Conclusion (Will be at the end of the experiment page!)

* + Data Analysis & Conclusion
    1. Experiment 1: All purpose flour has “9-13 percent [of protein]…[and is used for] cookies, cakes, quick breads…” (Gardiner and Wilson). Water combines with the gluten in the dry flour and creates a sticky, viscous paste. This allows for a more stable structure to hold air pockets after fermentation during baking. This higher the gluten, the more stable the cake will be.
    2. Experiment 2: Gluten Free flour has the 0% count of protein. The gluten free flour is made from rice flour and potato starch, (along with a few other things), this could give the batter and cupcakes the grainy texture that was not found in the all purpose experiment. The fact that the cupcakes were dry could be a miscalculation on my part when it came to measuring all of the ingredients, or possibly baking the cupcakes too long causing them to dry out . This gluten free flour was also an ‘all purpose’ gluten free flour, which could be used as a substitute for those that have a gluten allergy. The other added ingredients to the flour give the batter the ability to rise and ferment while baking just like the refined all purpose flour from experiment 1.
    3. Experiment 3: The pastry flour, with its small amount of protein, did not do a very good job at making a cupcake. The small amount of protein in the flour gave the ability to trap some air bubbles during baking and held the structure that it had when spooned into the liners. On the bag of the Arrowhead Mills pastry flour it says “ flour provides a finer texture and light consistency with lower gluten…perfect for flaky and delicate pastries and cakes.” I think that since I used a cupcake recipe with this flour, the eggs and sugar caused the cake to be a little dense and have a nice crumble factor when I pulled them apart.
    4. Experiment 4: Gluten flour was used for this experiment, gluten flour normally

has “30-40 percent [protein]…and [is] added in small amounts to boost the protein content of low-protein flour for yeast bread” (Gardiner and Wilson). The bag of Bob’s Red Mill gluten flour also reads “when combined with water, it becomes highly elastic and taffy-like. Added to bread dough, it helps retain the gas and steam from baking”. The high content of gluten plus a cake recipe caused the cakes to become play dough and taffy-like after being baked. A high gluten flour is good for baking in bread, or with other coarse flours in recipes to stabilize the dough’s structure when baking.

* + 1. Conclusion: My hypothesis stated that “If the wheat used makes flour with a high protein/gluten level, then protein will act as a more stable and firm agent in the batter and the cupcakes will have the consistency of bread.” As shown in the experiments, the higher the amount of gluten (as in the gluten flour), the more like the consistency of bread the cupcakes were. The batter turned more dough-like, and there was less fluff than in the all purpose flours (refined or gluten free).A lot of the experiments turned out to be bland, but I do not think that this was a reflection on the flour, I think that it was a reflection on the simplistic easy recipe I found online .A similar experiment conducted by FSTA (Food Science and Technology Abstracts) tested two glutenin and mixing times of dough in baking. In their abstract they stated that “the ratio of glutenin I and II was generally higher in bread wheat flours exhibiting long mixing times and strong dough.. These flours also contained the highest amount of unextracted proteins.” (Huebner). Their experiment shows that higher protein plus a longer mixing time gives the baked bread a stronger composition. Although I did not test the mixing of my batter, I think that the more mixing of the dough could let more air enter the batter before baking it. Add the high protein to support the extra air pockets and you get a strong, elastic bread after it’s baked. Overall, I think that the best flour to use here would be the refined all purpose flour. This flour has the best balance of gluten plus other nutrients that help the cake ferment and stabilize into a fluffy texture, without being grainy. If I were to redo this experiment, I would measure a little more carefully, have a set baking time (whether the cupcakes are done or not, to get an accurate reading of the flour’s affect), and to test a flour made specifically for cakes.
  + Bibliography
    1. Gardiner, A. Wilson, S. (1998). In *Protein Content of Flour .* Retrieved Apr. 17, 2011, from <http://www.exploratorium.edu/cooking/bread/flour.html>
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