been using store bought in all of our prototypes to inject inside, so we wanted to use this last week to test the difference between store bought and homemade frosting. Dependent

variables we used half of the cupcakes for one frosting and half for the other. We chose to do this to improve the overall flavor and healthfulness of the cupcakes. Even though frosting is still loaded with fat and sugar, homemade has much less preservatives and other added chemicals that the store bough variety has.

Ingredient	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
AP Flour	x	-	-	-	-	-
WholeWheat Flour	-	x	X	X	X	X
Cinnamon	x	x	X	X	X	X
Salt	x	x	X	X	X	X
Baking Soda	x	x	X	X	X	X
Egg	x	x	x	X	X	X
Buttermilk	x	x	X	X	X	X
Vegetable Oil	X	X	X	X (half the amount)	X(half the amount)	-
Vanilla	x	x	x	X	X	X
Sugar	x	x	X	X	X	X
Brown Sugar	x	x	X	X	X	X
Shredded Coconut	x	x	X	X	X	X
Crushed	x	x	x	X	X(blended)	X(blended)

Pineapple					)	)
Grated Carrots	x	x	X	X	X	X
Chopped Walnuts	x	x	x	x	x	x
Golden Delicious Apple	-	-	-	X(other half amount from oil)	X(other half from oil and blended)	X(amount from oil and blended)

For instrumental methods we chose to test the wetability, we wanted to see how much moisture our cakes could hold. For descriptive analysis each week we looked for comparisons in flavor, aroma, and texture for each sample. In the benchmark testing each week, ourselves and unit one would rank the two samples on scales for sweetness, apple flavor, nutty, etc.

For consumer testing we made our final prototype with the whole-wheat flour, no oil, added applesauce, and homemade cream cheese frosting. We chose to only use one sample because we did not want the consumers to compare our carrot cake to something less healthy, we wanted them to want to try something healthy but delicious. We allowed the first 39 consumers to taste our sample of one mini cupcake. They were provided with a score sheet and pencil, a napkin, and rinse water. For statistical analysis we compiled information from our consumer testing, as well as one of our prototype weeks to run a paired T-test on sweetness of two samples.

**Results:**

After our 6 prototypes of our product we learned along the way what changes needed to be made to reach our goal. Our instrumental test we thought the wetability test was the most relevant to us. We found that our cake held 1.2 grams of water.

	Test 1	Test 2	Average Weight
Dry Weight	1.6 g	1.8 g	1.7 g
Weight in Water	2.8 g	3.0 g	2.9 g

\*(wet weight-initial weight)/initial weight=water retention per gram of sample(2.9g-1.7g)/1.7g = 0.71g = 71% moisture content

In week 10 we had our test panel perform a descriptive analysis on two samples. Here are the results from the analysis in a paired samples chart.

### Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	sweet smell 1	4.50	2	.707	.500
	sweet smell 2	3.00	2	.000	.000
Pair 2	apple smell 1	7.00	1 <sup>a</sup>	.	.
	apple smell 2	3.00	1 <sup>a</sup>	.	.
Pair 3	nutty smell 1	4.00	1 <sup>a</sup>	.	.
	nutty smell 2	6.00	1 <sup>a</sup>	.	.
Pair 4	buttery smell 1	3.00	1 <sup>a</sup>	.	.
	buttery smell 2	5.00	1 <sup>a</sup>	.	.
Pair 5	sweet flavor 1	5.33	3	.577	.333
	sweet flavor 2	3.33	3	.577	.333
Pair 6	wholesome flavor 1	5.00	3	1.000	.577
	wholesome flavor 2	5.67	3	.577	.333
Pair 7	nutty flavor 1	4.00	3	1.732	1.000
	nutty flavor 2	4.67	3	.577	.333
Pair 8	pineapple flavor 1	2.67	3	.577	.333
	pineapple flavor 2	3.00	3	1.000	.577
Pair 9	dry texture 1	2.00	3	1.732	1.000

	dry texture 2	3.00	3	1.000	.577
Pair 10	grainy texture 1	3.67	3	1.155	.667
	grainy texture 2	4.33	3	1.528	.882
Pair 11	moist texture 1	6.00	3	1.732	1.000
	moist texture 2	4.33	3	.577	.333
Pair 12	chunky texture 1	5.33	3	1.155	.667
	chunky texture 2	6.00	3	.000	.000

a. The correlation and t cannot be computed because the sum of caseweights is less than or equal to 1.

Sample one was our control cupcake from the previous week used our whole-wheat, applesauce recipe and store-bought icing, in sample two we made the same recipe but made our own homemade icing to inject. From this chart we gathered that sample 2 was the product we wanted. Sample two became our final prototype because it was the product we were looking for; wholesome taste, not as sweet, and a fruity and nutty flavor. We wanted a product that was sweet but the consumer could taste the fruit and the wholesome homemade taste we were going for.

In the final week making our product we had random consumers test our product where they tasted our product and filled out our score sheet with the three categories we wanted to test.

### Statistics

		Appearance	Sweetness	Overall
N	Valid	39	39	39
	Missing	0	0	0
	Mean	6.00	5.10	6.77
	Median	6.00	5.00	7.00
	Mode	5	5	7
	Std. Deviation	2.417	1.188	1.912

This chart shows the mean of those three categories we wanted to test. The appearance was slightly above average. The sweetness was at average. Overall the consumers thought it was slightly better than average. We wanted to create a product that looked appealing and was the perfect amount of sweetness and overall satisfaction with Mini Carrot Cupcakes so they wouldn't want to grab a candy bar.

### Appearance

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 0	1	2.6	2.6	2.6
1	2	5.1	5.1	7.7
3	3	7.7	7.7	15.4
4	2	5.1	5.1	20.5
5	9	23.1	23.1	43.6
6	3	7.7	7.7	51.3
7	8	20.5	20.5	71.8
8	3	7.7	7.7	79.5
9	8	20.5	20.5	100.0
Total	39	100.0	100.0	

In this Appearance chart it is easy to see the frequency of the points chosen. Most of the scores are above 5. This shows us that the appearance impressed the consumer.

### Sweetness

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 0	1	2.6	2.6	2.6
3	1	2.6	2.6	5.1
4	2	5.1	5.1	10.3

5	26	66.7	66.7	76.9
6	6	15.4	15.4	92.3
7	2	5.1	5.1	97.4
8	1	2.6	2.6	100.0
Total	39	100.0	100.0	

In creating this product we were curious if the sweetness was too great for the type of product we were trying to create. This frequency chart does indicate that we were only slightly sweeter than average. We believe that this is just perfect because this product is marketed for those with a sweet tooth.

### Overall

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 0	1	2.6	2.6	2.6
4	3	7.7	7.7	10.3
5	5	12.8	12.8	23.1
6	6	15.4	15.4	38.5
7	9	23.1	23.1	61.5
8	7	17.9	17.9	79.5
9	8	20.5	20.5	100.0
Total	39	100.0	100.0	

Overall our product was above average, this also lets us know that we exceeded the consumers expectations. 35 out of the 39 consumers liked our overall product.

# Nutrition Facts

Serving Size (101g)  
Servings Per Container

**Amount Per Serving**

**Calories** 220    **Calories from Fat** 70

**% Daily Value\***

**Total Fat** 8g    **12%**

**Saturated Fat** 3.5g    **18%**

    Trans Fat 0g

**Cholesterol** 25mg    **8%**

**Sodium** 280mg    **12%**

**Total Carbohydrate** 37g    **12%**

    Dietary Fiber 3g    **12%**

    Sugars 27g

**Protein** 4g

Vitamin A 25%    •    Vitamin C 4%

Calcium 2%    •    Iron 4%

\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

		Calories:	2,000	2,500
Total Fat	Less than	65g	80g	
Saturated Fat	Less than	20g	25g	
Cholesterol	Less than	300mg	300mg	
Sodium	Less than	2,400mg	2,400mg	
Total Carbohydrate		300g	375g	
Dietary Fiber		25g	30g	

Calories per gram:

Fat 9    •    Carbohydrate 4    •    Protein 4

# Nutrition Facts

Serving Size 50 G

Servings Per Container 12

**Amount Per Serving**

**Calories** 200    **Calories from Fat** 35

**% Daily Value\***

**Total Fat** 4 G    **6**    **15**

**Saturated Fat** 1.5 G    **8**    **12**

    Trans Fat 0 G

    Monounsaturated Fat 1 G

**Cholesterol** 0 Mg    **0**    **18**

**Sodium** 260 Mg    **11**    **12**

**Total Carbohydrate** 39 G    **13**    **13**

    Dietary Fiber 1 G    **4**    **4**

    Sugars 23 G

**Protein** 2 G

Vitamin A 20    •    Vitamin C 6

Calcium 2    •    Iron 4

\*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

		Calories:	2,000	2,500
Total Fat	Less than	65g	80g	
Saturated Fat	Less than	20g	25g	
Cholesterol	Less than	300mg	300mg	
Sodium	Less than	2,400mg	2,400mg	
Total Carbohydrate		300g	375g	
Dietary Fiber		25g	30g	

Calories per gram:

Fat 9    •    Carbohydrate 4    •    Protein 4

The label on the left is our Nutrition Facts Label for a full package of our Mini Carrot Cupcakes, the label on the left is from a Duncan Hines Carrot Cake package. Note that our weight is twice as much as the Duncan Hines Label. Our calories, sodium, and sugar content is less, our fiber content is more in our product. Clearly our product is a healthier option. We have created a product that is better for you and probably better tasting.

### **Discussion:**

As a team we are very satisfied with the product we have come up with. We were looking to create a product for consumers with a sweet tooth but looking for a healthier option without compromising taste. We came up with Mini Carrot Cupcakes. We changed one aspect every week to get our final product. From the first prototype to the final product it is a completely different product. Looking at our consumer tests we feel confident in that we reached our goal. Also looking at our descriptive analysis we can also feel confident that we reached our goal in accomplishing a wholesome product as we planned to in the first couple of weeks.

### **Conclusion and Recommendations**

In the end we found that majority of the people who sampled our carrot cake mini cupcakes enjoyed them. 35:39 stated that the overall flavor was good and liked it. We found that substituting whole wheat flour for all-purpose flour gives the carrot cake more of a nutty flavor. Also, this substitution brought a more nutritional value to the cupcakes by adding whole grain versus grain that has been striped and refined. Another big change that was made to the cupcakes for both nutrient value and for feeling/touch is the substitution of applesauce for the oil. The oil was omitted for two reasons: one, it was leaving the cupcakes greasy and two, applesauce is more nutritious than oil. Our recipe originally used vegetable oil which contains a good amount of saturated fat and stimulates the liver to produce more cholesterol. Omitting the oil from the recipe did not show any difference in the consumers' preference and in fact the cupcake made with only applesauce was preferred over the cupcake made with the oil. The cupcakes were also found to be less dense and fluffier when only applesauce is used.

A discovery we made was the texture of the cupcakes. The pineapple that was added was crushed pineapple and the applesauce we added was homemade applesauce that we made using a golden delicious apple. Although the pineapple was crushed and the apple was mashed, some cupcakes would have chunks of one or the other which would then overpower the flavor of the whole cupcake. When a large chunk was detected, the person sampling would taste only that chunk of say pineapple and not taste the carrot, cinnamon, cream cheese icing, walnuts, or any other ingredient. What we did to solve this dilemma was that after the crushed pineapple had been drained it was placed in the blender and pureed. This was also done to the cooked apple. Once both were pureed there were not any more chunks and the pineapple and the apple no longer overpowered the cupcakes with flavor but rather accented it.



An example of how the Carrot Cake Mini Cupcakes would be sold. Hostess packages their product in counts of 3 wrapped in plastic then packaged into a box. The Carrot Cake Mini Cupcakes would be packaged in 4 counts and sealed in the plastic wrap with no box. They will be sold in counts of 4, 4 equaling 1 serving. They would be sold at convenience and grocery stores and sold as whole wheat and a good source of fiber product.

Further recommendations that would be made to this product would be to see how the product changes once it has been wrapped. Seeing the quality of the cupcake after packaging will have either a negative effect or positive effect on the quality, taste, and appearance of the cupcake. The packaging could create moisture on the inside, could produce mold on the product or could dry out the product. Also, the shelf life of the product would have to also be determined.

Changes that would be made if the project were to be repeated are to try making different lines with different ingredients and or added ingredients to produce differing flavors and nutrition content. Some additions would be adding all-bran bran buds to the batter or adding benefiber. Adding bran and or adding benefiber to the batter would add

more fiber to the cupcake. For different flavors shredded zucchini, raisins, or toasted pecans could be added. To cut back on the fat content of the cupcakes, taking out the coconut will lower the amount. Also to lower the amount of fat and thus lowering calories, an alternative to the buttermilk would be to make buttermilk by adding 1 tablespoon of lemon juice to about 1 cup of milk. Another line of carrot cake mini cupcakes could be making them to be sugar free and gluten free.

# Masc Carrot Cake Mini Cupcakes

A delicious, sweet and wholesome treat

**Good source  
of fiber**

**Made with fresh  
carrots and apple**



Ingredients: Pineapple, Wheat flour, Applesauce, Buttermilk, Brown sugar, Sugar, Carrot, Coconut, Egg, Cream cheese, Butter, Confectioner sugar, Walnut, Baking soda, Vanilla extract, Salt, Cinnamon  
\*Allergens: wheat, dairy, egg, walnut (tree nuts) NET WT 101g