Tofu used as a Ricotta substitute in

Traditional Cheese Lasagna

Food 230

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Introduction

High Cholesterol is a large problem in the United States with 13% of the population suffering from this condition. High cholesterol is a major risk factor for heart disease and stroke. An unhealthy diet can cause high cholesterol. A food that is high in fat in the American diet is lasagna. Americans consume six billion pounds of pasta annually or 19.8 pounds per person. A certain percentage of this pasta is consumed in the form of lasagna. The ricotta cheese in lasagna contains the highest level of saturated fat. Half a cup of ricotta cheese has 216 calories with 141 calories coming from fat. It contains 50% of the daily value of saturated rat. It also contains 21% of the daily value of cholesterol In order to improve the nutritional value of our lasagna we replace the ricotta cheese in lasagna with tofu.

Tofu is a food mad by coagulating soy milk and then pressing the curds into soft white blocks. There is a wide variety of tofu's available in the market. Soft tofu's have the highest moisture content. Its texture is described to be similar to fine custard. Firm tofu has been drained and pressed, however it still retains moisture. It has the firmness of raw meat but bounces back. The texture of firm tofu is similar to firm custard. Tofu is produced in a similar way as cheese and can be substituted for cheese in certain products. Tofu is high in protein with 10% protein in firm tofu. The FDA has granted the health claim that 25 grams of soy protein a day as part of a diet low in saturated fat and cholesterol may reduced the risk of heart disease. For these health benefits we believe that tofu can be an acceptable substitute for ricotta cheese in lasagna.

In our experiment we will use soft, light firm, and firm tofu to replace all the ricotta cheese in cheese lasagna. We choose to do meatless lasagna because we wanted to keep the recipe as low in fat and cholesterol as possible. We also didn't want our

evaluators to be distracted by the meat sauce in our lasagna. The only difference in the recipe is the change from ricotta cheese to tofu. We will drain the tofu before we place it in the lasagna. We are doing this so that the extra moisture from the tofu does not change the recipe of the lasagna too much. In our experiment we still had mozzarella and parmesan cheese in the lasagna. In further research we could see if the lasagna would be accepted without any type of cheese just lasagna. We believe that tofu can replace ricotta cheese in lasagna because it does not have to have the melting or browning properties that mozzarella cheese has. It will be more able to replace ricotta cheese than the other types of cheese.

In our experiment we will have twenty-six students evaluate our lasagna. We will create a blind taste test of the four different lasagnas. We want to evaluate our lasagna on taste, texture, color, flavor, and overall acceptability. We believe if tofu was accepted as a substitute for ricotta cheese than lasagna could become a healthier food option.

Review of Literature

Moisture Retention and Consumer Acceptability of Chocolate Bar Cookies Prepared With Okra Gum as a Fat Ingredient Substitute
Abstract

The intent of this study was to determine the viability of using okra gum (OK) as a fat ingredient substitute in chocolate bar cookies. The fat-free cookies were prepared by substituting OK or applesauce (AP) for 113g melted margarine and 85g egg yolk in high fat control cookies. In this study, a dry to moist ingredient ratio of 1.9:1.0 was used amongst cookie formulas. After 48 hours, moisture ratings for fat-free cookies were determined and the results of the moisture content of the cookies containing OK were (28.3±0.4%) and AP were (27.6+1.1%). Both of the fat ingredient substitute cookies had higher moisture content than the control (8.5±0.3%). Overall, the results of this study

show that both OK and AP cookies contain three times the moisture than that of the control. Also, in sensory tests the color and smell of the OK cookies did not significantly differ from the control cookies. The color of the cookies containing AP received similar ratings to the control cookies, but the smell of the AP cookies was less acceptable than the control cookies. Overall, this study shows that OK can be a satisfactory fat ingredient substitute in chocolate bar cookies.

Summary

Cookies are known to be high in fat, and high intakes of dietary fact are related to the development of Coronary Heart Disease. The purpose of this study was to offer an alternative to fat in baked goods in order to help Americans lower their fat intake. This is the same approach we took in our experiment using tofu as a fat replacer in lasagna.

Pureed Cannellini Beans Can Be Substituted for Shortening in Brownies

Abstract

The purpose of this experiment was to establish the overall acceptability, sensory characteristics and nutrient content of brownies made using cannellini beans as a substitute for shortening rather than the full shortening (control) study. The brownies were prepared by substituting cannellini beans to replace 25%, 50% and 75% of the shortening by weight (oz) in a control brownie formula. In this study, the nutritional analysis indicated that the control brownie contained 152 kcal, 6.4 g total fat, 1.8 g saturated fat and 36% kcal from fat per 1.4 oz brownie. The 50% bean brownie had 21 fewer kcal and 2.6 less g of fat per 1.4 oz serving than the control and 25% of kcal from fat. On the whole, the results of this study indicated that neither the 25% nor the 50% bean brownies were significantly different from the control in overall acceptability, tenderness, texture or flavor. However, the 75% bean brownie was noticeably different

in acceptability, tenderness, texture and flavor from the other brownies. This study illustrated that not only substituting cannellini beans for shortening in brownies can replace as much as 50% of the fat by weight, but it also showed to be an acceptable fat substitute in baked goods.

Summary

In the experiment "Pureed Cannellini Beans Can Be Substituted for Shortening in Brownies, it proved that a percentage of shortening could be replaced to make a healthier and still tasteful brownie, showing that it is not difficult to make healthier alternatives to not so healthy foods.

Textural properties of low-fat cookies containing carbohydrate- or protein-based fat replacer

Abstract

Dietary guidelines have proven fat should be consumed in moderation thus reducing fat in the everyday diet is a current and on-going phenomenon. The majority of cookies contain a large amount of fat. Fat is one of the main ingredients of cookies which can affect texture and taste. The purpose of this study was to use five different carbohydrate or protein based fat mimetics to replace half the fat in cookies in order to examine the difference in taste and texture through stress-strain curves. Five types of mimetics were used including polydextrose, C*deLight, Raftiline, Dairytrim, and Simplesse Dry 100. Polydextrose, C*deLight MD 01970, Raftiline, and Dairytrim were dissolved 20% wt/wt in cold water. Simplesse was dissolved 33% wt/wt in cold water. All cookies were prepared using flour, 200 g; sugar, 81 g; margarine, 88 g; cold soluble starch, 10 g; whey, 3.5 g; ammonium bicarbonate, 2.6 g; sodium bicarbonate, 1.7 g; tartaric acid, 0.6 g; SSL, 2.0 g; water, 36 g. 11.5%, 23.0%, 35.0%, and 50% of

margarine was replaced by an equal amount of fat mimetic. Stress-Strain curves were developed with the use of an equation containing maximum stress (σ_{max}), maximum strain (ε_{max}), and a viscoelastic exponent (*f*). A mathematical model for σ_{max} and the ratio $\sigma_{max}/\varepsilon_{max}$ represented the hardness and bitterness of the cookies, correspondingly. All values were dependent upon the percentage and type of fat replacer. Overall, bitterness increase correspondingly to the amount of fat mimetic. An increase in fat mimetics polydextrose and Dairytrim content results in harder cookies. An increase in fat mimetics C*deLight, Simplesse or Raftiline result in a softer cookie thus can be used to prepare low-fat tender cookies.

Summary

The purpose of the study was to use five different carbohydrate or protein based fat mimeticsto replace half the fat in cookies in order to examine the difference in taste and texture through stress-strain curves. The study's results suggested that the bitterness of the cookies increased correspondingly to the amount of fat mimetic. An increase in fat mimetics polydextrose and Dairytrim content results in harder cookies. An increase in fat mimetics C*deLight, Simplesse or Raftiline result in a softer cookie thus. Therefore, fat mimetics C*deLight, Simplesse or Raftiline are effective and should be used when preparing low-fat tender cookies.

Effect of ground poppy seed as a fat replacer on meat burgers

Abstract

Obesity is an ongoing concern in the United States. High fat intake not only increases the risk of obesity but increases the risk for high cholesterol levels and coronary heart disease as well. Therefore, there is an urgency to reduce the amount of fat

consumed daily.   The purpose of this study is to test the effectiveness of ground poppy

seeds as a fat replacer in meat burgers by testing and comparing cooking yield, moisture,

and fat retention. Additionally, the study determines if ground poppy seeds decrease the

amount of saturated fatty acids and cholesterol in meat burgers. All meat burgers were

prepared by removing subcutaneous and intramuscular fat from muscles and used as fat

source. Spices used were 0.3% ground black pepper, 0.2% red pepper, 0.2% cumin, 2%

salt, 7% toasted bread crumbs, and 5% union rind. The dough produced was then divided

into four even batches. The control batch had adjusted fat content to 20% using the extra

subcutaneous and intramuscular fat. Fat and GPS were added to the last three batches as

a percentage of GPS/fat (15/5, 10/10. 0/20), respectively. GPS were found to be an

effective fat replacer in meat burgers considering it positively affects overall acceptability

and flavor of meat burgers while improving the cooking yield, moisture, and fat retention.

Additionally, GPS decrease SFA and cholesterol while increasing PUFA and minerals in

the meat burger. GPS can be used as a suitable choice fat replaced for up to 50% of

original animal fat without effecting overall acceptability and flavor of meat burgers.

Summary

In the article, "Effect of ground poppy seed as a fat replacer on meat burgers" the

effectiveness of ground poppy seeds as a fat replacers in meat burgers was tested

comparing the cooking yield, moisture, and fat retention. In addition, this study

attempted to see if replacing the fat in meat burgers with ground poppy seed would

reduce the amount of saturated fatty acids and cholesterol. Replacing the fat in meat

burgers with ground poppy seeds showed to improve the cooking yield, moisture, and fat

retention and decrease the saturated fatty acids and cholesterol. Ground poppy seeds

were found to be an effective fat replacer for up to 50% of original animal fat without

effecting the overall acceptability and flavor.

Effect of Fat Replacement on Sensory Attributes of Chocolate Chip Cookies

Abstract

Many people choose to eat healthier since doing so can lower their chances of contracting serious health conditions such as heart disease, obesity, and cancer as well as having positive effects such as reducing their cholesterol absorption. They do this by choosing foods that are produces using less fat and have acceptable sensory qualities such as smell and texture. The purpose of this study was to find products, which compare to cookies with traditional fats while retaining an overall acceptability of their high fat counterpart. For this experiment three fat replacements were tested in chocolate chip cookies consisting of Gerber prune paste, Wonderslim brand fat and egg replacement while the control batter included Crisco butter flavor shortening as the fat. Ninety-three untrained, randomly selected panelists from a college in the Southwest used a scale to rate each cookie for appearance, color of surface, texture, tenderness, flavor, and overall acceptability from 1 to 7 with the data analyzed using two-sample t-tests at a .05 significance level. Overall the there was good replications for all treatments however some attributes from various groups showed uniformity between groups. The Oatrim samples appearance, color, tenderness, and overall scores varied between replications while the control group stayed consistent with each replication. Some common fat replacement products generally will not produce qualities that imitate those produced by traditional, true fats. By purchasing cookies made with the fat replacements considered in this study, consumers can reduce fat consumption by nearly 70%.

Acceptability of Peanut Butter Cookies Prepared Using Mungbean Paste as a Fat Ingredient Substitute

Abstract

The Dietary Guideline for American recommends having a diet low in fat, saturated fat and cholesterol. To reduce fat intake for the long term, foods with modified fats is considered one of the easiest ways to achieve this goal. The success of fat modified foods is often dependent on the sensory acceptability and their similarity to their full fat counterpart. Beans seem to be an acceptable replacement for fat when used in low quantity. Mungbean averages 1.2% lipid, with approximately 72.8% of the lipid being unsaturated. Because resemblance to a familiar food reduces the negative responses people have when trying new foods, nonsprouting mungbeans may be more acceptable to various segments of the population if they were incorporated into familiar foods such as cookies. The objective of this study was to find out if mungbean paste used in place of peanut butter would produce a cookie with a similar taste and texture to a full-butter peanut butter cookie. To test these claims Mungbean paste was substituted for 25%, 50%, 75%, and 100% of the butter in the US Department of Agriculture (USDA) commodity foods formula for peanut butter cookies. Nine semi trained taste panelists used a 10-point hedonic scale to rate the cookies on 3 separate occasions. They were testing to find uniformity across senses such as hardness, fracturability, peanut flavor, and butter flavor. In addition two consumer panels were also conducted made up of 181 untrained panelists. Consumers used a 6-point scale to rate the cookies. A 1-sample *t* test was used on sensory data to compare each experimental cookie against the control. Consumer data were analyzed using 2-paired t-tests. Cookie spread had a ratio measure (in mm) of 8.07±0.09 for the control, 7.45±0.20 for the 25% mungbean paste cookie, 7.01±0.23 for the 50% MBP cookie, 6.35±0.16 for the 75% MBP cookie, and 5.31±0.18 for the 100% MBP cookie. Since Mungbean paste has a higher percentage of water than the butter being replaced the cookies were more vulnerable to moisture migration resulting in a

product that is softer and more cakelike. All Mungbean paste cookies had lower perceived peanut flavor than the control; the Mungbean paste cookies, however, did not rate significantly different in peanut flavor as the percentage of mungbean paste increased in the recipe. All Mungbean paste cookies were significantly higher in different flavor than the control, but were not significantly different from each other with increasing amounts of mungbean paste. Differences from the control do not automatically imply that the cookies would be unacceptable to consumers just that they differ from the standard recipe. Overall legumes could serve as an appropriate partial butter substitutes. Sensory analysis has shown that it is difficult to differentiate between the butter replacement levels of legumes that are used in cookies therefore reducing negative response.

Moisture retention and consumer acceptability of chocolate bar cookies prepared with okra gum as a fat ingredient substitute

Abstract

One of the causes of coronary heart disease is diets with high intakes of fat. It is recommended by the Dietary Guidelines to consume less than 30% of energy from fat. This study looks at the acceptability by consumers for okra gum to be used as a fat substitute. Okra gum and apple sauce was used in two separate cookies to replace the margarine and portions of the egg yolk. The okra gum cookie was compared to a high fat control cookie and a fat-free cookie made with applesauce. The moisture was determined by a drying oven. They were tested when fresh and after 24 and 48 hours. The moisture levels of fat-free cookies were 2.2 to 2.9 times higher than full fat cookies. The cookies were evaluated by sixty-two consumers on a hedonic scale for color, smell, flavor, aftertaste, moisture, and overall acceptability. Consumers rated moisture acceptability of both fat free cookies were similar to full fresh cookies. The results show that okra gum can be an acceptable fat replacers.

Summary

The article "Moisture retention and consumer acceptability of chocolate bar cookies prepared with okra gum as a fat ingredient substitute" showed the acceptability for okra gum and apple sauce to be used as a fat substitute. The test replaced the margarine and portions of the egg yolk with okra gum and apple sauce. Consumers rated the moisture acceptability of both fat free cookies similar to full fat cookies. This test indicated that okra gum can be an acceptable fat replacer in cookies.

Acceptability of oatmeal chocolate chip cookies prepared using pureed white beans as a fat ingredient substitute

Abstract

American diets are lower in fiber and higher in fat than are recommended. Their has been an increase in demand and consumption of reduced fat foods. Due to legumes high carbohydrate levels they might have the potential to replace fat in cookies. They are low in fat the are also high in dietary fiber, protein, B vitamins, zinc, potassium, magnesium, calcium and iron. This study looks at replacing butter with 25%, 50%, and 75% puered Great Northern beans in oatmeal chocolate chip cookies. The canned Great Northern beans where drained and the beans pureed. Fifty ml of liquid were added for each 425 g can of beans. Cookies were also stored in tightly sealed containers and evaluated at 16 to 18 hours after baking. Ninety-two untrained panelists rated the cookies on a 9-point hedonic scale for appearance, color, flavor, texture, and overall acceptability. As the amount of bean substitution increased the hedonic ratings increased. The cookies became less acceptable. However they were still liked slightly to liked very much. The flavor of the control was 2.8 while the 25% bean had a 2.9. The study shows that pureed white beans can be used as a fat replacer with favorable results.

Summary

In the article "Acceptability of oatmeal chocolate chip cookies prepared using pureed white beans as a fat ingredient substitute" looked to replace the fat in oatmeal chocolate chip cookies with Great Northern beans. They replaced the butter in increments of 25%, 50%, and 75%. Ninety-two untrained panelists rated the cookies on a 9-point hedonic scale for appearance, color, flavor, texture, and overall acceptability. As the amount of bean increased the acceptability of the cookies became less acceptable. However with 25% bean would be an acceptable fat replacer.

The use of Apricot Kernel Flour as a Fat Replacer in Cookies

Abstract

Obesity is on the rise in this country due to many factors. Of which include lifestyle, exercise routines, genetics, and of course diet is one of the most important factors. In fact many people with obesity make poor food choices. These choices not only lead to a weight increase but a decrease in health, such as heart disease and diabetes. The purpose of this study is to see if using apricot kernel flour, a common ingredient in the Middle East, is a viable option in replacing fat in cookies. After production the cookies will be sampled with a control group and an experimental group to see if people like and enjoy the cookies with the apricot kernel flour. Concentrations of the apricot kernel flour (AKF) are as follows, 10% AKF/ 90% fat, 20% AKF/ 80% fat, 30% AKF/ 70% fat, 40% AKF/ 60% fat. Spread ratios, overall sensory scores, hardness, and total fiber will be determined of the samples after baking. The increase of AKF decreased the spread ratio from 7.10ab to 5.98d in the 40% cookies. Hardness increased from 47.12 e to 109.93 a (N). The sensory score did not have real significant decrease. As for the total dietary fiber went from 1.86 a to 12.86 e in the 40% cookies, a very significant increase. Apricot kernel flour is a readily available fat replace that is already being used for human

consumption in the Middle East. Its provides better health benefits than the fats

commonly used in cookies, just one way to help fight the rise in obesity.

Summary

Apricot Kernel Flour was used as a fat replacer in cookies. The ratios were 10, 20,

30, and 40 percent apricot kernel flour to regular fat. In the experiment the overall quality

of the cookies decreased as the amount of apricot kernel flour increased. They became

hard and less appealing. However the total fiber increased and fat decreased, thus making

the cookies healthier but less acceptable.

Effects of Avocado Fruit Puree and Oatrim as Fat Replacers on the Physical, Textural and Sensory Properties of Oatmeal Cookies

Abstract

A well balanced diet is an important part of a healthy lifestyle. In today's world

people love food, unfortunately the dietary choices people make are not as healthy as

they could be. These poor food choices can lead to many problems such as diabetes and

obesity. One way to help reduce these health problems is to lower the consumption of fat

in the diet. Fat replacers in baked goods can offer the foods people like to eat but are also

a little bit better for them. For example Avocado Fruit Puree (AFP) and Oatrim can be

used to replace fat in oatmeal cookies. The purpose of this study is to see if using AFP

and Oatrim will produce a cookie that has similar properties as cookie made with

conventional fats. Concentrations will be 50% fat and 50% fat replacer, in the experiment

cookies and the control cookies will use conventional fat. After baking the Oatrim had a

13% increase in height and a 3.8 spread ratio. AFP had 20% increase in height and a 2.6

spread ratio. Both had minimal moisture loss compared to the control. In terms of texture

the experimental cookies had more moisture than the control so they were softer. The

sensory properties were promising, they scored within one point of the control in most categories, overall the control scored a 3.75, AFP scored 3.45, and Oatrim 3.59. These two fat replacers are a healthy alternative to fat and can be used by consumers at home.

Summary

Avocado Puree and Oatrim were used as a fat replacer in oatmeal cookies. The ratio in the experiment was 50 percent fat to 50 percent of one of the fat replacers. The results of the experiment were that the fat replacers produced a softer cookie compared to the control due to higher moisture content. More importantly however the cookies contained less fat than the control makes them a healthier alternative.

Hypotheses

Before performing the research project, we believed that soft tofu would have shown to be the most acceptable as a substitute for ricotta cheese in lasagna. This is due to the fact that ricotta cheese is soft and that soft tofu would mimic the texture best.

Methodology

Overall Research

This research project explores the acceptability of using tofu of different firmness as the cholesterol replacer in lasagna and provides the option for a replacement method.

The Academy of Nutrition and Dietetics has previously indicated and discussed the fact that cholesterol should be limited to under 200 ml/dl. In addition, the AND has proven ricotta cheese is high cholesterol food. In this study, a traditional and well accepted cheese lasagna recipe, will be developed as the control sample. Soft, lightly firm, and firm tofu will be substituted for the ricotta cheese in the controlled recipe.

Instrument Design and Survey Procedures

A self-administered sensory evaluation questionnaire (shown below) was developed to rate each product for the taste, texture, appearance, flavor, and overall quality. Twenty-six questionnaires were given to assess the overall product. Water was provided to cleanse the palate after each sample.

Survey: Lasagna Questionnaire

Sample 1
Please mark the response that properly represented your perception for this product by using the following scale:
1 = Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

Q1: The taste (mouth feeling) is acceptable………………….1 2 3 4 5
Q2: The texture is acceptable……………………….....…1 2 3 4 5
Q3: The appearance is acceptable …………………….…...1 2 3 4 5
Q4: The flavor (mouth feeling + smelling)…………………..1 2 3 4 5
Q5: The overall quality is acceptable………………………...1 2 3 4 5
If you don't accept this product, Please specify the reason.
_____

Lasagna Questionnaire
Sample 2
Please mark the response that properly represented your perception for this product by using the following scale:
1 = Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

Q1: The taste (mouth feeling) is acceptable………………….1 2 3 4 5
Q2: The texture is acceptable………………………..………1 2 3 4 5
Q3: The appearance is acceptable …………………….…...1 2 3 4 5
Q4: The flavor (mouth feeling + smelling)…………………..1 2 3 4 5
Q5: The overall quality is acceptable………………………...1 2 3 4 5
If you don't accept this product, Please specify the reason.
_____

Lasagna Questionnaire
Sample 3
Please mark the response that properly represented your perception for this product by using the following scale:
1 = Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree
Q1: The taste (mouth feeling) is acceptable………………….1 2 3 4 5
Q2: The texture is acceptable………………………..………1 2 3 4 5
Q3: The appearance is acceptable …………………….…...1 2 3 4 5
Q4: The flavor (mouth feeling + smelling)…………………..1 2 3 4 5
Q5: The overall quality is acceptable………………………...1 2 3 4 5
If you don't accept this product, Please specify the reason.
_____

Lasagna Questionnaire
Sample 4
Please mark the response that properly represented your perception for this product by using the following scale:
1 = Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

Q1: The taste (mouth feeling) is acceptable…………………...1 2 3 4 5
Q2: The texture is acceptable……………………..………...1 2 3 4 5
Q3: The appearance is acceptable ……………………………1 2 3 4 5
Q4: The flavor (mouth feeling + smelling)……………………1 2 3 4 5
Q5: The overall quality is acceptable………………………...1 2 3 4 5
If you don't accept this product, Please specify the reason.
_____

Design and Experiment Procedures

This research experiment will use the tradition cheese lasagna recipe as the control. The recipe includes 1 (16 ounce) package lasagna noodles, 3 cups ricotta cheese, 1/4 cup grated Parmesan cheese, 4 eggs, salt and pepper to taste, 1 teaspoon olive oil, 3 cloves garlic, minced, 1 (32 ounce) jar spaghetti sauce, 1 teaspoon Italian seasoning and 2 cups shredded mozzarella cheese. The additional three recipes will replace the initial 3 cups of ricotta cheese with the soft, lightly firm, and firm tofu. Independent variables include the three different tofu's (soft, lightly firm, and firm) while dependent variables include taste (mouth feel), flavor, texture, appearance, and overall quality. Traditional instructions will be followed (as shown below.)

1. Preheat oven to 350 degrees F (175 degrees C).

2. In a medium bowl, combine firm tofu, Parmesan, eggs, salt and pepper; mix well.

3. In a medium saucepan, heat oil over medium heat and saute garlic for 2 minutes; stir in spaghetti sauce and Italian seasoning. Heat sauce until warmed through, stirring occasionally, 2 to 5 minutes.

4. Spread 1/2 cup of sauce in the bottom of 7x11 baking dish. Cover with a layer of noodles. Spread half the tofu mixture over noodles; top with another noodle layer. Pour 1 1/2 cups of sauce over noodles, and spread the remaining ricotta over the sauce. Top with remaining noodles and sauce and sprinkle mozzarella over all. Cover with greased foil.

5. Bake 45 minutes, or until cheese is bubbly and top is golden.

Data Analysis

Data regarding the sample characteristic, taste, was first analyzed. Survey results have determined that the control group (with Ricotta Cheese) had the highest taste (mouth feel) rating of 4.60 and the soft tofu received the lowest taste rating of 3.14. The overall order of acceptability in taste ranked control (4.60), firm (3.86), lightly firm (3.68), and soft (3.14).

Next, the outcome data regarding the sample characteristic, texture, was analyzed. Survey results determined that the control group (with Ricotta Cheese) had the highest texture rating of 4.23, while the soft tofu received the lowest taste rating of 3.09. The order of acceptability in texture ranked control (4.23), firm (3.83), lightly firm (3.55), and soft (3.09).

Data was then analyzed regarding the sample characteristic, appearance. Survey results have indicated that the control group (with Ricotta Cheese) had the highest appearance rating of 4.68, while the lightly firm tofu received the lowest appearance rating of 3.77. The order of acceptability in appearance ranked control (4.68), firm (4.32), soft (3.82), and lightly firm (3.77).

Data analyzed regarding the sample characteristic, flavor, expressed the control group (with Ricotta Cheese) having the highest flavor rating of 4.55, and the soft tofu receiving the lowest flavor rating of 3.18. The order of acceptability in flavor ranked control (4.55), firm (3.95), lightly firm (3.50), and soft (3.18).

Finally, the outcome data regarding the sample characteristic, overall acceptability, was analyzed. The control group (with Ricotta Cheese) had the highest overall acceptability rating of 4.59, while the soft tofu received the lowest taste rating of 3.14. The order of acceptability in overall acceptability ranked control (4.59), firm

(3.82), lightly firm (3.68), and then soft (3.14).

Treatments	Percentage of Ricotta Cheese	Percentage/Tofu of Tofu
Firm Tofu	0	100% Firm 3 cups
Control (Ricotta Cheese)	100% Ricotta Cheese 3 cups	0
Soft Tofu	0	100% Soft 3 cups
Lightly Firm Tofu	0	100% Light Firm 3 cups

DV	Lasagna 1 Firm Tofu	Lasagna 2 Control (Ricotta Cheese)	Lasagna 3 Soft Tofu	Lasagna 4 Lightly Firm Tofu
Taste (Mouth feel)	3.86	**4.60**	3.14	3.68
Texture	3.83	**4.23**	3.09	3.55
Appearance	4.32	**4.68**	3.82	3.77
Flavor (mouth feel/ Smelling)	3.95	**4.55**	3.18	3.50
Overall	3.82	**4.59**	3.14	3.68

Acceptability of Lasagna Treatments
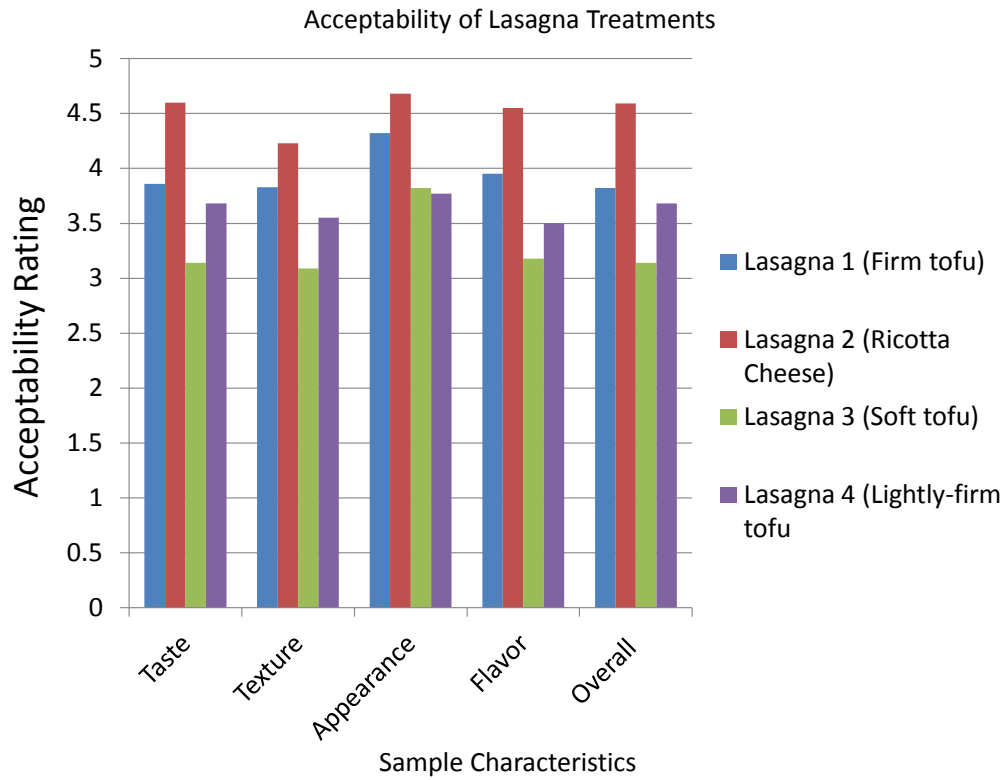
Nutritional Analysis

Nutrients	Control	Soft	Light Firm	Firm
Calories	580	470	450	490
Calories from Fat	190	140	120	140
Total Fat	**22g**	**15g**	**13g**	**15g**
Saturated Fat	11g	6g	5g	6g
Cholesterol	**165mg**	**125mg**	**125mg**	**125mg**
Total Carb	64g	62g	59g	61g
Sodium	1170mg	1020mg	1120mg	1060mg
Fiber	**5g**	**5g**	**5g**	**5g**
Protein	35g	26g	26g	29g

Nutritional Comparison

- Total Fat g
- Cholesterol mg
- Calories

Treatment 1 Firm · Treatment 2 Control · Treatment 3 Soft · Treatment 4 Light...
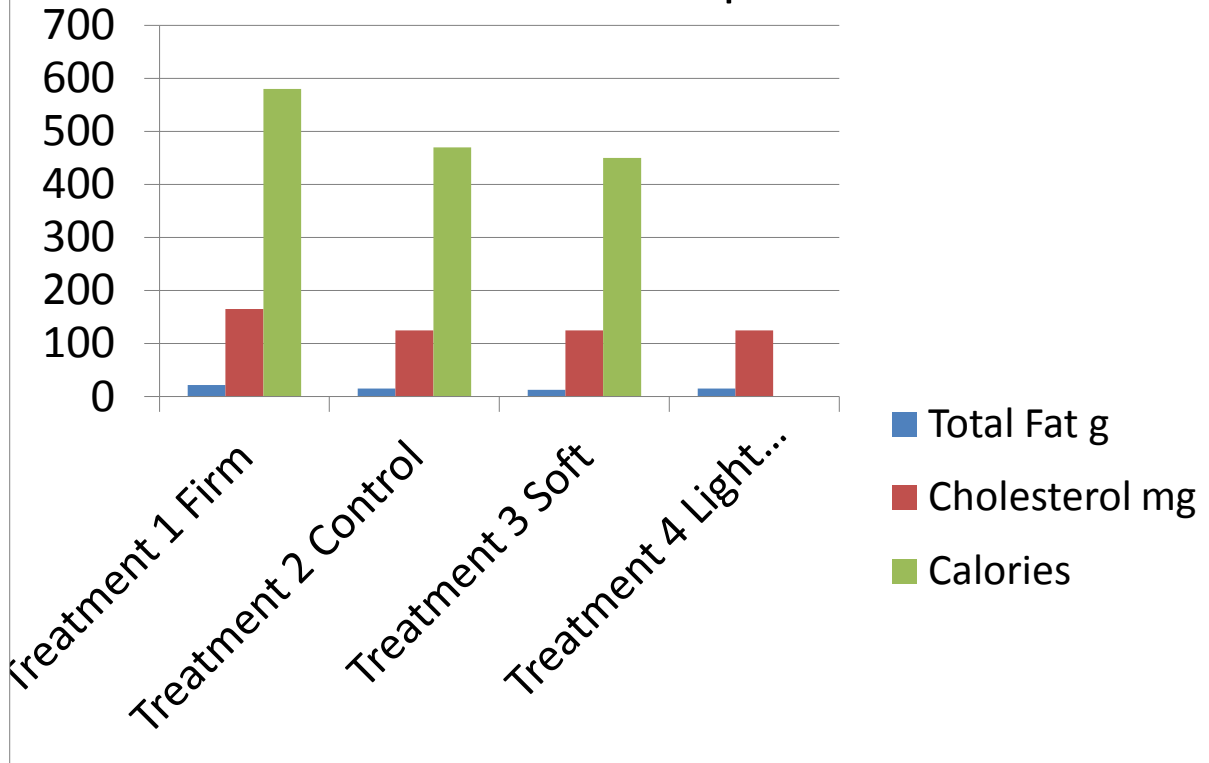
Control

Nutrition Facts

Serving Size (353g)
Servings Per Container

Amount Per Serving

Calories 580   Calories from Fat 190

	% Daily Value*
Total Fat 22g	**34**%
Saturated Fat 11g	**55**%
Trans Fat 0g	
Cholesterol 165mg	**55**%
Sodium 1170mg	**49**%
Total Carbohydrate 64g	**21**%
Dietary Fiber 5g	**20**%
Sugars 11g	
Protein 35g	

Vitamin A 30%	•	Vitamin C 15%
Calcium 60%	•	Iron 25%

*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

Soft Tofu

Nutrition Facts

Serving Size (353g)
Servings Per Container

Amount Per Serving

Calories 470   Calories from Fat 140

	% Daily Value*
Total Fat 15g	**23**%
Saturated Fat 6g	**30**%
Trans Fat 0g	
Cholesterol 125mg	**42**%
Sodium 1020mg	**43**%
Total Carbohydrate 62g	**21**%
Dietary Fiber 5g	**20**%
Sugars 13g	
Protein 26g	

Vitamin A 25%	•	Vitamin C 15%
Calcium 35%	•	Iron 25%

*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

Lightly Firm Tofu   **Firm Tofu**

Nutrition Facts
Serving Size (355g)
Servings Per Container

Amount Per Serving

Calories 450   Calories from Fat 120

% Daily Value*

Total Fat 13g   20%

  Saturated Fat 5g   25%

  Trans Fat 0g

Cholesterol 125mg   42%

Sodium 1120mg   47%

Total Carbohydrate 59g   20%

  Dietary Fiber 5g   20%

  Sugars 12g

Protein 28g

Vitamin A 25%   •   Vitamin C 15%

Calcium 35%   •   Iron 25%

*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 (355g)
Servings Per Container

Amount Per Serving

Calories 490   Calories from Fat 140

% Daily Value*

Total Fat 15g   23%

  Saturated Fat 6g   30%

  Trans Fat 0g

Cholesterol 125mg   42%

Sodium 1060mg   44%

Total Carbohydrate 61g   20%

  Dietary Fiber 5g   20%

  Sugars 13g

Protein 29g

Vitamin A 25%   •   Vitamin C 15%

Calcium 35%   •   Iron 25%

*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

Results

Our results indicated that there is trend with the firmness of the tofu and the overall acceptability of the lasagna. The firmer the tofu the higher the overall acceptability rate was. The firm tofu was a runner up of the control group of the ricotta cheese. Considering the goal of the experiment was to find the most overall acceptable fat replacer for ricotta cheese firm has shown to be the best option. The nutritional analysis shows that firm tofu is lower in fat, cholesterol, and calories. This also emphasizes the fact that firm tofu is an effective replacer of ricotta cheese in Lasagna.

Discussion

Our results suggested that firm tofu is the best substitute for ricotta cheese used in lasagna. Firm tofu as a substitute not only reduces the fat content of the product but the lowers the overall cholesterol as well. We have found firm tofu to be an excellent replacer of ricotta cheese due to the fact that tofu is technically considered a cheese.

Tofu is a cheese made from soy milk. The protein in soy milk is precipitated out through the use of coagulants such as calcium sulfate dehydrate, calcium chloride, or magnesium chloride. The liquid produced during coagulation is removed, the curds are pressed, and blocks of tofu are formed and stored. Considering the method of making tofu is consistent with the general method of making cheese, tofu ends up having the same cooking applications as ricotta cheese. Furthermore, the firmness of tofu is based on its ability to be cut into cubes. Research has shown that the firmer the tofu, the more pressed together the tofu is thus more water can be squeezed out and the tofu can be held together more. Consequently, the softer the tofu the softer the consistency thus the ability for the tofu to fall apart is greater.

Application/Implication

Our findings were that the firm tofu had the highest overall acceptability rating, and therefore was the best substitute for ricotta cheese in lasagna.

Applications for these findings would be using this substitution as a healthier alternative for ricotta in other recipes, including ravioli, ricotta pie, manicotti, and many others. These recipes are very popular, but are also very high in cholesterol, calories, and fat. Substituting firm tofu for the ricotta in these recipes would not only lower the cholesterol, calories, and fat in the dishes, but the soy in tofu also has antioxidant effects. Studies have also shown that intake of soy-based products prevent breast cancer, osteoporosis and cardiovascular disease. The isoflavones are also known to decrease bone loss. Besides the health benefits of tofu, it is also a great alternative for those who are lactose intolerant, and a cheap and complete source of protein.

Also, when tofu, is incorporated in recipes such as lasagna, it is often perceived as more palatable than when served alone, or in a tofu stir-fry.

Recipe Recommendation Firm Tofu (Lasagna)

Yield: 6 servings
Ingredients

- (12 ounce) package oven ready lasagna noodles

- 3 cups firm tofu

- 3 tablespoons grated Parmesan cheese

- 3 eggs

- salt and pepper to taste

- 3/4 teaspoon olive oil

- 2-1/4 cloves garlic, minced

- 3/4 (32 ounce) jar spaghetti sauce

- 3/4 teaspoon Italian seasoning

- 1-1/2 cups shredded mozzarella cheese

Directions
6. Preheat oven to 350 degrees F (175 degrees C).

7. In a medium bowl, combine firm tofu, Parmesan, eggs, salt and pepper; mix well.

8. In a medium saucepan, heat oil over medium heat and saute garlic for 2 minutes; stir in spaghetti sauce and Italian seasoning. Heat sauce until warmed through, stirring occasionally, 2 to 5 minutes.

9. Spread 1/2 cup of sauce in the bottom of 7x11 baking dish. Cover with a layer of noodles. Spread half the tofu mixture over noodles; top with another noodle layer. Pour 1 1/2 cups of sauce over noodles, and spread the remaining ricotta over the sauce. Top with remaining noodles and sauce and sprinkle mozzarella over all. Cover with greased foil.

10. Bake 45 minutes, or until cheese is bubbly and top is golden.

Limitation

The first limitation of the research was that the main demographic taking the survey were

students aged 18-24. Considering this is such a small range, the change in perception

between different age groups was not tested. Secondly, a survey question regarding the

appearance of the product was potentially misinterpreted since other ingredients

contribute to overall appearance of the product.

Conclusion

Our findings were that the firm tofu had the highest overall acceptability rating, and therefore was the best substitute for ricotta cheese in lasagna.

Applications for these findings would be using this substitution as a healthier alternative for ricotta in other recipes, including ravioli, ricotta pie, manicotti, and many others. These recipes are very popular, but are also very high in cholesterol, calories, and fat. Substituting firm tofu for the ricotta in these recipes would not only lower the cholesterol, calories, and fat in the dishes, but the soy in tofu also has antioxidant effects. Studies have also shown that intake of soy-based products prevent breast cancer, osteoporosis and cardiovascular disease. The isoflavones are also known to decrease bone loss. Besides the health benefits of tofu, it is also a great alternative for those who are lactose intolerant, and a cheap and complete source of protein.

Also, when tofu, is incorporated in recipes such as lasagna, it is often perceived as more palatable than when

served alone, or in a tofu stir-fry.

Further research could be done, testing the acceptability on a larger scale, to determine if the same acceptability results will be produced again. Another experiment could be done using firm tofu as a replacer in the other ricotta recipes previously listed (ricotta pie, manicotti), to determine if the same acceptability is reported in these recipes as it was in the lasagna. Also more research could be done on how tofu can substitute meats, fats, and other cheeses in various recipes.

References

Brown, A. (2008). Understanding food: principles and preparations 3ed. Belmont, CA: Thomson Wadsworth.