

NUTR 320 Science and Methods of Food Preparation

Recipe Modification Project: Yeast Bread Gluten-Free

Gluten-Free Pumpkin Bread

FINAL REPORT

Breaking Bread

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Write a brief summary that includes the background for why you made the modifications and the in general terms, the ingredient changes that you made to the standard recipe to modify it.

In this project, we made gluten-free pumpkin yeast bread by substituting eggs with banana and all-purpose flour with brown rice flour. We chose this modification because banana is rich in protein, potassium and fiber. Brown rice flour is not only whole grain, but also gluten-free; for this reason we decided to use brown rice flour in place of all-purpose flour. We also used xanthan gum to act as a binder for the gluten-free bread.

Describe the differences or similarities you observed in each recipe as you were preparing it.

In the preparation stage, both recipes required a lot of flour and yeast. We had to add more milk and puréed pumpkin than the recipe called for because the flour mixtures were too dry. Another similarity between the recipes was that both mixtures had a uniform color. Initially the dough of the original recipe was sticky, however during kneading it formed a smooth pliable ball. This was not the case for the modified version. We were not able to form a proper dough for the gluten-free bread because it was too crumbly and kept falling apart, so we ended up shaping it according to the loaf pan size. When baked in the oven, the gluten-free bread did not rise while the original bread did.

Describe the differences or similarities you and your taste testers observed in the final product for both recipes.

Based on our observation and evaluation, we thought the crumb of gluten-free bread was denser than that of original bread. The gluten-free bread had a grainy and sandy texture, whereas the original bread had a slight airy and chewy texture. Moreover, the crust of gluten-free bread was not bread-like, unlike the crust of original bread. The gluten-free bread was unexpectedly bitter and the original bread tasted bland. The breads did not have a strong pumpkin flavor, especially the gluten-free bread. Sweetness was missing in the breads too. Choosing between original bread and gluten-free bread, all of our test-tasters preferred the original bread, even though it did not meet their overall expectations. The gluten-free bread was highly disliked due to its poor appearance, gritty texture as well as bitter and unpleasant taste.

Compare the projected outcome you made in RMP#2 with the final outcome of your product.

We projected that brown rice flour would make the gluten-free bread dense in volume with no air pockets. The bread would also have a chewy texture and prominent pumpkin flavor.

Furthermore, by substituting eggs with banana, we expected that the gluten-free bread would taste sweet and moist as banana has a lot of sugars and it contributes moisture. We also expected that the gluten-free bread would brown more since the sugars from banana would caramelize as the bread cooks. Eliminating eggs in the modified recipe would decrease the structure of the gluten-free bread. In the final outcome, the gluten-free bread was very dense as expected; however, it did not have the volume and structure like regular yeast bread and it looked more like a brownie instead. In terms of appearance, the gluten-free bread had cracks formed throughout its surface and the color of the bread and dough were similar. The gluten-free bread did not have a chewy texture and there was no pumpkin flavor at all. Although the substitution of banana increased the sugar content, the bread still lacked sweetness. Caramelization did not occur in the gluten-free bread. Additionally, it was extremely dry, as the banana did not provide moisture.

Describe the scientific principles for why the observed changes occurred.

Brown rice flour does not contain gluten, and with yeast as the only leavening agent, we did not observe much rise in the altered recipe. Carbon dioxide gas produced in yeast activity was more likely to escape from gluten-free dough and therefore the bread had a low, dense volume. When gluten “traps” the carbon dioxide gas, the volume of the dough increases as it rises and expands, giving the bread its structure and shape. Gluten-free bread recipes normally do not require the same processing as wheat flour recipes like the one followed in this assessment. Activities like kneading and punching down the dough are unnecessary and often detrimental to the rise of gluten free loaves. Our gluten-free dough showed no signs of rising after kneading for a few minutes and did not rise once baked.

The addition of banana did not provide enough liquid to the dough and did not help bind ingredients. This contributed to the sandy texture our tasters described in the final product. We expected the banana to act as more of a binding agent, equivalent to what an egg would provide to the mixture. Also the original recipe did not have enough liquid, and by altering the recipe, the

banana did not compensate for the inadequate liquid to flour ratio. Tasters also found that the banana did not make the modified recipe taste much sweeter than the original. Xanthan gum was added to act as an additional thickener to compensate for the lack of gluten and binding agents. When mixed with a liquid, xanthan gum creates a gel that usually allows recipes to achieve the elasticity and stickiness desired in a bread dough. In our recipe, it is possible that not enough xanthan gum was used to achieve a desirable texture in the finished product.

Describe the nutritional changes that you observed between the two recipes.

Nutrient	Original Recipe	Modified Recipe	Changes
Total calories	336 kcal	396 kcal	Increase
Sugar	11 g	12 g	Increase
Fiber	3 g	6 g	Increase
Sodium	554 mg	548 mg	Decrease
Potassium	194 mg	391 mg	Increase
Total fat	4 g	5 g	Increase
Saturated fat	1 g	1 g	No change

For our modified recipe, we substituted eggs with banana and all-purpose flour with brown rice flour. Banana is lower in fat and has less cholesterol, but it didn't change the recipe as a whole because of the use of the brown rice flour. Banana is also higher in fiber and potassium. The brown rice flour also contributed to the increase in fiber for the modified recipe. The sodium in our modified recipe decreased because of omitting the eggs. The modified recipe was higher in sugar because of the use of banana. The total fat of the modified recipe increased because of the use of brown rice flour. All-purpose has 1.2g of fat per cup and brown rice flour has 4.4g of fat per cup. The calories increased because of the brown rice flour. All-purpose flour has 455 kcal per cup and brown rice flour has 574 kcal per cup. We were also accommodating patients with a wheat allergy and brown rice flour is gluten-free.

Future changes to improve the modified recipe.

We have evaluated several factors that would improve our recipe in the future. We found the brown rice flour to be very dense. Instead we will use white rice, buckwheat flour or a combination of both. We also did not find the banana to be a good emulsifier. We plan to keep the eggs in the recipe, as they will provide valuable structure to the dough. The use of yeast did not play a major role since it is gluten-free and we are not making gluten. Instead we will use baking powder and/or baking soda. The bread came out dry, so we will add more milk. The biggest disappointment of the bread was the lack of pumpkin flavor. We plan to add more spices, like cinnamon, cardamom, and pumpkin spice, to enhance the flavor.

Original Recipe	Modified Recipe
2 tablespoons instant or active dry yeast	2 tablespoons instant or active dry yeast
½ cup lukewarm milk	½ cup lukewarm milk
2 large eggs	½ cup ripe banana puree
1 ½ cups puréed pumpkin, either fresh or canned	1 ½ cups puréed pumpkin, either fresh or canned
2 tablespoons vegetable oil	2 tablespoons vegetable oil
6 ½ cups unbleached all purpose flour	6 ½ cups brown rice flour
½ cup brown sugar	1 ½ teaspoons xanthan gum
2 ½ teaspoons salt	½ cup brown sugar
½ teaspoon ground ginger	2 ½ teaspoons salt
½ teaspoon ground cardamom	½ teaspoon ground ginger
	½ teaspoon ground cardamom