Abstract

Peanut butter is a food staple in most American homes which yields many health benefits. The present project looked at the effect had on peanut butter candy by using various forms of peanut butter and soy nut butter. Three trials were conducted using a control with variables of reduced fat peanut butter, natural peanut butter and soy nut butter. Each trial was objectively tested using a texture analyzer and colorimeter. Subjective tests were done to determine taste and graininess. Results showed that all the variables produced a product that was acceptable with soy nut butter candy having a slightly lower approval rating. The overall findings illustrate the point that candy can be made healthier and still taste good.

KEY WORDS: peanut butter, candy, soy nut butter, cholesterol, fat

Introduction

Obesity is a huge problem in America with nearly 66% of the population being over weight or obese. Therefore, it is of great importance for the food industry to try and develop or modify foods in ways that could be healthier, for example making foods with less fat. One such food that is being altered to provide more health promoting benefits is peanut butter. Peanut butter is currently being sold in various healthier forms such as reduced fat, low sodium and low sugar. These alternative forms are in response to current attempts at providing healthier food choices to consumers. The fact that peanut butter is so widely used in the making of various food products provides a great market for the utilization of the various health promoting versions of peanut butter.
There are many current health conditions that peanut products have been shown to have a positive effect on. One such condition is atherosclerosis. A study done by (Hargrove and others 2001) showed that diets high in sources of MUFA, such as peanut butter, could lower LDL cholesterol concentrations. Typical peanut lipid content is ~50% MUFA and 32% PUFA. Some studies have found that LDL enriched in MUFA versus PUFA are less susceptible to oxidation of LDL. Modifying the rate of LDL oxidation is very important in reducing the risk of developing atherosclerosis (Hargrove and others 2001).

Another disease that peanuts and peanut products have been shown to have a positive effect on is in reducing the risk of developing certain types of cancers like colon, prostate and breast. This is due to the presence of phytosterols (PS) in such foods as peanut butter. Peanut butter, which accounts for 50% of the peanuts consumed in the U.S., contains 144-157 mg PS/100g (Awad and others 2000). Phytosterols are plant sterols and are the counterparts of cholesterol, with the most common PS being beta-sitosterol. These plant sterols are absorbed at a lower rate than cholesterol (Awad and others 2000). It is the presence of these plant sterols in peanut butter that provide the protection against cancer development. Regular and natural peanut butter contain 156.7 and 143.5mg/100g respectively. Since the per capita consumption of peanuts in the U.S. is 6 lb/yr; 50% of which is in the form of peanut butter (Awad and others 2000), consumption of peanut butter in its various forms is a great way to get phytosterols into the diet and reduce the risk of developing some types of cancer.

The fact that peanut butter has these various health promoting attributes makes it a product that can be widely used in the making of various food products. Also with the
introduction of health promoting modified versions, peanut butter can be used in ways that nearly everyone can enjoy its benefits. Because of these various peanut butter attributes the objective of this project was to evaluate the effects of different peanut butter types on peanut butter candy. The types of peanut butter used included regular peanut butter as a control, reduced fat and natural peanut butter as well as soy nut butter as variables. The dependent variables measured include: texture, color, taste and graininess. The independent variables included: weighing and measuring of ingredients.

**Methods**

The procedure followed in the making of the peanut butter candy is as follows: first all ingredients were weighed out in grams using a digital gram scale. The measuring tool was first weighed and then subtracted from the total of tool plus the ingredient being weighed in order to get the weight of the ingredient. The recipe used was for Buckeye Candy (VanDyke 1989). The recipe in gram weight for all ingredients is as follows:

57.5 g Margarine  
218.8 g Creamy peanut butter  
164 g Powdered sugar  
11.7 g Shortening  
345 g Chocolate Chips

Cream butter, peanut butter and vanilla together adding powdered sugar until proper consistency is reached. Roll candy into one inch balls, place on wax paper lined cookie sheet. Melt chips and shortening together in top of a double boiler. Keep chocolate mixture in double boiler over low heat while dipping each candy.

The weights for the various peanut butters are:

231.4 g Reduced Fat peanut butter  
230.6 g Soy nut butter  
240.65 g Natural peanut butter
Two batches of candy were made and each batch was divided in half to make the four types of candy. Each half of a batch was altered by adding the desired type of peanut butter. This procedure was repeated three times.

To objectively test the texture and color of the candy the Texture Analyzer was used. The pretest, test and posttest speed was 1.0 mm/s. The force was set at 4.0g and the distance of the probe from the product was 4mm. The cone probe was used and the setting was for fudge. The Hunter Colorimeter was used to test color using L, a, b values.

Subjective testing was done to evaluate taste and graininess of the candy. A structured ranking scale with each mark anchored with a description was used by a sensory panel of 11 semi-trained panelists. These results were tallied to determine the individual characteristic. Taste was evaluated using a 9 point Hedonic scale and the results averaged. The graininess was measured using a similar 6 point scale for graininess with 1 being extremely smooth and 6 being extremely grainy.

9 point Hedonic ranking for taste

_____ Like extremely
_____ Like very much
_____ Like moderately
_____ Like slightly
_____ Neither like nor dislike
_____ Dislike slightly
_____ Dislike moderately
_____ Dislike very much
_____ Dislike extremely
6 point ranking scale for graininess

___ Extremely grainy
___ Moderately grainy
___ Slightly grainy
___ Slightly smooth
___ Moderately smooth
___ Extremely smooth

Each time a trial was made samples along with sensory scorecards were set out for the panelists to sample and rank. Each sample was randomly numbered with a three digit number. Each time a trial was done the samples were given different three digit numbers. Once the trials were completed the numbers for taste and graininess were averaged and put into tables and appropriate figures.

**Discussion:**

The objective of this study was to evaluate the effects of different peanut butter types on peanut butter candy. The results have shown that some changes did occur but without having a negative impact on the final candy product. Using the Hunter Colorimeter to assess color showed that Trials 1 and 3 had very similar results as shown in Figures 1 and 3. Both had moderate L values indicating a lighter more white color. The a values were somewhat low with an average for Trial 1 of 7.7 and 8.4 for Trial 3; these numbers can be seen in Table 1. The lower a values indicate a green color. The b values for Trial 1 averaged 13.7 and 13.3 for Trial 3 which indicates more yellow. The averages can be seen in Tables 1 and 3. Trial 2 had very different L, a, b values, as seen in Table 2. The highest L value, which was given for reduced fat peanut butter, was 20
indicating a darker product. The a values were higher for Trial 2 with an average of 10 indicating a more red color. The b values for this trial were lower than for Trials 1 and 3 with an average of 9 indicating a more blue color. These results for Trial 2 can be seen in Figure 2. A possible reason for the difference in the values of Trial 2 may be due to the fact that the readings were taken right after the candy was made. Therefore, it was very soft and not as firm and set up as Trials 1 and 3 were prior to using the colorimeter.

The texture analyzer results indicated that Trial 1 reduced fat peanut butter required the most force overall to puncture. This data can be seen in Figure 4. Overall the reduced fat peanut butter required the most force for all three trials. The control required the least force for all three trials. The fact that the reduced fat peanut butter required the most force is of interest because when compared to a study done by (Swanson 98) on the acceptability of reduced fat peanut butter cookies the final product was very soft. This difference in texture may be due to the fact that the candy was made with reduced fat peanut butter and the peanut butter cookies were made with a fat replacer. Thus, it may be that a fat replacer is what makes a product soft not just using a reduced fat version of an ingredient such as was used in the candy.

The sensory evaluation for taste of Trial 1 showed that all variables were liked moderately with the candy made with soy nut butter being neither liked nor disliked. The graininess ranged from slightly to moderately smooth for all the variables. These numbers can be seen in Table 2. Trial 2 had somewhat lower taste rankings, ranging from dislike moderately to like moderately. The candy made with the soy nut butter had the lower ranking being disliked slightly. The graininess for all four variables was ranked slightly smooth. Trial 3 candy was ranked the highest for taste. The control and
natural peanut butter were liked very much with reduced fat and soy being liked slightly and neither liked nor disliked respectively. The graininess for the reduced fat and soy were ranked higher than in Trials 1 and 2 with a slightly grainy texture, seen in Table 6. The control and natural peanut butter were ranked moderately smooth. This data is presented in Figure 5 and 6.

The candy made with soy nut butter was ranked the lowest in all three trials. However, the product was not totally disliked, as can be seen in Table 5. It averaged dislike slightly Trial 2 and averaged neither like nor dislike in Trials 1 and 3. Although the soy nut butter was ranked lower it could still be used as an alternative, such as for individuals allergic to peanut butter. In a study done by (Bordi and others 2003), acceptance of a soy enhanced reduced fat chocolate peanut butter candy was compared to a usually formulated chocolate peanut butter candy for acceptance. The peanut butter filling for a chocolate candy product was enhanced with soy protein isolate. The result was a product 5 g lower in fat, 5 g higher in protein with 75 fewer calories and an increase in calcium to 213 mg (Bordi and others 2003). The results indicated an overall liking of the soy enhanced candy that was not significantly different from the control product. This study indicates that a soy enhanced product is not always distinguishable from a non-soy product. Even though the average rankings for the soy nut butter candy in the present project were lower overall, there were panelists who were unable to tell a difference.

Products made with soy such as soy nut butter have been shown to have numerous health benefits. These health benefits come from the presence of isoflavones, which are naturally occurring plant chemicals belonging to the phytoestrogen class. Isoflavones are
found almost exclusively in legumes. The soybean provides the most abundant source of isoflavones. Most soy foods provide a significant dietary source of these bioactive nonnutrients with soy germ products providing one of the most concentrated sources of isoflavones, >20 mg/g (Setchell and other 1999).

A health benefit associated with high intake of soy products is a reduction in total cholesterol. A study done by (Nagata and others 1998), examined the relationship between soy products and serum cholesterol concentration in a community in Japan. The results of the study did show a positive correlation between increased soy protein and decreased total cholesterol. A suggested intake of 25 g soy protein/day would be associated with a decrease in total cholesterol concentration of 0.45 mmol/L (Nagata and others 1998).

Genistein and daidzein are two isoflavens present in soybeans which are believed to reduce cancer risk. Typically more genistein exists in soybeans and soy foods than daidzein (Messina). It has been shown that there is a strong correlation between the intake of soy protein and reduction in the risk of breast cancer in premenopausal Singapore Chinese women (Cord and others 1993). A study done by (Coward and others 1993) showed that isoflavone containing soybean products prevented the appearance of mammory tumors in rat models of breast cancer and inhibited the growth of human breast cancer. These findings were consistent with the hypothesis that Asian women’s lower incidence of breast cancer is strongly correlated with their high consumption of soybeans containing isoflavones (Coward and others 1993). These findings indicate that soybeans are a potentially important link between diet and cancer risk.
It is estimated that Asians consume the equivalent of 10-35 g of soybeans/day per capita which indicates a daily isoflavone intake of 25-100 mg, whereas the average American or Western European consumer may only take in a few milligrams per day of isoflavones (Coward and others 1993). In Asian countries soy is used in many foods and soybeans are consumed in many forms. Commercial soy products used in U.S. foods all contain isoflavones but aren’t consumed in high enough quantities to have the same positive effects as in Asian countries. Because serum isoflavone levels increase in response to soy food consumption in a dose dependent fashion, Asians can have plasma levels around 500 nmol/l (Messina). It is also thought that 30-50% of the isoflavone dose ingested is absorbed and can be done so regardless of form (Messina). If Americans were to consume three servings of soy foods per day they could begin to lower their risk of developing certain types of cancer. Even modest amounts, one to two servings per day, of soy foods could provide sufficient levels of isoflavones to have positive physiological effects (Messina).

Soy foods have even been shown to have positive effects on bone health. Soybeans have high calcium content relative to other plants and high fractional absorption of calcium (Weaver and others). To replace one cup of milk for absorbable calcium would require approximately 3 servings of cooked soybeans (Weaver and others). Soy foods, if consumed in adequate quantities, can provide calcium needed to build and maintain bone and possibly protect against osteoporosis (Weaver and others). This is a unique aspect of soy foods as plants are not known for providing calcium and since maintaining bone health is so important, these findings provide an additional way to get adequate amounts of calcium.
Due to all of the positive health benefits that can come from soy consumption, more soy consumption should try to be had by more Americans. One way to incorporate more soy could be by making things such as peanut butter candy with soy nut butter. The current project has demonstrated that although the candy made with soy nut butter was ranked lower for taste than the other variables it was still only disliked slightly based on the averages from the trials.

Like soy nut butter, peanut butter also offers many health benefits such as lowering the risk of atherosclerosis and developing cancer. To add to the benefits are the fact that peanut butter has non-detectable levels of trans-fatty acids. Trans-fats are of interest due to their increasing plasma lipids and lipoprotein concentration which is strongly linked to the development of atherosclerotic cardiovascular disease.

Manufactures of peanut butter add small quantities of hydrogenated vegetable oils to peanut butter in order to stabilize and prevent separation during handling and storage, however this amount is <0.5g trans–fatty acids per 100 g of stabilizer (Sanders 2001). The serving size for peanut butter is 2 tablespoons, so in order to reach reportable levels of trans-fatty acids in this serving size, the hydrogenated oil added at the upper level of 2% would have to contain 80% trans-fatty acids to be reportable at 0.5 g per serving (Sanders 2001). Therefore, consumption of peanut butter should not concern those monitoring trans-fatty acid intake. Natural types and freshly ground peanuts were not found to be different from commercial peanut butters in trans-fatty acid content (Sanders 2001). Due to all the health benefits offered by peanut butter, it really is a great way to add some health benefits even when used in the making of candy.
Overall the literature provides good evidence as to the health benefits that come from the use of products like soy nut butter and peanut butter either by themselves or use in cooking or baking. The data collected in this project also supports the fact that various types of health promoting peanut butters and even soy nut butter can be used in the making of candy to provide a very acceptable product that not only tastes good but also provides many health benefits. To continue improving the health benefits of candy, margarine could possibly be replaced by a healthier fat such as Smart Balance. Such a product could help to further reduce the fact content and cholesterol level in the candy.

Results

Table 1. Trial 1 Colorimeter Averages

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Table 2. Trial 2 Colorimeter Averages

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Table 3. Trial 3 Colorimeter Averages

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<tr>
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Figure 1. Trial 1 Parameter Values vs. Variables

Figure 2. Trial 2 Parameter Values vs. Variables
Figure 3. Trial 3 Parameter Values vs. Variables

Figure 4. Texture Analyzer Averages
Table 4. Texture Analyzer Averages For All Three Trials

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<th>Natural</th>
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<td>2</td>
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<td>3</td>
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Table 5. Average Taste Rankings, 9 Point Hedonic Scale

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<th>Trial 3</th>
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<tbody>
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<tr>
<td>Reduced Fat</td>
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<tr>
<td>Soy</td>
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<tr>
<td>Natural</td>
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<td>8</td>
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Figure 5. Average Taste Rankings-All Three Trials

Table 6. Average Graininess Rankings, 6 point scale

<table>
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<tr>
<th></th>
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<th>Trial 2</th>
<th>Trial 3</th>
</tr>
</thead>
<tbody>
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<td>2</td>
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<tr>
<td>Reduced Fat</td>
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<tr>
<td>Soy</td>
<td>3</td>
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<td>4</td>
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Figure 6. Average Graininess Rankings-All Three Trials
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