The Quality of Peanut Butter-Chocolate Cookies

ABSTRACT

Peanut Butter is a common product found in many American’s homes and used on a regular basis. However, peanut butter while having many positive health benefits associated with its consumption, also has some negative side effects. Because of the high amount of fat and sugar in peanut butter products, many producers have provided modified products. This is helpful to American’s diet because it will hopefully decrease the amount of fat and sugar intake and thus help to reduce the rate of obesity and other health problems. Two examples of modified peanut butter products include reduced fat Jif peanut butter and simply Jif peanut butter, which is a product with lower sodium and 33% less sugar. These modified peanut butter products as well as regular Jif peanut butter were independent variables in this experiment, testing the overall quality of peanut-butter chocolate cookies. This experiment used three tests, which were the dependent variables, to determine the quality of the cookies. First was the texture analyzer, which was used to assess how crisp the cookies were. The results indicated that the cookies made with regular peanut butter had the softest texture. Next, the water activity machine was used to determine that amount of moisture in each of the cookies. The results from this test found that the fat and sugar content did not affect the overall quality of the cookies. Lastly the use of a sensory analysis was completed to determine the taste of the cookies. The average scores from the sensory analysis indicate that there was not a substantial difference in taste between the cookies. Because the results from these tests indicate that there is not a great difference in the quality of peanut butter
cookies, when looking at crispness, moistness, and taste, it would be recommended that consumers try to include modified peanut butter into their diets to help reduced the amount of fat and sugar intake.

INTRODUCTION

The purpose of this experiment is to determine if the use of different kinds of peanut butter affects the overall quality of Peanut Butter-Chocolate Cookies. This experiment hopes to conclude that there is no difference between peanut butter products when they are used as an ingredient in a larger product. This experiment will use three different types of peanut butter as variables; reduced fat peanut butter, a low sodium peanut butter with 33 percent less sugar, and regular creamy peanut butter. The independent variable or the controlled variable will be the amount of peanut butter used in each cookie. The dependent variables will be the use of regular Jif, reduced fat Jif, or simply Jif peanut butter. All of these peanut butter products will be the same brand to eliminate other outside variables. To accurately measure if there is an effect on the quality of peanut-butter chocolate cookies, specific tests have to be performed. One such test will be the water activity of each of the peanut butter-chocolate cookies. The use of the Water Activity Machine will allow for comparison on different degrees of moisture in the cookies. A reading from the Texture Analyzer will also be needed for this experiment. The results from the Texture Analyzer will indicate how hard or gritty the cookies have become. The final test used in this experiment, to compare the 3 variables, is the sensory analysis test.

Peanut butter has shown to have many health benefits associated with its consumption. Peanuts are loaded with vitamins A and E, folate, magnesium, zinc, fiber, and protein. Regular consumption of peanuts has been shown to elevate one’s resting
metabolic rate and thus increasing the number of calories burned (Kalyn, 2004). Along
with these nutrients, peanuts have also been found to have anti-aging antioxidants. More
specifically, peanut butter contains monounsaturated and polyunsaturated fats. Both of
these fats have been linked to a reduced blood pressure, lower blood triglycerides, and
promote a higher level of HDL in cholesterol (Dowd and others 2005). A study was
conducted to distinguish a connection between peanut butter consumption and a lower
risk of type 2 diabetes in women. The study found that there are possible benefits of
consuming peanut butter, especially when avoiding caloric intake because peanut butter
can replace refined grains or red meat (Hu and others 2002).

Peanut butter was introduced to the market around the 1914. Since that time there
have been numerous advances in the production of peanut butter. In 1958, Jif marketed
its regular peanut butter product, which is still on the market today (History of Jif 2002).
Through the years, the regular peanut butter spread has been modified to keep up with the
market trends. Simply Jif, a peanut butter with low-sodium and less sugar when
compared to the regular Jif, was introduced in 1991 (History of Jif 2002). When there
was a demand for products with reduced fat, Jif responded by manufacturing reduced fat
Jif in 1995 (History of Jif 2002).

With all of the health benefits associated with the consumption of peanut
butter it is an important item to keep on the market. As more Americans are concerned
about their calorie and fat intake it is important to recognize that modified products,
reduced fat Jif and simply Jif, have been introduced into the market. However, these
products on the market have not been popular with the public. The data on the quality of
reduced fat Jif and simply Jif to sensory panels has been negative. However, this
experiment is determined to find the effects of using regular Jif, reduced fat Jif, and simply Jif on a final product, peanut butter-chocolate cookies. This study differs from others because it will be looking at how the modified peanut butters affect the quality of a complete product, peanut butter-chocolate cookie, not just the quality of the peanut butters on their own. The importance of determining the quality of peanut butter-chocolate cookies with one ingredient being modified (peanut butter) is important for two reasons. First, the consumption of peanut butter has been linked to many positive health benefits because of its great amount of nutrients. It is important for Americans to continue to consume peanut butter products for these beneficial reasons. However, as people become educated and concerned about their diets, and the increasing number of people who are obese, it is important to have alternatives in which people can decrease their fat, sodium, and sugar intake. The second reason why it is important to determine the quality of products using modified peanut butters as an ingredient, is for those who still wish to continue to have peanut butter on a regular basis, but want to have a healthier alternative. It is important for the public to be aware of how modified peanut butters can be used, while still providing nutrient benefits, and limiting fat or sodium intake.

METHODS
The approach of this experiment is to bake three different types of peanut butter-chocolate cookies based on different kinds of peanut butter to test using measurements from the water activity machine and texture analyzer and results from a sensory analysis test. The first step in this process will be to make the cookies. The recipe for peanut butter-chocolate cookies is as follows for one week (Betty Crocker 2005):

168 grams Granulated sugar

144 grams Packed brown sugar
62 grams Regular Jif peanut butter
62 grams Simply Jif peanut butter
72 grams Reduced fat peanut butter
84 grams Butter
72 grams Shortening
100 grams Egg
270 grams Gold medal all purpose flour
113.400 grams Baking soda
3.6 grams Baking powder
246 grams of Hershey milk chocolate kisses

Mix together granulated sugar, brown sugar, peanut butter, butter, shortening and egg. Stir in flour baking soda and baking powder. After all the ingredients have been mixed the next step is to shape dough into balls, roll in granulated sugar, and place on ungreased cookie sheets. Bake at 190°C until edges are light brown. Immediately press 1 milk chocolate piece into each cookie and let cookies cool on a wire rack. At this time the cookies will be ready to analyze with the texture analyzer, water activity machine, and sensory evaluation. The texture analyzer was used with the probe attachment each time to decrease the variability in the readings. Also the “cookie” setting was used. The parameters for the “cookie” setting are as followed: pretest speed of 2.0mmls, test speed of 5.0mmls, post test speed of 5.0mmls, rupture test distance of 1.0mm, distance of 5.0mm, force of 2000g, time of 5.0sec, and count of 5. These values are important and need to remain the same each time a test is run, to ensure that the variability of this experiment is at a minimal. Three readings were taken and then these three readings
were averaged to give a final value. These values can be seen in Table 1. Next a reading was taken from the water activity machine. A small piece of the cookie was taken and placed into the plastic cup. There could be some variability at this stage of the experiment because it is difficult to take a piece of cookie from the same spot on several difference cookies. However, it is a step that should be carefully measured and effort should be made in an attempt to take a piece of cookie from the same relative spot on each cookie. The values taken from the water activity machine are shown in Table 2. The final test that was taken was a sensory analysis test. This test was the best way to measure how well people liked each cookie. This test used a nine-point hedonic scale. A sample of the hedonic scale that was used is shown below. Also, that values that were used to calculate the averages for each cookie are listed in the box that it correlates with. The averages from the hedonic scale calculations are shown in Table 3.

Hedonic Rating Scale:

<table>
<thead>
<tr>
<th>Dislike Extremely 2</th>
<th>Dislike very much 3</th>
<th>Dislike moderately 4</th>
<th>Dislike slightly 5</th>
<th>Neither like nor dislike 6</th>
<th>Like slightly 7</th>
<th>Like moderately 8</th>
<th>Like very much 9</th>
<th>Like extremely 10</th>
</tr>
</thead>
</table>

DICUSSION

After the experiment was completed and the data was recorded, an analysis of the data had led to some conclusions. First as one can see from Figure 1, there is an only slight difference between the variables in trail two and trail three. However, in the readings from trail one reduced fat seems to be an outlier with a value of 1232.7g, which is much greater than any of the other values. It is important to consider why this reading
is substantially larger than the other values. One very likely reason could have been due to the amount of cooking time that the cookies were in the oven. It is possible that this particular cookie could have been on the outside of a pan which might have made it crisper than the other cookies from that trail and the other trails. It was expected that the lowest texture analyzer averages would have been from the cookies in which the variable was the regular peanut butter. It was thought that if the cookie had regular peanut butter in it, the texture would be softer and thus have a lower value from the texture analyzer because it would take less force to puncher the cookie’s surface. From the results collected it is clear that for two of the trails, the second and third, this was proven true for regular peanut butter at 92.1 grams and 47.57 grams respectfully. However, for the first trail the reading from the variable of simply peanut butter had the lowest values from the texture analyzer at 165.4 grams. From this information one can conclude that the regular peanut butter cookies did have the softest texture and this would make the quality of these cookies overall much more appealing to the consumers.

Next, the water activity machine was used to measure the degree of moisture in the cookies. The reason the water activity was chosen as one of the objective tests was because it will assess the amount of moisture in the cookies. By determining the moisture of the cookie, it is hoped to help determine how the different amount of fat in the peanut butter affects these results. It is expected that the regular peanut butter cookies are going to have a higher water activity because of the high content of fat in the regular peanut butter. The water activity was used to determine which cookies were going to have to the moistest texture and produce higher appetizing product. As is shown by Figure 2, all three of the trails produced results that were relatively similar. However, in
trail one the cookies with the highest water activity, and thus highest moisture, was regular peanut butter at a value of 0.576 aw. Trail two actually measured the reduced fat peanut butter to have the highest water activity value, at a value of 0.64 aw. Finally the third trail has results that will be difficult to determine because all three of the variables produced results that were very similar. However, the variable that did have the highest amount of moisture was simply peanut butter at a value of 0.63 aw. From these results it difficult to conclude which type of peanut butter provides the greatest amount of moisture to the final cookie product. Some of the possible reasons for the inconsistence data could be from taking a sample for each cookie. It is difficult to remove a sample from the same relative place on each cookie. Another reason for the variability could be due to the other ingredients that were in the cookies, such as shortening or butter. Because this experiment found no substantial difference between the three trails and each trail had one variable as the cookie with the highest water activity it is concluded that the type of peanut butter, and more importantly the fat from the peanut butter, has no effect on the amount of moisture in the cookie.

The last item that was examined in this experiment was a subjective test, involving a sensory analysis. This information is important because it is valuable to determine how well the cookies tasted, especially when compared to one another. It is important to realize that the higher the score from the sensory analysis the more likeable the cookies were to the taste testers. The results from the hedonic scale sensory analysis tests are averaged and shown in Figure 3. These scores produced results that are very similar to that of the water activity. Trail one found that the cookies most liked by the panelists were the regular peanut butter cookies with an average score of 6.5. In trail two
the most liked cookie was the reduced fat peanut butter cookies with an average score of 9. And finally, the third trial found that the cookie made with simply peanut butter to have the best taste, with a score of 8.6. There could be many reasons why the results from each trail produced different results. One reason could be because, unfortunately, each sensory analysis panel consisted of different people and often times none of the people that were involved in the first trail were involved in the second or third trail. Because none of the people that were used in the sensory analysis tests were repeated it is likely that many of the errors were due to this fact. It is also important to keep in mind that this was a sensory analysis test and because of that fact, it is greatly influenced by people’s previous perceptions and how well they like peanut butter cookies to begin with. From these results, each test providing a cookie with the best taste, it is again difficult to determine which cookie was liked the best overall from the sensory tests and thus it can be concluded that the use of different peanut butter products did not have an effect on the overall taste value of the cookies.

The results from this experiment differ from existing data for a couple of reasons. First, most of the existing data available tests just the taste of the peanut butter alone, not within a product (such as a cookie). Second, the results from this experiment indicate that consumers were not able to distinguish a difference in the quality of the peanut butter cookies compared to other experiments in which people were able to distinguish a difference. One such study was completed in Bulgaria and performed sensory analysis on peanut butter. On a 9-point hedonic scale the results were calculated. The results from this study indicate that the most popular product was crunchy peanut butter, then regular peanut butter, and finally low sodium peanut butter (Beuchat and others 2001).
Another study compared, with a sensory test, three different Jif brands peanut butter (regular, simply, and reduced). The results from this test are similar to that of the other study. The participants of this study found the reduced fat Jif peanut butter to be too salty, but tasted better than the simply Jif peanut butter (Antheil and others 1996). Simply Jif was found to have a bland taste and explains why it was not the preferred choice (Antheil and others 1996). As is evident from the data in this experiment, there was not a substantial difference in cookies when looking at the moisture, by analysis using the water activity machine, and sensory analysis, using a hedonic scale. And there was minimal difference in the crispness of the cookies, determined by the texture analyzer.

Because of the tests run during this experiment and the data that was gathered, analysis has been made to conclude that there is not a great difference in peanut butter-chocolate cookies, when using regular, reduced fat, or simply Jif peanut butter. Because of the conclusion made, the purchase and use of alternative peanut butter products by consumers should be broaden. Many Americans consume peanut butter on a regular basis and using a product that has been modified will help consumers watch there fat, sodium, and sugar intake. It is important for consumers to realize that better taste results are going to be seen when modified peanut butter products are used as an ingredient in a larger food product than when eaten alone. This consideration is based upon the evidence shown in this experiment. Because of conclusions from this research the use of modified peanut butter could be as an ingredient in a larger product and not greatly affect the texture, moisture, or taste.
Finally as with all research it is necessary to look at where further experiments could stem from this data. An interesting study could look at the baking time of the cookies and see how this affects the texture analyzer, water activity, and sensory analysis results. Because the sensory analysis tests produced results indicating that each cookie was liked equally as well, another study could be done at a greater intensity. This would require more cookies and more tasters but the results might indicate that different types of peanut butter do truly affect the cookie’s taste. Another way to look at the sensory analysis is to complete experiments to see what aspects of the cookies made them more appealing to the tasters. Could differences be made in the amount of shortening, egg, or maybe butter? All of these variations could be tested and the results may correlate with the data found in this experiment or may it be very conflicting. Ideally more research will be done in the area of modified peanut butter products in order to offer consumers more choices that will have a positive effect on their health.

RESULTS make lines on graphs and titles with descriptions

Table 1
Average texture analyzer values, in grams, from three different trails with three different variables. The variables include simply, reduced fat, and regular Jif peanut butters.

<table>
<thead>
<tr>
<th>Peanut Butter</th>
<th>Trail 1</th>
<th>Trail 2</th>
<th>Trail 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simply</td>
<td>165.4</td>
<td>207.8</td>
<td>141.4</td>
</tr>
<tr>
<td>Reduced</td>
<td>1232.7</td>
<td>126.4</td>
<td>156</td>
</tr>
<tr>
<td>Regular</td>
<td>246.5</td>
<td>92.1</td>
<td>47.57</td>
</tr>
</tbody>
</table>

Table 2
Values from the water activity machine for three different trails with three different variables. The variables include simply, reduced fat, and regular Jif peanut butters.

<table>
<thead>
<tr>
<th>Peanut Butter</th>
<th>Trail 1</th>
<th>Trail 2</th>
<th>Trail 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simply</td>
<td>0.461</td>
<td>0.569</td>
<td>0.630</td>
</tr>
<tr>
<td>Reduced</td>
<td>0.421</td>
<td>0.640</td>
<td>0.619</td>
</tr>
<tr>
<td>Regular</td>
<td>0.576</td>
<td>0.587</td>
<td>0.620</td>
</tr>
</tbody>
</table>
Table 3
Average scores from the sensory analysis tests from three different trails with three different variables. The variables include simply, reduced fat, and regular Jif peanut butters.

<table>
<thead>
<tr>
<th>Peanut Butter</th>
<th>Trail 1</th>
<th>Trail 2</th>
<th>Trail 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simply</td>
<td>5.7</td>
<td>8.4</td>
<td>8.6</td>
</tr>
<tr>
<td>Reduced</td>
<td>5</td>
<td>9</td>
<td>8.4</td>
</tr>
<tr>
<td>Regular</td>
<td>6.5</td>
<td>8.7</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Texture Analyzer averages from 3 different trails with different types of peanut butter. The different types of peanut butter included Simply, Reduced Fat, and Regular Jif Peanut Butters.

Water Activity values from 3 different trails with different types of peanut butter. The different types of peanut butter include Simply, Reduced Fat, and Regular Jif Peanut Butters.
Sensory Analysis averages from the hedonic scale tests for 3 different trails using 3 different types of peanut butter. The different types of peanut butter included Simply, Reduced Fat, and Regular Jif Peanut Butters.

REFERENCES:

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