

Nutrient-Packed Muffins

Project 3: Manuscript

Product Development

Nutrition 405-06 Group 07

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Product Description and Use

Our product is a muffin, which is part of the category of baked goods. It can be eaten for breakfast due to the healthy nutritional composition, or it can be eaten as a snack or treat in replacement of a typical high-fat or high-sugar baked item. It is easy to bring places on the go since it does not require refrigeration or reheating. This muffin is intended to provide a healthy treat for a large reach of the population. With the increased popularity in diets such as vegan or gluten-free, due to personal preference or health conditions, our muffin is a product they can enjoy as a snack or dessert. It is packed with quality ingredients coming from organic, whole foods, providing sources of vitamins, minerals, fiber, protein, and antioxidants. The main ingredients are garbanzo bean flour, almond flour, apple sauce, and shredded zucchini, making it a desirable chewy and moist texture. Our product can appeal to all ages and humans with the ability to eat solid foods. It is great for children as an alternative to popular processed muffins high in added sugar and fat, to decrease childhood obesity. As for adults, according to the Centers for Disease Control and Prevention (CDC) report of 2021, 6 in 10 American adults have one or more chronic diseases (diabetes, heart/cardiovascular disease, cancer, stroke, etc.), and therefore improving dietary habits can improve these conditions or help reduce one's risk (Chronic Disease Center, 2021).

Product Formulation and Ingredients

Having the best product possible while also appealing to our consumers requires trial and error of ingredients. When trying to formulate the “perfect” muffin, we made sure to stand by our mission of creating a muffin low in sugar, fat, and processed ingredients without sacrificing taste or texture. A base recipe was formulated with commonly used ingredients, such as sugar, eggs, almond flour, and butter. When conducting trials, one ingredient was eliminated at a time until

the muffin was deemed “perfect.” This helps us decide if the ingredient was a good substitute or not without creating confusion on which specific ingredient it was, which may happen when too many ingredients are changed at once. The ingredient swaps consisted of flax-egg in place of egg, applesauce in place of butter, and monk fruit extract in place of cane sugar (*see Table I*). After three trials, the final recipe for our muffin was determined (*see Table II*).

Base Recipe

The base recipe for our muffins included: $\frac{1}{3}$ cup water, 2 whole eggs, $\frac{3}{8}$ cup almond meal, $\frac{3}{8}$ cup almond flour, $\frac{3}{4}$ cup garbanzo bean flour, 2 cups cane sugar, 2 teaspoon baking powder, $\frac{1}{4}$ tablespoon baking soda, $\frac{1}{2}$ cup shredded zucchini, $\frac{1}{4}$ cup golden berries, 1 pinch salt, $\frac{3}{4}$ cup almond milk, 1 cup butter, and $\frac{1}{2}$ tablespoon of vanilla extract. Although this batch was acceptable taste-wise, it did not fit our goal of a heart-healthy vegan muffin. Having eggs in the recipe contradicted our goal of a vegan muffin, so we decided that would be one of the first changes to our recipe. Having one cup of sugar and one cup of butter were also changes that needed to be adjusted or swapped for in this recipe.

Trial 1

For Trial 1, our first ingredient to be changed were the eggs. To be considered vegan or vegetarian, we would have to omit them. Lecithin, found in egg yolks, is a natural emulsifying agent, which is where one end of the molecule attracts water, and the other end is drawn to fat. This helps keep fat and water (or other liquids) from separating (Brown, 2019, p. 241). Similarly, a flaxseed-water mixture works in the same manner. Flaxseed gel can be utilized for emulsion stability. A substitute for one egg would be one tablespoon of flaxseed with three tablespoons of water and cause baked goods to be slightly gummier and chewier than those baked with eggs (Kaijla, 2015). We swapped the two eggs with two tablespoons of ground flaxseeds and

proceeded to bake. Once finished, we tasted the batch of muffins and decided that the texture of our muffins wasn't that different from the base recipe with whole eggs.

Trial 2

Trial 2 focused on butter as the ingredient to remove. Rather than decreasing the amount of butter in our recipe, we decided to find a substitution for heart-healthy reasons and because butter is considered dairy, which is not vegan-friendly. Butter contains a high percentage of saturated fat, which we wanted to stray from for our muffins. Butter is responsible for the desirable mouthfeel of baked goods and flakiness in pastry. It decreases shelf-life by decreasing moisture loss and slowing the staling of starches. Other properties of butter include aeration of dough, emulsification, and flavor extension (Brown, 2019, p. 441). Adding applesauce to baked goods helps achieve a similar effect. Applesauce contains a polysaccharide known as pectin. Pectin binds with water, swells, and mimics some of the texture, mouthfeel, and opacity of fat (Brown, 2019, p. 441). Since applesauce contains a lot of water, it is best to reduce the amount of applesauce in a recipe to $\frac{1}{3}$ of the amount of butter. Once Trial 2's batch of muffins were complete, we did a taste test and the muffin's texture came out like our base recipe, which is what we had hoped.

Trial 3

With the applesauce also adding to the sweetness of our muffin, the goal of Trial 3 was to find a swap for the two cups of sugar in our recipe. Instead of adding two cups of sugar to our muffins we investigated non-nutritive sweeteners. A non-nutritive sweetener, also known as artificial sweeteners or sugar substitutes, contain no or few calories and nutrients. Non-nutritive sweeteners have a higher sweetness intensity compared to sugar, so a smaller amount is needed when used. We decided to use monk fruit extract as our non-nutritive sweetener and is also FDA

approved. Monk fruit extract has a distinct aftertaste, but with applesauce and golden berries in our recipe, we decided to continue with this substitute. One possible problem that may arise is the rejection of the muffin's taste by our consumers, but some studies have shown that health-conscious individuals preferred non-nutritive sweeteners over cane sugar (Li, 2015). For Trial 3, we swapped two cups of sugar for a half-cup of monk fruit extract. Once finished, the muffins were tasted and although the muffins had a slightly different taste without the cane sugar, the overall taste of the muffin wasn't unpleasant since it was masked by the sweetness of the applesauce and goldenberries.

Final Recipe

After completing three trials, the final recipe of our muffins was determined. Eggs were swapped for a “*flax-egg*” mixture, butter for applesauce, and cane sugar for monk fruit extract. The rest of the remaining ingredients remain the same as the base recipe. By removing the eggs and butter, our muffins are now considered vegan/vegetarian. Substituting the butter for applesauce significantly decreased the number of calories and saturated fats in our product and mimicked many of the properties of fats. Lastly, by swapping the cane sugar for monk fruit extract, calories were reduced, and the total amount of sugar was reduced. The final batch of muffins were not the same as the base recipe, but the final muffins have our approval for taste, texture, and ingredient quality. A standardized recipe was created for an exact recipe for either a 12 or 24 batch of muffins (*see Appendix A*).

Table I: Base recipe for a batch of muffins followed by three trials. Ingredients highlighted in red are the ingredient of focus for a swap or adjustment.

<u>Base Recipe</u>	<u>Trial 1</u>	<u>Trial 2</u>	<u>Trial 3</u>
1/3 c. Water	1/3 c. Water	1/3 c. Water	1/3 c. Water
2 Whole Eggs	2 tbsp. Ground Flaxseeds	2 tbsp. Ground Flaxseeds	2 tbsp. Ground Flaxseeds
3/8 c. Almond Meal	3/8 c. Almond Meal	3/8 c. Almond Meal	3/8 c. Almond Meal
3/8 c. Almond Flour	3/8 c. Almond Flour	3/8 c. Almond Flour	3/8 c. Almond Flour
3/4 c. Garbanzo Bean Flour	3/4 c. Garbanzo Bean Flour	3/4 c. Garbanzo Bean Flour	3/4 c. Garbanzo Bean Flour
2 c. Sugar	2 c. Sugar	2 c. Sugar	1/2 c. Monk Fruit Extract
2 tsp. Baking Powder	2 tsp. Baking Powder	2 tsp. Baking Powder	2 tsp. Baking Powder
1/4 tsp. Baking Soda	1/4 tsp. Baking Soda	1/4 tsp. Baking Soda	1/4 tsp. Baking Soda
1/2 c. Shredded Zucchini	1/2 c. Shredded Zucchini	1/2 c. Shredded Zucchini	1/2 c. Shredded Zucchini
1/4 c. Golden Berries	1/4 c. Golden Berries	1/4 c. Golden Berries	1/4 c. Golden Berries
1 pinch Salt	1 pinch Salt	1 pinch Salt	1 pinch Salt
3/4 c. Almond Milk	3/4 c. Almond Milk	3/4 c. Almond Milk	3/4 c. Almond Milk
1 c. Butter	1 c. Butter	1/3 c. Applesauce	1/3 c. Applesauce
1/2 tbsp. Vanilla Extract	1/2 tbsp. Vanilla Extract	1/2 tbsp. Vanilla Extract	1/2 tbsp. Vanilla Extract

Table II: Final recipe for a batch of muffins. Contains recipe for “*flax-egg*” mixture and muffin mixture.

<u>Final Recipe - Nutrient-Packed Muffins</u>	
Flax Egg Mixture: <ul style="list-style-type: none"> ● ⅓ cup water ● 2 tablespoons ground flaxseeds 	
Muffin: <ul style="list-style-type: none"> ● ⅜ cup almond meal ● ⅜ cup almond flour ● ¾ cup garbanzo bean flour ● ½ cup monk fruit extract ● 2 teaspoons baking powder ● ¼ teaspoon baking soda ● ½ cup shredded zucchini ● ¼ cup goldenberries ● 1 pinch salt ● ¾ cup almond milk ● ⅓ cup applesauce ● ½ tablespoon vanilla extract 	

Market Potential

With an increased awareness of health concerns relating to chronic diseases associated with poor dietary habits, the market of healthier alternatives to consumer’s favorite treats is essential. There is a reasonable amount of baked goods with reduced sugar, low-fat, less refined grains, etc., but our product is made to suit these improved dietary needs, as well as targeting consumers with specific dietary restrictions. A comparison chart of our competitors was generated and unlike similar competitors on the market, such as *Veggies Made Great*, *Bobo’s*, *Zen Bakery*, and *Flax4Life*, we appear to reach a larger portion of the population (*see Appendix B*). It can be hard to find a delicious baked food that is Vegan, gluten-free, grain-free, and

organic all in one. Whether the consumer has a specific dietary restriction for personal preference or due to a health condition, we made a muffin that they can enjoy. The number of people eating “plant-based diets” was at 290,000 back in 2004. A new study by Ipsos Retail Performance has revealed that the number of Americans following plant-based diets is up about 9.4 million over the last 15 years to over 9.7 million in total (Danziger, 2020). This growing popularity in plant-based diets shows the increasing demand for more products like ours on the market. Not everyone is a competent baker or has the time to spend in a kitchen preparing muffins that are suitable to their needs, so we provided a product, so they don’t have to miss out on one of their favorite foods. It also appeals to consumers who are looking to improve the quality of their diet by increasing consumption of fruits, vegetables, nuts, and legumes, all of which are included in our muffin. With almonds being one of the main ingredients as the “flour”, they are a low-glycemic food, making our product an ideal choice for people with diabetes who are trying to control their blood sugar.

Sensory/Consumer Survey

To create the best possible product for consumers, it is necessary to conduct a survey to get a better understanding of our customers. Our survey consists of three sections. A description of our product with ingredients, a demographics section, and a product survey, which includes attribute ranking, product preferences, and a few specific questions relating to other products on the market (*see Appendix C*). We wanted to survey individuals to gain information about their dietary habits as well as preferred packaging methods and overall desirability when choosing between items in the grocery store. Demographics of age and gender were included to categorize data and see if there were any trends associated with age and gender to the other questions in the survey. We asked a question about their diet to see which diet is popular in trend now. With our

diet being vegan, we would also like to know if consumers in non-vegan diets are likely to consume our muffins. How often they consume baked goods will show us how in demand this category of food is. The question about reading nutrition labels will indicate how careful or aware the individual is about consuming foods with specific ingredients, especially if they have dietary restrictions. Rating the importance of packaging, freshness, shelf-life, texture, fresh ingredients, and sweetness will help us determine which area to focus on with the development of our muffin product. The question about individual or multi-packaged muffins will help decide the type of packaging method we should use. Lastly, the question about their favorite brand of muffin will help indicate our competition and we can focus on making our muffin better than those and more appealing.

Regulatory Stipulations

Part of product development includes following regulatory stipulations. This includes following Food and Drug Administration (FDA) and United States Department of Agriculture (USDA) standards. These set the standards of what we can and cannot do when marketing our product. Certifications for health claims such as gluten free, organic, vegan, and grain-free must follow guidelines to be labeled on our product. We also plan to follow the American Heart Association's (AHA) guidelines for creating a healthy lifestyle to decrease and raise awareness of heart disease and stroke.

Food and Drug Administration (FDA) Standards

It is the Food and Drug Administration's (FDA) responsibility to ensure foods that are sold in the U.S. are properly labeled, wholesome, and safe. Before offering foods for distribution, one of our priorities is to be familiar with laws and regulations to minimize legal action. The Nutrition Labeling and Education Act (NLEA) requires that most foods contain nutrition

labeling and requires that food labels contain nutrient content claims and comply with specific requirements (US Food and Drug Administration, 2013). The FDA labeling guide provides important information, such as where label statements should be placed, how to label, and what to include. Other labeling guidelines include net quantity statements, font size of labels, ingredients list, and food allergen labeling. Ingredient lists must list ingredients in descending order of predominance by weight. When listing foods in the ingredient list the common name should be used.

Food Allergen Labeling and Consumer Protection Act (FALCPA)

Under the FDA guidelines, the Food Allergen Labeling and Consumer Protection Act (FALCPA) requires labels for foods containing one or more of the eight major foods or food groups (US Food and Drug Administration, 2018). The eight major foods or food groups include milk, eggs, fish, crustacean shellfish, tree nuts, peanuts, wheat, soybeans. These foods or food groups account for 90% of food allergies.

According to the FDA guidelines, in the case of tree nuts, the specific type of nut must be declared. With our product using almond meal/flour and almond milk as an ingredient, this guideline must be closely followed and stated on the label. Since our muffins use a flax egg mixture in place of egg, we do not need to worry about that as an allergen in our product.

Gluten Free

Our product is Certified gluten-free. The gluten-free labeling regulation gives consumers a standardized tool for managing their health and dietary intake — especially those with celiac disease, an auto-immune reaction to eating gluten, a protein found in wheat, barley, and rye. The rule specifies that any foods that carry the label “gluten-free,” “no gluten,” “free of gluten,” or “without gluten” must contain less than 20 parts per million (ppm) of gluten. This level is the

lowest that can be reliably detected in foods using scientifically validated analytical methods.

The rule also permits labeling a food “gluten-free,” if the food does not contain:

- An ingredient that is any type of wheat, rye, barley, or crossbreeds of these grains,
- An ingredient derived from these grains that has not been processed to remove gluten, or,
- An ingredient derived from these grains that has been processed to remove gluten, but results in the food containing more than 20 ppm of gluten. (Center for Food Safety and Applied Nutrition, 2021)

United States Department of Agriculture (USDA) Standards

The U.S. Department of Agriculture’s (USDA) Agricultural Marketing Service (AMS) provides American agriculture with valuable tools such as grading, certification, and verification. This guarantees the quality of American food and adds value to products (USDA, 2017). Labels under the AMS include meat, fruit, vegetable, and specialty crop grades. The USDA label assures that the products that consumers buy have gone through a rigorous review process by highly skilled graders and auditors that follow the official grade standards and process standards developed, maintained, and interpreted by USDA’s AMS. One certification under the AMS includes the organic seal, which we will be incorporating in our muffins.

Organic

Our product is organic and does not contain any artificial ingredients or preservatives. When packaged products indicate they are “made with organic (specific ingredient or food group),” this means they contain at least 70% organically produced ingredients. The remaining non-organic ingredients are produced without using prohibited practices (genetic engineering, etc.) but can include substances that would not otherwise be allowed in 100% organic products. Products labeled “organic” must contain at least 95% organically produced ingredients

(excluding water and salt). Products meeting either of these labeling requirements may display these phrases, as well as the percentage of organic content, on the product's principal display panel (Organic Labeling Requirements, 2021).

When it comes to processed, multi-ingredient foods, the USDA organic standards specify additional considerations. Regulations prohibit organically processed foods from containing artificial preservatives, colors, or flavors and require that their ingredients are organic, with some minor exceptions. For example, processed organic foods may contain some approved non-agricultural ingredients, like enzymes in yogurt, pectin in fruit jams, or baking soda in baked goods. Produce can be called organic if it's certified to have grown on soil that had no prohibited substances applied for three years prior to harvest. Prohibited substances include most synthetic fertilizers and pesticides. In instances when a grower must use a synthetic substance to achieve a specific purpose, the substance must first be approved according to criteria that examine its effects on human health and the environment (McEvoy et al., 2019).

USDA requirements for products that are labeled with the term "organic" are separate from the laws that FDA enforces. Food products that are ordinarily under FDA's jurisdiction and labeled with organic claims must comply with both USDA NOP regulations for the organic claim and FDA regulations for food labeling and safety. FDA does not regulate the use of the term "organic" on food labels. The National Organic Program (NOP) is the federal regulatory framework governing organically produced crops and livestock. The U.S. Department of Agriculture (USDA) oversees the program and enforces the NOP regulations and standards. They regulate use of the term "organic" on food labels.

Vegan Certification

The vegan certified logo is a trademark for products that do not contain animal products or byproducts and have not been tested on animals (Vegan, 2017). This includes, but not limited to, meats, fish, eggs or egg products, honey or honeybee products, and insect or insect products. Having a vegan certification ensures our product contains these four main components:

- No animal products
- No animal testing
- No animal GMO or contain no known animal-derived GMOs or genes
- Provide verification that all conditions have been met

Our equipment used in production of our muffins must be sanitized if using non-vegan ingredients to ensure no cross-contamination occurs. This helps customers trust that the product they are purchasing is vegan, so they do not have to keep referring to the ingredients list. Having the vegan certification logo on our product helps bring awareness to the growing vegan market.

Grain-Free Certification

The grain-free certification offered by the Paleo Foundation ensures that our product does not contain grains or gluten (The Paleo Foundation, 2020). The FDA defines gluten-free as a product containing less than 20 parts per million (ppm) of gluten. However, the Paleo Foundation requires that the product tests 10 ppm of gluten or gliadin. Only those who have entered a contractual agreement with the Paleo Foundation are permitted to use the Grain-Free label on products.

Having this certification is important to the success of our product because a grain free diet may be beneficial to people with digestive disorders and metabolic syndromes. From a marketing standpoint, having a grain-free label may help increase sales. According to a Nielson

study, over a 52-week period, products with a “Grain-free” label went up with more than 75% in sales (Nielson, 2016). With the market being saturated with many “healthy” baked goods, this may set us apart from our competitors.

The American Heart Association (AHA)

The American Association is a non-profit organization that aims to fight against and raise awareness of heart disease and stroke through helping people achieve a heart-healthy lifestyle. Our product strives to promote the sane philosophy endowed through the AHA.

One of the main goals when choosing our product ingredients was to limit the amount of sugar and include a natural sweetener, such as monk fruit extract. The AHA labels low-calorie sweeteners, artificial sweeteners, and non-caloric sweeteners as non-nutritive sweeteners (NNSs). These offer no nutritional benefits but may be lower in calories. The FDA approves the use of monk fruit extract to be a safe NNSs. The AHA recommends limiting added sugars since this leads to weight gain, which in turn, may result in health issues (The American Heart Association, 2018). Besides obesity, too much sugar in one’s diet may lead to an increase in triglyceride levels. An increase in triglyceride levels is a risk factor for heart disease.

Product Cost

To calculate the final price for each muffin, we created a table for the raw food cost of the muffin’s ingredients for a batch of 12 (*see Table III*). We will sell our muffins in individual packages, as well as packs of four. To determine the price per batch of muffins, the wholesale price, percent yield, amount per batch, edible portion, and raw food cost were needed. The edible portion (EP) cost was calculated by converting the wholesale price to the amount needed per batch, followed by multiplying by the percent yield. To calculate for the raw food cost, we converted the wholesale price of each item to the price for one serving. Totals for raw food price

were then added to the end of the table. When choosing which brand of ingredients to use, we tried to use as few suppliers as possible and buy in bulk. Most of our items came from Costco, such as the flaxseeds, almond flour, baking soda, zucchini, salt, almond milk, and applesauce. The rest of the ingredients were not available at Costco, so we had to look elsewhere, while keeping the items at bulk prices. The almond meal, baking powder, and garbanzo bean flour were found at Trader Joe's and Sprouts. Other items, such as monk fruit extract and golden berries were hard to find, so they had to be ordered in bulk from online specialty stores such as iHerb.com and Food to Love. Packaging for individual muffins and four-pack muffins were calculated as well as one-time equipment cost, such as a mixer and baking pans (*see Table IV*).

Table III: Price of each muffin ingredient. Brand, supplier, wholesale price, % yield, amount per batch, EP cost, and raw food cost are listed.

Ingredient	Brand	Supplier	Wholesale Price	% Yield	Amount per Batch (12 muffins)	Edible Portion (EP Cost)	Raw Food Cost
Ground Flaxseeds	Manitou	Costco	\$25.99/10 lbs.	100%	2 tbsp.	\$0.16	\$0.16
Almond Meal	Trader Joes	Trader Joes	\$12.66/lb	100%	$\frac{3}{8}$ c.	\$2.37	\$2.37
Almond Flour	Kirkland	Costco	\$14.79/3lbs	100%	$\frac{3}{8}$ c.	\$0.92	\$0.92
Garbanzo Bean Flour	Bob's Red Mill	Sprouts	\$7.70/16oz	100%	$\frac{3}{4}$ c.	\$2.89	\$2.89
Monk Fruit Extract	Now Foods	iHerb	\$10.07/lb	100%	$\frac{1}{2}$ c.	\$2.52	\$2.52
Baking Powder	Trader Joes	Trader Joes	\$10.73/16oz	100%	2 tsp.	\$0.22	\$0.22
Baking Soda	Arm & Hammer	Costco	\$8.57/13.5lbs	100%	$\frac{1}{4}$ tsp.	\$0.002	\$0.00
Zucchini (Shredded)	Wholesum Harvest	Costco	\$8.70/3.5lbs	100%	$\frac{1}{2}$ c.	\$0.62	\$0.62
Golden Berries	Food to Live	Food to Live	\$45.99/4lbs	100%	$\frac{1}{4}$ c.	\$1.44	\$1.44
Salt	Kirkland	Costco	\$8.32/80oz	100%	1 pinch	\$0.00	\$0.00
Almond Milk	Silk	Costco	\$11.18/5.68L	100%	$\frac{3}{4}$ c.	\$0.37	\$0.37
Apple Sauce	Kirkland	Costco	\$11.06/76.08 fl oz	100%	$\frac{1}{3}$ c.	\$0.39	\$0.39
Vanilla Extract	Kirkland	Costco	\$22.38/16 fl oz	100%	$\frac{1}{2}$ tbsp.	\$0.35	\$0.35
						Raw Food Cost per Batch (12 Muffins)	\$12.25
						Price (1 muffin)	\$1.02
						Price (4 muffins)	\$4.08

Table IV: Equipment and packaging prices. Includes weekly price and one-time pricing for equipment.

Item	Brand	Supplier	Price per Item	Quantity	Total
Packaging (1 Pack)	Web Restaurant Store	Web Restaurant Store	\$27.49 / 200 ct \$0.14 / ea	x2 per week	\$54.98 / week
Packaging (4 Pack)	Web Restaurant Store	Web Restaurant Store	\$38.49 / 150 ct \$0.26 / ea	x5 per week	\$192.45 / week
24 Cup Muffin Pans	Chicago Metallic	Web Restaurant Store	\$41.76	2	\$83.52
6 Qt. Mixer	Kitchen Aid	Kitchen Aid	\$289.99	1	\$289.99
				Weekly Total	\$247.43
				One-Time Total	\$373.51

Packaging and Shelf Life

The shelf life of our product is like the Flax4Life muffins, which hold a 14-day shelf life for best quality. This can be extended if the product is stored in the freezer for 3 months. To preserve freshness of the product, we chose to package our products in plastic since this material can be recycled, in the efforts to reduce waste in the landfills. The clear plastic is also ideal to display the visual aesthetic appeal of the muffin to our consumers. Individual muffins will be packaged in a sealed thin plastic bag, while the 4-pack of muffins will be in a hard plastic box so the muffins can remain intact in their own section of the box without squishing against the others.

Selling price:

Selling price was determined using the factor method pricing approach. With an estimated food cost of 30%, the mark up factor came to 3.3, which was then multiplied by the sum of the raw cost of the muffin and packaging cost. An additional 10% hidden cost was added to the selling price to account for fluctuations in ingredient cost. This entire calculation was done

for the individual muffin and 4-pack of muffins. Odd pricing menu strategy was then applied to the final selling price (ie: price ending in 5, 7 or 9) (*see Table V*).

Table V: Pricing for one and four-pack muffins. Total cost of product, packaging, and a 10% markup were calculated into the final selling price.

Item	Total cost of product + packaging	Selling price with 10% markup	Selling Price
1 Pack Muffin	\$1.16	\$4.21	\$4.25
4-Pack Muffins	\$4.34	\$15.75	\$15.75

Nutrition Label

Nutrition labels will be made for individually wrapped and four-pack muffins. (*see Appendix D*). Each batch of 12 muffins contained one serving. One serving of muffins equaled 114 calories. Total fat content totaled 6.5g (8% daily value) with saturated fat totaling 0.4g (2% daily value). Cholesterol per serving is 0mg (0% daily value). Sodium content is 68mg (3% daily value). Total carbohydrates equaled 15.6g (6% daily value) with dietary fiber being 2.6g (9% daily value). Total sugars equaled 2.4g and protein being 4.1g). Remaining totals are as follows: Vitamin D with 17mcg (87% daily value), calcium with 52mg (4% daily value), iron 1mg (4% daily value), and potassium 104mg (2% daily value). Ingredients will also be included on the packaging of the product in descending order as required by the FDA. The ingredients list will be listed in the following order: Garbanzo Bean Flour, Almond Milk, Shredded Zucchini, Monk Fruit Extract, Almond Meal, Almond Flour, Apple Sauce, Water, Ground Flaxseeds, Vanilla Extract, Baking Powder, Baking Soda, Salt.

Nutrient Profile

Our muffin product is made without refined ingredients, providing wholesome quality ingredients high in nutritional value. Each muffin contains 114 calories, which is ideal for the purpose of this food being a small treat or snack. It is low in fat, only about 6 grams, with sources coming from almonds and flax seed. Almonds provide vitamins and minerals such as vitamin E, magnesium, riboflavin, calcium, and potassium. Flax seeds contain omega-3 fatty acids which help reduce inflammation, and contain vitamins and minerals such as phosphorus, magnesium, manganese, copper, and thiamin. The main “flour” source apart from almond meal is garbanzo bean flour, also known as chickpea flour. Garbanzo beans are a legume which are packed with fiber and protein, also containing B vitamins, iron, magnesium, selenium, and folate. These flour sources are low-glycemic, making it a friendly treat for diabetics controlling their blood sugar. The fiber content of one muffin is 3 grams, which promotes healthy bowel movements, and aids in lowering LDL cholesterol, helping to reduce the risk of heart disease. The protein content is 4 grams, again coming from plant sources: almonds and chickpeas. One muffin contains only 3 grams of sugar, much lower than typical muffins on the market. It is sweetened with monk fruit extract, which is 150 to 200 times sweeter than sugar, and contains zero calories. This again is a friendly treat for someone trying to reduce their daily sugar intake or controlling blood sugar. Carbohydrate content is about 16 grams, lower than other muffins. This is due to the low sugar content and is also made with fruits and vegetables. The muffin is made with shredded zucchini and applesauce, which are low in carbohydrates, but provide moisture and volume, along with the benefits of fruit and vegetables. Apples are a good source of vitamin C, antioxidants, and potassium. Zucchini is also rich in antioxidants and vitamin C, and contains vitamin A, lutein, and zeaxanthin, which is great for vision. Overall, the muffin

provides a good balance of vitamins and minerals essential for the diet, along with protein for amino acid synthesis, and fiber to aid in digestion and satiety.

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Appendices

Appendix A: Standardized recipe for 12 and 24 servings. Contains ingredients, servings, weight, measure, prep/cook time, and instructions.

Nutrient-Packed Muffin

Servings: 12 and 24 Muffins **Serving Size:** 1 Muffin **Prep Time:** 10 Mins **Total Time:** 26 Mins

<u>Ingredient</u>	<u>12 Servings</u>		<u>24 Servings</u>		<u>Instruction</u>
	<u>Weight</u>	<u>Measure</u>	<u>Weight</u>	<u>Measure</u>	
					1. Preheat oven to 375°F/190°C
					2. Line 12-cup muffin pan with liners
Water	2.75 oz	1/3 c.	5.5 oz	2/3 c.	3. In a small bowl, mix flax seeds and water. Set aside for gel to form
Ground Flaxseeds	8.87 g	2 tbsp.	17.75 g	4 tbsp.	
Almond Meal	60 g	3/8 c.	120 g	3/4 c.	4. In mixer, combine flours, monk fruit, baking soda, baking powder, salt, shredded zucchini, almond milk, salt, apple sauce, golden berries, and vanilla extract
Almond Flour	60 g	3/8 c.	120 g	3/4 c.	
Garbanzo bean	116 g	3/4 c.	232 g	1 1/2 c.	
Flour	100 g	1/2 c.	128 g	1 c.	
Monk Fruit	8.87 g	2 tsp.	17.74 g	4 tsp.	
Extract	1.11 g	1/4 tsp.	2.22 g	1/2 tsp.	
Baking Powder	64 g	1/2 c.	155 g	1 c.	
Baking Soda	32 g	1/4 c.	64 g	1/2 c.	
Shredded	1 Pinch	1 pinch	2 pinch	2 pinch	
Zucchini	9 oz	3/4 c.	18 oz	1 1/2 c.	
Golden Berries	4 oz	1/3 c.	8 oz	2/3 c.	
Salt	2.22 g	1/2 tbsp.	4.44 g	1/2 tbsp.	
Almond Milk					
Applesauce					
Vanilla Extract					
					5. Mix on slow speed until all ingredients are combined
					6. Evenly pour batter into muffin cups. Each muffin cup will be just over ½ full
					7. Bake in oven for 16-18 minutes, until a toothpick inserted comes out clean
					8. Remove from oven
					9. Allow to cool in muffin pan for about 10 minutes, then transfer to wire rack
					10. Serve warm or room temperature

Appendix B: Supermarket Safari and comparative product analysis.

Competitor's Brand Name/Price	Product Forms: Fresh, Processed, Dried, Freeze, Canned, etc.	Packaging and Sizes: Box, Glass, Pouch, etc.	Flavors or Varieties	Main Ingredient	Website
Veggies Made Great / 6ct (12oz) Muffins for \$4.99	Frozen	Box: 6 muffin box or Costco 20 pack box	Blueberry, Double Chocolate, Apple	Vegetables (Mainly zucchini) and Rolled oats	https://www.veggiesmadegreat.com/muffins
Bobo's / 5ct x 1.3oz (6.5oz) Muffins for \$4.70	Individually Packaged - Processed	Box: 5ct (6.5oz total) muffins	Chocolate Chip, Brownie, PB&J, Apple Pie, Peanut Butter Chocolate Chip, Lemon Poppyseed, Strawberry, Coconut	Organic Rolled Oats and fruits (depends on flavor of muffin)	https://eatbobos.com
Zen Bakery / 4ct (19oz) Muffins for \$6.95	Fresh (Packaged)	Plastic box of 4ct muffins (19oz total)	Apple Bran, Apple Cranberry Bran, Banana Bran, Blueberry Bran, Blueberry Raspberry Oat Bran, Blueberry Cranberry Oat, Carrot Cake, Blueberry Oat, Banana Nut, Pumpkin	[varies] <u>Bran Muffins:</u> water, white grape juice, wheat bran <u>Oat Bran Muffins:</u> rolled oats <u>Others:</u> whole wheat flour	https://www.zenbakery.com
Flax4Life / 4ct (14oz) Muffins for \$5.50	Fresh (Packaged) 14-day shelf life	Plastic box of 4 ct (14oz total), or single plastic pouch for 1 muffin	Apple Cinnamon, Blueberry, Carrot Raisin, Chocolate Chip, Cranberry Orange, Hawaiian Pineapple	Dry blend (ground flax seed, evaporated cane sugar, pure oats)	https://flax4life.net

Does one of these competing products stand out? Why or why not?

- ☐ All four muffins advertise oats as the main ingredient, but the Veggies Made Great muffin stands out the most since the main ingredient advertised on the box are vegetables. This appeals to the consumer because they feel they are getting a serving of vegetables in their muffin treat.

Where in the store were most of the products located?

- ☐ Fresh Bakery (Flax4Life and Zen Bakery)
- ☐ Freezer Section (Veggies Made Great)
- ☐ Snack/Granola Bar Aisle (Bobo's)

Were any products easier to find than others? If so, where were they located?

- ☐ The Zen Bakery and Flax4Life muffins are usually harder to find than the other two muffins since they are made fresh and are sometimes out of stock.

Which of the products was most expensive? Why?

- ☐ The Zen Bakery muffins are more expensive. The muffins are large (4oz) compared to the rest, baked fresh, and the company claims to use quality and wholesome ingredients.

Which of the products was least expensive? Why?

- ☐ Bobo's muffins are the least expensive when looking at the box as a whole, but when looking at price per muffin, the Veggies Made Great muffins are least expensive. The reason these may be least expensive when compared to the rest are most likely because of their shelf life, ingredients, and freshness of the product.

Which packaging stood out the most? Why?

- ☐ The Flax4Life muffin's packaging stood out most for us. The muffins looked fresh with an eye-catching logo/font on the front.

What can be done to get our product to stand out from the others?

- ☐ The market is saturated with healthy muffins, so we plan on choosing quality ingredients packed with nutrients. The muffins will be freshly made and packaging will be appealing to the customer. A survey will be given to determine what most people would like to see and what could be changed. From the survey, we will be able to focus on what is lacking in the market.

Write a summary of your findings:

- ☐ Based on these four muffins, the quality of the ingredients stood out the most. The Zen Bakery and Flax4Life muffins are closer to how we plan to have our muffins than the other two. They are both made fresh and claim to have quality ingredients. All the muffins contain sweeteners, so we plan on using monk fruit extract to keep the sugar content low.

Appendix C: Sensory Questionnaire to be given to consumers.

Sensory Questionnaire

Our product is a muffin that is gluten-free, grain-free, vegan, and contains superfoods. Target audience is those who are looking for a healthy baked treat.

Ingredients: *almond meal/flour, garbanzo bean flour, shredded zucchini, apple sauce, flax “egg”, golden berries, almond milk, vanilla extract, monk fruit extract, salt, baking powder, baking soda.*

Directions: CIRCLE all answers

Demographics:

Age: 10-17 18-24 25-39 40-59 60 and over

Gender: Male Female

Diet (circle all that apply): Gluten-free Grain-free Vegetarian Vegan Keto
Low-Carbohydrate Other: _____ None

Survey Questions:

How often do you consume baked goods? (circle one)

Every day 4-6x per week 1-3x per week Never

Do you read nutrition labels when buying products? Yes No

Rate the importance of each: Number 1 through 7 (1 being least important. 7 being most important.)

_____ Packaging
_____ Freshness
_____ Shelf-life
_____ Texture
_____ Fresh ingredients
_____ Sweetness

Do you prefer [individual] or [multi-packaged] muffins? (circle one)

Do you have a favorite brand of muffin? Yes No

If yes, which one(s) and why?

Appendix D: Nutrition Labels: Nutrition labels to be put on each package with an ingredient list that will be put on the product as well. The only difference among labels is a pack of four muffins (left) show four servings per package while individual muffins (right) show one serving per package. Nutrient profiles remain the same.

Four-Pack Muffin Package

Nutrition Facts	
Serving size: 1 Muffin	
Servings: 4	
Amount per serving	
Calories	114
	% Daily Value*
Total Fat 6.4g	8%
Saturated Fat 0.4g	2%
Cholesterol 0mg	0%
Sodium 68mg	3%
Total Carbohydrate 15.6g	6%
Dietary Fiber 2.6g	9%
Total Sugars 3.4g	
Protein 4.1g	
Vitamin D 17mcg	87%
Calcium 52mg	4%
Iron 1mg	4%
Potassium 104mg	2%
*The % Daily Value (DV) tells you how much a nutrient in a food serving contributes to a daily diet. <u>2,000 calorie a day</u> is used for general nutrition advice.	

Individual Muffin Package

Nutrition Facts	
Serving size: 1 Muffin	
Servings: 1	
Amount per serving	
Calories	114
	% Daily Value*
Total Fat 6.4g	8%
Saturated Fat 0.4g	2%
Cholesterol 0mg	0%
Sodium 68mg	3%
Total Carbohydrate 15.6g	6%
Dietary Fiber 2.6g	9%
Total Sugars 3.4g	
Protein 4.1g	
Vitamin D 17mcg	87%
Calcium 52mg	4%
Iron 1mg	4%
Potassium 104mg	2%
*The % Daily Value (DV) tells you how much a nutrient in a food serving contributes to a daily diet. <u>2,000 calorie a day</u> is used for general nutrition advice.	

Ingredients: Garbanzo Bean Flour, Almond Milk, Shredded Zucchini, Monk Fruit Extract, Almond Meal, Almond Flour, Apple Sauce, Water, Ground Flaxseeds, Vanilla Extract, Baking Powder, Baking Soda, Salt