

Red Kidney Beans Substituted for Shortening in Brownies

By
Rebecca Capek

For
Dr. Dowdell
Professor of Food Science

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Table of Contents

1) Introduction	Pg 3
a) Goal.....	Pg 3
b) Variables.....	Pg 3
c) Hypothesis.....	Pg 3
2) Review of Literature	Pg 4 - 9
a) Methodology	Pg 4 - 6
i) Research Design.....	Pg 4
ii) Variables.....	Pg 4
iii) Ingredients.....	Pg 4
iv) Equipment Used.....	Pg 5
v) Procedures.....	Pg 5
vi) Evaluation Plan.....	Pg 5 - 6
vii) Data Analysis Conducted.....	Pg 5 - 6
b) Results	Pg 6 - 7
i) Results.....	Pg 6
ii) Nutritional Analysis.....	Pg 6 - 7
c) Discussion	Pg 7 - 9
3) Conclusion	Pg 10
4) Appendix	Pg 11 - 16
a) Appendix A.....	Pg 11
i) Recipe.....	Pg 11
b) Appendix B.....	Pg 12
i) Evaluation Form.....	Pg 12
c) Appendix C.....	Pg 13 - 16
i) Nutrition Analysis.....	Pg 13 - 16
(1) Control.....	Pg 13
(2) Variation 1.....	Pg 14
(3) Variation 2.....	Pg 15
(4) Variation 3.....	Pg 16
5) Works cited	Pg 17

Introduction

For this project, we decided to look for brownie substitutions. The substitution that caught the group's attention was the substitution of red kidney beans for shortening. We found a research paper that did this; however, we wanted to conduct the experiment ourselves. Our goal for this project was to create an overall accepted brownie that contains less fat and has an increased nutritional value in comparison to a brownie that has not been modified. Our way of substituting the red kidney beans into the brownies was to puree them at specific percentages. The control had no bean puree just a shortening puree, variation one had a 25% bean puree substitution and only 75% shortening. Variation two had 50% bean and shortening puree, while the variation 3 had a 75% bean puree and 25% shortening.

Throughout the course of two months, as a group, we researched different recipes, did a pilot test, as well as a research test. With the results that we received after the pilot and research test, we were able to prove our hypothesis correct, to a certain point. Our hypothesis was that substituting red kidney beans for fat in brownies will not alter the brownies flavor, texture, appearance, and overall acceptability but will increase their nutritional quality. The results showed that the brownies with a 25% bean puree were acceptable over the control brownie. However, the 50% and 75% bean puree results showed that the testers were ok with them, but would not pick them over the control or 25% bean puree.

Review of Literature

Methodology

For this project, a basic recipe was followed, but a puree step was added and minor changes were made. For the research the independent variables included replacing fat in brownies with red kidney beans at three different levels; 25, 50, and 75%. While the dependent variables were volume, texture, flavor, appearance, overall acceptability, and nutritional content, which was all a measurable difference between the four variations.

The ingredients included:

Ingredient	Control (XYZ)	Variation 1 (ABC)	Variation 2 (QRS)	Variation 3 (HIJ)
	Quantity	Quantity	Quantity	Quantity
All Purpose Flour	½ C	½ C	½ C	½ C
Sugar	1 C	1 C	1 C	1 C
Shortening	½ C	1/3 C	¼ C	1/8 c
Red Kidney Beans	-----	1/8 C	¼ C	1/3 C
Salt	¼ tsp	¼ tsp	¼ tsp	¼ tsp
Vanilla	1 tsp	1 tsp	1 tsp.	1 tsp.
Large Eggs	2	2	2	2
Cocoa Powder	1/3 C	1/3 C	1/3 C	1/3 C
Baking Powder	¼ tsp	¼ tsp	¼ tsp	¼ tsp

The equipment used also included:

Item	Total Quantity Needed
8"x8"x1" Baking pans	4 Pans
Non-Stick Spray	1 Can
Measuring Cups	All sizes
Measuring Spoons	All sizes
Mixing bowls	Medium
Wisk	
Spatula	

First, the oven was preheated to 350⁰F. Then the dry ingredients were measured out by weight, and mixed them together in a bowl. After, eggs and vanilla extract were added, and thoroughly mixed. Then the kidney beans were drained and then measured out based on the variation they were used in, and were pureed respectively with the amount of shortening needed and 1 Tbsp of water. The puree was then incorporated with the dry ingredients. After all the ingredients were thoroughly mixed, the batter was poured into a greased pan, and smoothed out to make a consistent level within the pan. Two experimental pans were placed in the oven at a time, and every 10 minutes the pans were switched and rotated clockwise. The pans were allowed to bake until a knife came out clean when inserted into the center. After they were allowed to cool, they were cut into uniform pieces, tested with a pentrometer, and then evaluated by a panel.

The evaluation form the panel used can be found in appendix B. The evaluators were given a plate of brownies, each separated and labeled, and an evaluation form, like the one above. The evaluators, were not people from the class, or people who have studied how to test and evaluate food, they were friends and people from the hallway.

After all of the results were in, the average of each variations numbers were found, which gave us the most acceptable brownie in flavor, texture, appearance, acceptability, as well as tenderness for the test group.

Results

For this project 10 random students test the brownies, and rate them on a scale of 1 to 10, 10 being the best and 1 being the worst. They rated the brownies on flavor, texture, appearance, acceptability, and tenderness. The tenderness was also measured before the testing with a pentrometer. After the results were taken, they were then average together to find the brownie that had the best results of all of the sections. The control (XYZ) had the highest averages in three sections including flavor (8.5), appearance (8.1), and tenderness (8.2). For the other two the highest average was variation 1 (ABC), with an 8.6 texture and 7.7 acceptability. However, the results for variation 2 (QRS) and variation 3 (HIJ) did not differ too far off the highest average.

With the pentrometer readings, the numbers had also very limited variances, ranging from 122 to 129.

	Flavor	Texture	Appearance	Acceptability	Tenderness	Pentrometer
XYZ	8.5	8.4	8.1	7.3	8.2	122
ABC	7.8	8.6	7.7	7.7	7.9	128
QRS	6.9	7.5	6.4	7.3	7.7	129
HIJ	5.8	6.2	7.0	6.6	6.0	127

The nutritional values of the brownies also varied from variation to variation. As more of a bean puree was added and less shortening was used the calories, total fat, and saturated fat decreased. Whereas total carbohydrates, dietary fiber, protein and iron

values increased. As expected the variation 3 (HIJ with 75% bean puree) was the healthiest of all the brownies. It had 184 calories, 4.5g of total fat, 1.5g saturated fat, and 2.2g of dietary fiber.

Nutrition Facts	Control	Variation 1 (XYZ)	Variation 2 (ABC)	Variation 3 (HIJ)
Calories	236	211	203	184
Total Fat	13g	9.2g	7.3g	4.5g
Saturated Fat	4.1g	2.9g	2.3g	1.5g
Cholesterol	47mg	47mg	47mg	47mg
Sodium	81mg	81mg	82mg	82mg
Total Carbohydrates	29.5g	31g	32.6g	33.6g
Dietary Fiber	1.1g	1.5g	1.9g	2.2g
Sugars	22.4g	22.5g	22.5g	22.6g
Protein	2.7g	3.3g	3.8g	4.2g
Vitamin A	1%	1%	1%	1%
Calcium	2%	2%	2%	2%
Vitamin C	0%	0%	0%	1%
Iron	6%	7%	8%	8%

Discussion

“Kidney beans are a very good source of cholesterol-lowering fiber, as are most other beans. In addition to lowering cholesterol, kidney beans' high fiber content prevents blood sugar levels from rising too rapidly after a meal, making these beans an especially good choice for individuals with diabetes, insulin resistance or hypoglycemia. When combined with whole grains such as rice, kidney beans provide virtually fat-free high quality protein.” <http://www.whfoods.com/genpage.php?tname=foodspice&dbid=87>

Red kidney beans are very high in fiber, with just one cup there is 45% of the RDA. This helps stabilize the sugar in the blood system, helps prevent heart disease, and help with bowel movements.

“Kidney beans' contribution to heart health lies not just in their fiber, but in the significant amounts of folate and magnesium these beans supply. Folate helps lower levels of homocysteine, an amino acid that is an intermediate product in an important metabolic process called the methylation cycle. Elevated blood levels of homocysteine are an independent risk factor for heart attack, stroke, or peripheral vascular disease, and are found in between 20-40% of patients with heart disease....Magnesium is Nature's own calcium channel blocker. When there is enough magnesium around, veins and arteries breathe a sigh of relief and relax, which lessens resistance and improves the flow of blood, oxygen and nutrients throughout the body.”

Red kidney beans are also beneficial for iron, and the iron stores in the body, this is because there is a high percentage of iron found in the beans. It's a great substitute for vegetarians to receive their iron. Also found in the beans is thiamin which has been proven to increase memory in a person who intakes enough of it. Manganese is also found in the beans, which helps with energy production and antioxidant defenses. Red kidney beans are also very low saturated fat, no cholesterol, low in sodium, low in sugar, high in phosphorus and potassium.

Shortening on the other hand, is not nutritional at all. It is considered a fat and has no beneficial nutrients. Many look for a substitution for shortening in baking because of this. Shortening is high in saturated fat; however, it has no cholesterol, no sodium and no sugar. Substitutions can also include, but are not limited to, different types

of beans, avocados, and applesauce. Substitutions can be very useful when trying to adapt to a healthier life style. “A diet high in fat has been associated with an increased risk for heart disease, certain cancers, and obesity. Obesity is the primary lifestyle factor associated with hypertension and contributes to insulin resistance. While public concern about fat in foods has declined recently, concern remains high and there is a demand for reduced-fat food products.”

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B758G-4GRH23B-17&_user=696796&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000038958&_version=1&_urlVersion=0&_userid=696796&md5=959b0df1f9841b9d7bf4036a28afe6d3

Conclusion

The hypothesis that was stated in the beginning, which stated that substituting red kidney beans for fat in brownies will not alter the brownies flavor, texture, appearance, and overall acceptability but will increase their nutritional quality. Through research and experiments, we were able to prove that the nutritional quality. However, as the bean puree increased the flavor, texture, appearance, acceptability, and tenderness decreased. But, the amount that they decreased was not enough to cause the panel of testers to never want to eat them again.

Appendix

Appendix A:

Ingredients:

Ingredient	
All Purpose Flour	½ C
Sugar	1 C
Shortening	½ C
Salt	¼ tsp
Vanilla	1 tsp
Large Eggs	2
Cocoa Powder	1/3 C
Baking Powder	¼ tsp

Recipe:

1. Preheat oven at 350F
2. Measure out dry ingredients and mix in a bowl
3. Measure out all other ingredients, mix into dry ingredients
4. Grease baking pans with non-stick spray
5. Pour in batter and smooth out to a consistent level within the pan
6. Bake in oven 25-30 minutes or until knife comes out clean when inserted into brownies.

Appendix B

Evaluation Tool:

	Flavor	Texture	Appearance	Acceptability	Tenderness
XYZ					
ABC					
QRS					
HIJ					

Each observer will receive a plate. On each plate there will be four different types of brownies, each labeled. All of the brownies will be taste tested and be evaluated on the flavor, texture, appearance, acceptability, and tenderness. Brownies will be rated on a scale of 1 to 10; 10 being the best and one being the worst. Tenderness will also be measured with a penetrometer before evaluations are done.

Appendix C

Nutritional Analysis:

Control:

Nutrition Facts	
Serving Size 56 g	
Amount Per Serving	
Calories 236	Calories from Fat 117
% Daily Value*	
Total Fat 13.0g	20%
Saturated Fat 4.1g	20%
Cholesterol 47mg	16%
Sodium 81mg	3%
Total Carbohydrates 29.5g	10%
Dietary Fiber 1.1g	5%
Sugars 22.4g	
Protein 2.7g	
Vitamin A 1%	Vitamin C 0%
Calcium 2%	Iron 6%
Nutrition Grade D-	
* Based on a 2000 calorie diet	

-  **1/2** cup All Purpose Flour ([view](#))
-  **1** cup Sugar ([view](#))
-  **1/2** cup Shortening ([view](#))
-  **1/4** tsp Salt ([view](#))
-  **1** tsp Vanilla ([view](#))
-  **2** large eggs ([view](#))
-  **1/3** cup Cocoa Powder ([view](#))
-  **1/4** tsp Baking Powder ([view](#))

Variation 1:

Nutrition Facts	
Serving Size 54 g	
Amount Per Serving	
Calories 211	Calories from Fat 83
% Daily Value*	
Total Fat 9.2g	14%
Saturated Fat 2.9g	15%
Cholesterol 47mg	16%
Sodium 81mg	3%
Total Carbohydrates 31.0g	10%
Dietary Fiber 1.5g	6%
Sugars 22.5g	
Protein 3.3g	
Vitamin A 1%	Vitamin C 0%
Calcium 2%	Iron 7%
Nutrition Grade D	
* Based on a 2000 calorie diet	

- 1/2 cup All Purpose Flour ([view](#))
- 1 cup Sugar ([view](#))
- 1/3 cup Shortening ([view](#))
- 1/8 cup Red Kidney beans ([view](#))
- 1/4 tsp Salt ([view](#))
- 1 tsp Vanilla ([view](#))
- 2 large eggs ([view](#))
- 1/3 cup Cocoa Powder ([view](#))
- 1/4 tsp Baking Powder ([view](#))

Servings 10

Variation 2:

Nutrition Facts	
Serving Size 55 g	
Amount Per Serving	
Calories 203	Calories from Fat 66
% Daily Value*	
Total Fat 7.3g	11%
Saturated Fat 2.3g	12%
Cholesterol 47mg	16%
Sodium 82mg	3%
Total Carbohydrates 32.6g	11%
Dietary Fiber 1.9g	8%
Sugars 22.5g	
Protein 3.8g	
Vitamin A 1%	Vitamin C 0%
Calcium 2%	Iron 8%
Nutrition Grade D+	
* Based on a 2000 calorie diet	

- 1/2 cup All Purpose Flour ([view](#))
- 1 cup Sugar ([view](#))
- 1/4 cup Shortening ([view](#))
- 1/4 cup Red Kidney beans ([view](#))
- 1/4 tsp Salt ([view](#))
- 1 tsp Vanilla ([view](#))
- 2 large eggs ([view](#))
- 1/3 cup Cocoa Powder ([view](#))
- 1/4 tsp Baking Powder ([view](#))

Variation 3:

Nutrition Facts	
Serving Size 54 g	
Amount Per Serving	
Calories 184	Calories from Fat 41
% Daily Value*	
Total Fat 4.5g	7%
Saturated Fat 1.5g	7%
Cholesterol 47mg	16%
Sodium 82mg	3%
Total Carbohydrates 33.6g	11%
Dietary Fiber 2.2g	9%
Sugars 22.6g	
Protein 4.2g	
Vitamin A 1%	Vitamin C 1%
Calcium 2%	Iron 8%
Nutrition Grade C-	
* Based on a 2000 calorie diet	

- 1/2 cup All Purpose Flour ([view](#))
- 1 cup Sugar ([view](#))
- 1/8 cup Shortening ([view](#))
- 1/3 cup Red Kidney beans ([view](#))
- 1/4 tsp Salt ([view](#))
- 1 tsp Vanilla ([view](#))
- 2 large eggs ([view](#))
- 1/3 cup Cocoa Powder ([view](#))
- 1/4 tsp Baking Powder ([view](#))