The Effect of Adding Whole Flaxseed to Chocolate Boxed Cake Mixes

Laura Searfoss
F&N 453
November 19, 2007
Abstract

Flaxseed is emerging in the food industry as a source of many health benefits such as helping to reduce high cholesterol, high blood pressure, helps to control type I and type II diabetes, lupus, and kidney disease and is still undergoing testing with respect to help reducing the risk of certain cancers. The objective of this project was to determine if the texture, water activity or any sensory characteristic changed with the addition of 28 grams of whole flaxseed to one box of Betty Crocker Super Moist Chocolate Fudge Cake Mix. Upon completion of the experiment, it is believed that there is no significant difference between the cake with flaxseed added and the control cake which has no flaxseed added.

Introduction

Flax seed is easy to add to just about any meal. Depending on the type of flax seed, it can be ground to a fine powder to be sprinkled in baked goods or sauces, sprinkled on cereal, or even in tablets to be taken orally. A flax seed mixture can be used as a substitute to eggs, but creates a gummier, denser product (Jenkins, 1999). The goal of this project is to maintain all the same characteristics of the cake, but incorporate the health benefits that flax seed can bring to the diet.

Flax seed has been used for its medicinal purposes for a long time and is one of the most studied oilseeds in the world (Oomah, 2001). Cardiovascular disease is one of the leading causes of death in some countries and the consumption of long chain polyunsaturated fatty acids have been associated in reducing morbidity rates for cardiovascular disease (Paschos, 2007). According to research, flax seed has shown beneficial effects for breast, colon, prostate and thyroid cancer. In addition to the cancer benefits, flax seed can help reduce the relative risk factors associated with high cholesterol, high blood pressure, type I and type II diabetes, lupus, and kidney disease (Westcott, 2003). Flax seed is also found to limit atherosclerotic development protect against cholesterol-induced vascular constriction (Dupasquier, 2006). The aforementioned health benefits are contributed to the nutrients in the seed which include compounds such as alpha-linolenic acid, ligands and dietary fiber to name a few. Flax seed is also known as Linum usitatissimum L. which is from an old cultivated plant.
Flax seed can be used as whole seeds, crushed seeds, or pressed oil depending on the application. Whole seeds were used in the addition of flax seed to chocolate cake mixes.

The water activity was of a concern due to the number of water-soluble polysaccharides present in flax seed. Each cultivar of flax seed has different monosaccharide and polysaccharide components which alters the amount of water that the flax seed will absorb (Oomah, 1995). It is for this reason that water activity can vary between trials based on if the flax seed being used came entirely from one cultivar or if the flax seed came from multiple cultivars. Based on the possibility that the water activity would change, the texture would change along with it.

One cake mix will have 1 ounce or 28 grams of flax seed added to it. This will increase the total caloric content of the entire box, not just one serving, by 150 calories. In addition to the caloric content it also provides 8 grams of dietary fiber and 5 grams of protein again for the entire box.

**Methods**

The recipe that is going to be used is the traditional recipe on the back of Betty Crocker Super Moist Chocolate Fudge Cake Mix. The first recipe is in percent by weight which is used in industry, and the second one is in grams. The second recipe is the standard for one boxed cake mix.

- Cake Mix - 46.2%
- Flax Seed - 2.5%
- Water - 28.1%
- Vegetable Oil - 9.7%
- Eggs - 13.4%
- Cake Mix - 517 g
- Flax Seed - 28 g
- Water - 314.7 mL
Vegetable Oil - 109 g

Eggs - approximately 150 g

The ingredients will be all added together in a bowl and then beat on a low speed for 30 seconds, and continued onto a medium speed for 2 minutes. After being mixed, the batter will be poured into a 13" x 9" pan that has had the bottom of the pan greased and baked for 29-34 minutes at 176.6 °C for a shiny metal or glass pan or baked at 162.7°C for a dark or nonstick pan. The cake will be ready when a toothpick comes out clean when inserted into the center of the cake.

Specific to the experiment, a nonstick pan was used for all trials. A hand mixer was used to blend the ingredients starting on speed two for 30 seconds and then increasing the speed to 4 for two minutes. This was timed using a stop watch to insure consistency between trials.

Once the cake was cooled, the samples were taken to analyze the water activity using the water activity meter and texture using the texture analyzer with the cone probe under a cake setting. A sensory panel was then used to analyze the flavor and appearance of the cake products. Attached is the sensory panel evaluation form in the appendix.

Results

Table 1. Water Activity results using the Water Activity Meter

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>0.813</td>
<td>0.78</td>
</tr>
<tr>
<td>Trial 2</td>
<td>0.863</td>
<td>0.754</td>
</tr>
<tr>
<td>Trial 3</td>
<td>0.791</td>
<td>0.819</td>
</tr>
</tbody>
</table>

Table 2. Texture results using the Texture Analyzer

<table>
<thead>
<tr>
<th></th>
<th>Control (g)</th>
<th>Test (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>42.6</td>
<td>23.4</td>
</tr>
<tr>
<td>Trial 2</td>
<td>22.9</td>
<td>22.8</td>
</tr>
<tr>
<td>Trial 3</td>
<td>23.2</td>
<td>24.7</td>
</tr>
</tbody>
</table>
Figure 1. Water Activity Results Comparing Control to Test

Figure 2. Texture Results Comparing Control to Test
Figure 3. Trial 1 Sensory Results; Sample 412 control and Sample 928 test

Figure 4. Trial 2 Sensory Results; Sample 615 control and Sample 462 test
Figure 5. Trial 3 Sensory Results; Sample 531 control, sample 197 test

**Discussion**

The water activities of the control and test samples for all three trials are relatively similar as can be seen in Table 1. When looking at this table, the test products tend to have a slightly lower water activity. This can be accounted for due to the addition of flax seed to the test product. In most flax seeds, there are approximately 3.6 to 8% of water-soluble monosaccharides and polysaccharides present (Oomah, 1995). This could be part of the reason why the water activity of the test products was slightly lower since not all of the flax seed was water-soluble.

The texture of the control and test samples was again relatively similar except for the control product for trial one as can be seen in Table 2. Baking a product with flax seed addition can cause some textural differences which can create a negative characteristic for the addition of flax seed (Pohjanheimo, 2006). This reaction can vary depending on the procedure used to extract the flax seed. The extraction conditions can yield different varieties of mono and polysaccharides creating different textural components (Oomah, 1995). Some sources of error which could account for the
deviation include the surface of the cake not being even when analyzed, the temperature of the cake not cooling down to room temperature before being analyzed, cake not being mixed as well as the others before baking. It is interesting to note that only the first sample made was the one with the texture deviations. This could also be a result of the fact that the first trial hardly ever goes as planned.

For the sensory analysis portion of the experiment, a requirement was put into place prior to the sampling. To get an honest opinion to determine if the addition of flax seed was noticeable, the panelists had to like chocolate cake. These results can be seen in Figures 3,4 and 5. There is some uniformity between the test and control samples, which was the ultimate goal of this project. Some panelists stated that there was a small difference, but that they couldn’t figure out what it was. The biggest complaint on the sensory ballots was that there was no icing on the cake. Icing was left off of the cake to avoid skewed results due to the flavor of chocolate icing and how it would change the appearance of the cake.

For the scope of the initial project, the addition of 28 grams of flax seed was successful. Though there were some small differences in texture and water activity as previously mentioned, the sensory results indicate that most individuals would still consume the cake and that the difference wasn’t that noticeable. Some possible sources of error include fluctuations of the texture analyzer because it broke the next day after it was used to evaluate the samples, a non-uniform cooling time prior to analysis, and differences between baking pans since two pans were used simultaneously for each trial.

To continue further work, it is advisable to do another sensory study after storing the cake for a few days. Flax seed can pick up cadmium from the environment creating unwanted reactions of unsaturated fatty acids, deteriorating the quality and sensory characteristics. The main characteristics to focus on would be flavor and texture (Pohjanheimo, 2006).
References


Mayo Clinic. Flax seed and Flax seed oil (Linum usitatissimum). Internet Source. Available at: http://www.mayoclinic.com/health/flaxseed/NS_patient-flaxseed


Appendix

Sensory Analysis

Please rate the samples an overall appearance
Sample 412
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Sample 928
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Please rate the samples on texture
Sample 412
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Sample 928
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Please rate the samples on flavor
Sample 412
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Sample 928
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Please rate the samples on moistness
Sample 412
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike

Sample 928
__ Extremely Like
__ Moderately Like
__ Slightly Like
__ Neither Like nor Dislike
__ Slightly Dislike
__ Moderately Dislike
__ Extremely Dislike