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Sensory Evaluation of Sugar Substitutes in Peanut Butter Cookies

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Abstract

Background: People with Diabetes Mellitus are faced with the challenge finding and making items with sugar substitutes.
Objective: The purpose of this experiment was to observe and record the differences in visual, sensory, and flavor characteristics of peanut butter cookies baked with different sugar substitutes to determine if a good alternative exists.
Methods: Four peanut butter cookie samples were made, consisting of one control and three sugar substitute variations (sucralose, monk fruit, and stevia). A subjective sensory evaluation was conducted, which was followed by a statistical analysis in Microsoft Excel and a nutritional analysis in NutritionistPro. Evaluators were randomly chosen.
Results: Sucralose had the highest scores for most of the characteristics evaluated.
Conclusion: Using a sugar substitute can still produce a pleasing baked good for individuals who are trying to limit their sugar intake.

Purpose of Study

The purpose of this study was to evaluate the use of different sugar substitutes in the place of white granulated sugar in peanut butter cookies by analyzing how flavor, appearance, texture, and aftertaste affected. The evaluation of the different sugar substitutes will decipher the acceptability of peanut butter cookies made with different sugar substitutions in order to determine what the best alternative is for those who cannot consume or are looking to avoid consuming regular sugar.

Significance of Study

Diabetes mellitus is a "group of diseases characterized by prolonged high blood glucose concentrations" and it is due to defects in the insulin secretion, insulin action, or both[2]. The result is hyperglycemia and leads to a change in the metabolism of carbohydrates, proteins, and fats. Type 2 diabetes and prediabetes are becoming increasingly prevalent and is the costliest illness in the United States, with the total expenses coming in at roughly $327 billion. This disease plagues more than four hundred thirty-three million adults and children in the world and is expected to rise to seven hundred million in 2045. The age of developing this illness is decreasing and thus the total number of people who develop diabetes is increasing. The medical nutrition therapy for this disease involves implementing a diet that improves blood pressure, and dyslipidemia, and having an overall lowered blood glucose level. One of the simplest ways to decrease the consumption of carbohydrates and sugars, is to substitute them with nonnutritive versions[1]. This project is significant because it will highlight the ways that recipes can be modified in order to be more conscientious of carbohydrate intake and emphasize the importance and impact of nonnutritive sweeteners in the realm of diabetes treatment.

Methodology

The oven was preheated to 325 degrees Farenheit. During lab, the first batch of cookies made was the control peanut butter cookies with regular white granulated sugar. The three ingredients were gathered, one egg, one cup of natural peanut butter, and one cup of white sugar (See Table 1).

Table 1. Recipe

	Control	Sucralose	Stevia	Monk Fruit
Peanut Butter	1 cup	1 cup	1 cup	1 cup
Egg	1	1	1	1
Sugar/Sugar Substitute	1 cup	1 cup	1 cup	1 cup

One egg was cracked into a medium sized bowl. The peanut butter was placed in a one cup measuring cup, and then put in the bowl with the egg. After this, one cup of sugar was placed in the bowl. The dough was then mixed using an electric hand mixer for approximately thirty seconds. The sides of the bowl were then scraped down with a spatula. A spoon was used to scoop the dough out and then it was rolled into a ball, then placed onto the baking sheet and repeated for the rest of the dough, placing them all two inches apart. When all the dough balls were on the pans, they were lightly pressed down until they were about half an inch thick and scored in a pound sign look using a fork. The pans then went in the oven and were left to bake for fifteen minutes. After the timer went off, they were taken out of the oven and let sit for ten minutes. The cookies were transferred onto a metal cooling rack and let cool and solidify further. These steps were repeated three more times, but each of the three batches had a cup of the different sugar replacements (monk fruit sweetener, stevia, sucralose). A nutrient analysis will be conducted on all the ingredients/recipes used.

Table 2. Peanut Butter Cookie Score Card

Cookie Score Card				
Characteristics	Samples			
	501	256	984	365
Exterior Color 1=much too pale 2=pale 3=golden brown 4=brown 5=burned				
Interior color 1=much too pale 2=pale 3=golden brown 4=brown 5=burned				
Tenderness 1=much too soft 2=soft 3=chewy (neither too soft nor too crunchy) 4=crunchy 5=much too crunchy				
Moisture 1=too dry 2=slightly dry 3=neither dry nor moist 4=slightly moist 5=very moist				
Flavor 1=unsweet 2=a little sweet 3=pleasantly sweet 4=too sweet 5=much too sweet				
Aftertaste 1=no aftertaste 2=slight aftertaste 3=moderate aftertaste 4=strong 5=very strong aftertaste				

Methodology continued

After the cookies were done baking and cooled, they were placed onto a paper plate with corresponding numbers that were assigned to each variation.
Twenty-five individuals were randomly selected from the Nutrition floor of Jones Science Center to taste test each variable that was prepared. Each plate was labeled with four numbers indicating a different variation of the number: 365, 501, 256, and 984 (See figure 1.). The participants tasted each cookie and rated them in six categories on the scorecard (See Table 2).

Figure 1. Peanut Butter Cookie test plate

After everyone evaluated all four peanut butter variations, they filled out a scorecard and handed it in. The scorecards were collected, and the data was placed into an excel document to be analyzed. The participants has mixed feelings about some of the variants. Each rating varied for each category on which was the most pleasing and the means were recorded (See Figure 2).

Results

Based on exterior color, the control scored right at the desired number of 3 with a follow up of sucralose at 3.25. Both monk fruit and stevia scored at about 3.75.

Based on interior color, the control scored right at the desired number of 3 with a follow up of sucralose at 3.5. Both monk fruit and stevia scored at about 3.15.

Based on the tenderness, the control and monk fruit has similar deviations to the ideal score, with the control being at 3.25 and monk fruit being at 2.75. Both sucralose and stevia had less than desirable scores at 2.25.

Based on moisture, control had the closest to most desirable score at a 2.75. The rest of the variants scores varied from 2 to 3.75.

Based on the flavor, the sucralose had the closest to most desirable score at a 2.75. The rest of the variants scores varied from 3.85 (monk fruit), 2.6 (control), and 2 (stevia).

Based on the aftertaste, the control had the least aftertaste with a score of 2.6. Both sucralose and monk fruit had scores of 2.75 and stevia was the least desirable at 3.

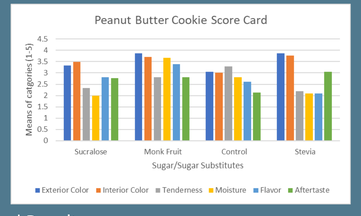

Figure 1. Score Card Results

Results continued

Using sugar alternatives significantly decrease calories, carbohydrates, and total sugar content of a peanut butter cookie (see Table. 3). Any of these sugar alternatives are a reasonable option for those wanting to limit their sugar intake. See Table 3. The stevia and monk fruit had the lowest calorie content at 51.3 kcal. The stevia had the least amount of carbohydrates at 2.1 g. The stevia and monk fruit had the least number of grams total sugar at 0.8 g. The sucralose, stevia, and monk fruit all had no added sugar.

Table 3. Nutrient Analysis of variations

	Control (sugar)	Variation 1 (sucralose)	Variation 2 (stevia)	Variation 3 (Monk fruit)
Kcal	76.5 kcal	53.9 kcal	51.3 kcal	51.3 kcal
Carbohydrates	8.6 g	2.8 g	2.1 g	8.3 g
Total sugar	7.3 g	1.4 g	0.8 g	0.8 g
Added sugar	6.5 g	0 g	0 g	0 g

Since sucralose ranked second in three of the six sensory evaluation categories and ranked the highest for flavor and aftertaste compared to the control, and has no added sugar, it could be considered the most acceptable sugar alternative for peanut butter cookies.

Conclusion

The purpose of this study was to identify an acceptable sugar alternative in peanut butter cookies. Each of the sugar substitutes was able to efficiently replace the essential function of sugar in the browning, however sucralose may be the preferred sugar alternative as it had the most pleasing scores. This knowledge is important because it can give people more freedom in choosing a substitute and helping them be more knowledgeable about their options. It also provides more options that are more acceptable to most people who are struggling with health conditions in which they need to watch their sugar intake.

References

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