Truvia as a Sugar Replacer in Sugar Cookies
By:
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Nicolette Nazanin
Abstract

Truvia comes from the stevia plant and is 30-45 times sweeter than sucrose (Scientific Committee on Food 1999). It is low in calories making it an excellent choice to be used in diabetic diets or for obese individuals (Scientific Committee on Food 1999). Sugar cookies are an exceptional choice to test for differences in using plain granulated sugar and Truvia as a replacement. In the experiment Truvia was substituted in the recipe in the following forms: 1 cup granulated sugar (control), ½ cup granulated sugar and ½ cup Truvia (variable 1), 1 cup Truvia (variable 2). Variables were labeled with different numbers and test subjectively and objectively. Overall the all Truvia cookie was the hardest to touch and had the largest average texture analyzer value of 1223.7. There were no significant color difference between the variations and each cookie was given a similar subjective rating making it seem that no individual could tell a true difference between each cookie by color or taste. (Word count 163)
Introduction
Truvia is a FDA approved sweetener. It is made from the stevia plant. Rebaudioside A and stevioside are the two major compounds from the stevia plant (Closs and all 2008). The sweetener has been found to be stable under dry conditions and is aqueous stable (Parkash and all 2008). It is 30-45 times sweeter than sucrose and is low in calories (Scientific Committee on Food 1999). This makes it an ideal substitute in sugar-based products for individuals suffering from diabetes or overweight and obesity (Scientific Committee on Food 1999). This replacement gives diabetics options that will be healthier and allow for consumption of foods once thought to be bad due to high levels of sugar. Cookies are often in this grouping.

In May of 2008 Cargill announced Truvia as a natural sweetener for their products. They stated in their news release that, “natural sweetener will provide consumers with a new, natural way to reduce calories in their diet while still enjoying sweet-tasting foods and beverages (Tucker 2008).”

Research for the future is being geared towards the effects of using Truvia as a replacement sugar in hypertensive individuals. Chan and all (2000) found that there was some help in the short term to control hypertension by consuming oral stevioside, a natural plant glycoside isolated from the Stevia plant. But this warrants more in-depth research.

Purpose of the Experiment
The purpose of the experiment is to test if a difference is present between using all sugar, all Truvia or half and half in sugar cookies. Therefore, the null hypothesis is that there will be no difference between using granulated sugar and Truvia as a replacement for sugar in sugar cookies.
Methods

The experiment began by making sugar cookies, the recipe was as followed:
Sugar Cookie Recipe from Crisco.com

Sugar Cookie Recipe
3/4 cup Golden Crisco or Butter-flavored Crisco (shortening)
1 cup granulated sugar
2 eggs
1 tsp vanilla
2-1/4 cups all-purpose flour
1-1/2 tsp baking powder
1/4 tsp salt

Cream Crisco, sugar, eggs and vanilla in large mixer bowl at medium speed of electric mixer until light and creamy. Combine flour, baking powder and salt. Add to creamed mixture, mixing on low speed until well blended. Cover dough and chill 1 hour, if desired, for easy rolling. Preheat oven to 375°F. Roll half of dough at a time. Roll out dough on lightly floured surface to 1/4-inch thickness. Using a cookie cutter, cut in desired shapes. Place on ungreased baking sheets. Roll leftover pieces. Sprinkle with colored decorations or leave plain to decorate when cool. Bake at 375°F for 8 to 10 minutes, or until edges are light brown. (Time will vary with cookie size.) Cool slightly, then remove to cooling rack.

The variable that was of interest was sugar. Variables used were 1 cup granulated sugar as the control (271), variable 1 was ½ cup sugar and ½ c Truvia (564), and variable 2 was 1 cup Truvia (798). For each variable one batch of cookies was made first making the control and baking then moving on to the all Truvia baking that and moving onto the ½ and ½ cookies. After all three were baked for the cooking time which had to be increased to 15 minutes due all the batches not being fully cooked in the center, the cookies were placed onto the plates with appropriate coding numbers. The first trial was placed at the front of the room to be subjectively tested by students and objectively tested on the texture analyzer and colorimeter. After finishing the objective testing was finished trial two cookies were baked and tested the same as the first trial and finally the third trial was completed the same way. Once all trials had been tested the numbers and ranking were collected and analyzed.
Subjective Testing-
Score Card:
Hedonic 9pt scorecard (please place the code number of the cookie next to the statement you agree with)

- Extremely like
- Like very much
- Like moderately
- Like slightly
- Neither like nor dislike
- Dislike slightly
- Dislike moderately
- Dislike very much
- Dislike extremely

Objective Testing-
A texture analyzer was used. Firstly turn on the computer and the texture analyzer, and then select the Texture Expert on the screen. The cone probe was chosen and the sample was placed on the stand, on the computer file, new, graph window was opened selecting T.A. choosing cookie for the product and update was selected. The probe was lowered after selecting quick test run. A test was run for all three samples for all three trials. Hunter Colorimeter was the second test concluded. The Lab Scan Xe was turned on along with the computer. Clicking on universal. The machine needed to be standardized by choosing sensor, standardize clicking OK, placing black glass on port hitting OK, the white glass on port hitting OK. Place sample on port in Petri dish, click Read Sam, average, click OK and click active view button and change scale to Yxy clicking ok.
Results

Tables-

<table>
<thead>
<tr>
<th>Sample</th>
<th>Recipe</th>
<th>X, L</th>
<th>Y, A</th>
<th>Z, B</th>
</tr>
</thead>
<tbody>
<tr>
<td>798</td>
<td>1/2 sugar &amp; 1/2 truvia (798)</td>
<td>8.21, 28.66</td>
<td>0.4475, 9.75</td>
<td>0.3940, 11.95</td>
</tr>
<tr>
<td>564</td>
<td>all truvia</td>
<td>8.87, 29.77</td>
<td>0.4582, 10.83</td>
<td>0.3937, 12.62</td>
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<tr>
<td>271</td>
<td>all sugar</td>
<td>11.19, 33.46</td>
<td>0.4559, 12.41</td>
<td>0.3955, 14.54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>X, L</th>
<th>Y, A</th>
<th>Z, B</th>
</tr>
</thead>
<tbody>
<tr>
<td>798</td>
<td></td>
<td>9.42, 30.63</td>
<td>.45, 10.99</td>
<td>.39, 13.04</td>
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<tr>
<td>564</td>
<td></td>
<td>15.30, 39.12</td>
<td>0.4377, 10.57</td>
<td>0.3989, 16.4</td>
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<tr>
<td>271</td>
<td></td>
<td>19.18, 43.8</td>
<td>0.4348, 11.59</td>
<td>0.3974, 17.73</td>
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</table>

<table>
<thead>
<tr>
<th>Sample</th>
<th>Recipe</th>
<th>X, L</th>
<th>Y, A</th>
<th>Z, B</th>
</tr>
</thead>
<tbody>
<tr>
<td>798</td>
<td></td>
<td>14.05, 37.48</td>
<td>0.4587, 13.28</td>
<td>0.4012, 16.87</td>
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<tr>
<td>564</td>
<td></td>
<td>15.44, 39.29</td>
<td>0.4593, 13.82</td>
<td>0.4022, 17.80</td>
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<tr>
<td>271</td>
<td></td>
<td>16.51, 40.63</td>
<td>0.4565, 13.81</td>
<td>0.4020, 18.22</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample</th>
<th>Recipe</th>
<th>X, L</th>
<th>Y, A</th>
<th>Z, B</th>
</tr>
</thead>
<tbody>
<tr>
<td>798</td>
<td></td>
<td>1.57, 2.51</td>
<td>.006, 1.34</td>
<td>.002, 1.34</td>
</tr>
<tr>
<td>564</td>
<td></td>
<td>4.29, 4.87</td>
<td>.005, .53</td>
<td>.0009, 1.41</td>
</tr>
<tr>
<td>271</td>
<td></td>
<td>1.23, 1.58</td>
<td>.0015, .31</td>
<td>.0005, .69</td>
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</tbody>
</table>

Table 1.1- Sugar Cookie Variations with Codes

Color Hunterimeter

Table 1.2- XYZ & LAB Values for 3 Trials

Table 1.3- Standard Deviations of XYZ & LAB Values
**Texture Analyzer**

<table>
<thead>
<tr>
<th>Samples</th>
<th>Average texture analyzer from all 3 trials (g)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 sugar &amp; 1/2 Truvia</td>
<td>448</td>
<td>197.77</td>
</tr>
<tr>
<td>All Truvia</td>
<td>1223.7</td>
<td>227.52</td>
</tr>
<tr>
<td>All sugar</td>
<td>503.9</td>
<td>256.22</td>
</tr>
</tbody>
</table>

Table 1.4- Average and Standard Deviation Values for 3 Trials Using Texture Analyzer (g)

**Hedonic Ranking**

<table>
<thead>
<tr>
<th>Variations</th>
<th>Ranking Averages from all 3 trials</th>
<th>Objective Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Sugar</td>
<td>5.1</td>
<td>Neither like nor dislike</td>
</tr>
<tr>
<td>50% Sugar, 50% Truvia</td>
<td>5.2</td>
<td>Neither like nor dislike</td>
</tr>
<tr>
<td>100% Truvia</td>
<td>6.63</td>
<td>Dislike slightly</td>
</tr>
</tbody>
</table>

Table 1.5- Average Ranking using Hedonic Ranking for 3 Trials
Chart 1.1- Texture Analyzer Results in Grams for the 3 Variables During 3 Trials
Chart 1.2 - Average values and Standard Deviations for Texture Analyzer

Correlation Value

1  Correlation between all sugar and 1/2/1/2
1  Correlation between all sugar and all truvia
1  Correlation between all truvia and 1/2/1/2
Chart 1.3- Hedonic Ranking Average for the 3 Variations During 3 Trials
Chart 1.4 - XYZ Values from 3 Variables During 3 Trials
Chart 1.5- LAB Values From 3 Variables During 3 Trials


Discussion of Results

During the Subjective Testing it was concluded from individuals after eating the cookies that sample containing ½ cup sugar and ½ cup Truvia was the softest to touch. This was confirmed after the texture analyzer was performed. The value was the lowest for this cookie variable at 448 grams. It was concluded that sample containing all Tuvia was the hardest and it was also confirmed on the texture analyzer with the highest value of 1223 grams.

In Chart 1.3 the Hedonic rankings were averaged for each variable. The all Truiva containing cookie was the given the highest ranking of 6.63 meaning it was Dislike Slightly on the scale with the both the all Sugar and ½ and ½ cookie variables receiving similar values of 5.1 and 5.2 which were neither like nor dislike. With using just the Hedonic Scale there was no significant difference between the All Sugar and ½ sugar/ ½ Truvia cookie. Individuals weren’t able to truly tell a difference in the taste of these cookies, but when the all Truvia cookie was thrown in they were able to tell a difference. This could point to that when all Truvia was used it made the cookie too hard and the taste and texture were not appealing, but if only half the Truvia was used there was no real difference than if just using sugar. This is extremely alluring to individuals suffering from diabetes or looking for a control point in their diets. They would still be able to use regular sugar and lose the taste of that sugar but be able to substitute half that with the Truvia. This would help keep the cost down of buying and using just Truvia. As well as lowering the amount of calories provided in foods by the typically granulated sugar.

All 3 variations had a correlation value of 1 when compared to each other meaning that they are all similar and not really significantly different. Looking at appearance of the cookies involved the XYZ and LAB values. Table 1.2 has the exact values obtained. All values were similar minus the X value average for ½ sugar ½ Truvia variation was lower than the rest by 10 and 6. The cookies all had close color making them look similar. They all were cooked for the same time period making note that not one cookie was burning more quickly than another.

Potential Errors

Some of the potential errors in this experiment could have been not measuring correctly or precisely on the measurements in cups, teaspoons, etc which could have altered the results. Another potential source of error could be that the texture analyzer or the color Hunterimeter could not have been calibrated correctly. Temperatures of the oven might have affected the fact that the cookies took longer than what the recipe stated.
Reference:


