



*I am just loving feeding, nurturing and using my sourdough starter. Thank you, Carol, so much for introducing me to this wonderful form of baking.*

...Judy Crawford, Martha's Vineyard

## **September/October 2013: Living with and Experimenting with Sourdough**

I love caring for and working with sourdough. In many ways, my sourdough culture has become my loyal pet now that our family dog and cat are no longer living. My starter, made of flour and water, is a magical mixture of live yeasts and bacteria feeding on the flour's starch. It is fascinating to sense the presence of these invisible creatures that whoosh about in our everyday environment. I see them at work every time I feed my starter with flour and water and then give it a vigorous stir. Invisible, yet they leave a visible footprint of their labors: After each feeding, my starter bubbles to life, rising higher and higher in its "keeping" jar, a tall two-quart canning jar that is now flour-encrusted from use. To keep it vibrant, I feed my starter and bake with it often. Baking sourdough bread and experimenting with sourdough in other recipes is a remarkable, whimsical, and endlessly fascinating science.

My fascination with the science and the art of sourdough baking led me last fall to write a newsletter that I called *Reviving Culture*.<sup>1</sup> In that piece, I explored sourdough in its many aspects, including its science, health benefits, and many advantages compared to commercial yeast bread, while also offering a series of tested sourdough recipes. But, at that time I left out an important piece of my research concerning sourdough's positive, modulating impact on blood sugar—something that has important implications for the prevention of insulin resistance, diabetes, and obesity. I felt then that my experimental results required more testing, and so now I want to share these results with you.

But first, a quick review of sourdough's other many benefits...

Using sourdough in baking contributes to taste, texture, and extends shelf life. Beyond curbing blood sugar reactions, our major focus, sourdough promotes good health in a variety of other ways: Sourdough degrades the phytic acid found in the bran of whole grains which would otherwise block digestive enzymes (pepsin, amylase, and trypsin) and the absorption of the vital minerals found in grains such as potassium, phosphorus, calcium, magnesium, iron, copper and zinc. Sourdough fermentation,

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<sup>1</sup> See <http://pathways4health.org/2012/10/22/novemberdecember-2012-reviving-culture-and-the-health-benefits-of-sourdough/>

like yogurt fermentation, also creates new nutrients—bacteria synthesize vitamins, including B<sub>12</sub>, while yeasts boost lysine, the limiting amino acid in grains, to help make sourdough bread a nearly complete protein.

Sourdough can also help alleviate digestive issues related to gluten intolerance by reducing gliadin and avenin, two culprits that elicit an immune response in all people. And, sourdough supports gut health and immunity by slowing the fermentation of fiber; generating polysaccharides which contribute prebiotics; and feeding micro-flora in the intestinal wall.

### **The Power of Sourdough to Control and Sustain Blood Sugar**

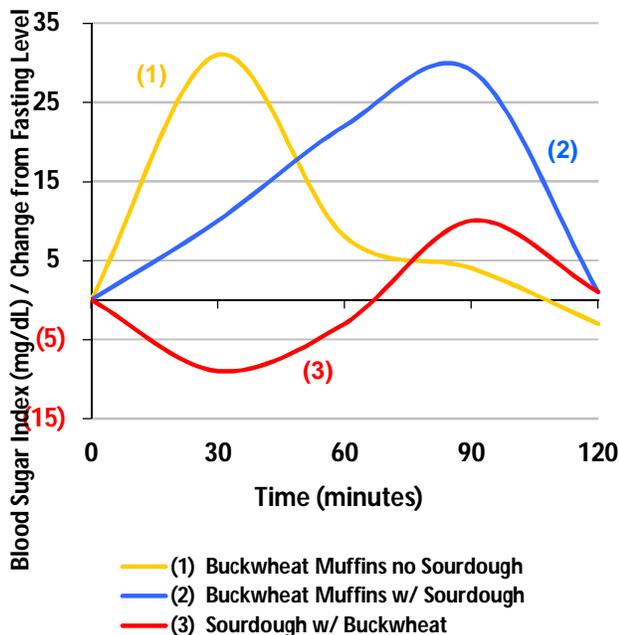
One of sourdough's greatest selling points, and our subject here, is its ability to curb the blood sugar spike and insulin reaction— "metabolic stress"—often associated with the consumption of carbohydrate-rich baked goods. It is a well-documented fact that adding sourdough to the dry ingredients of a baked good and allowing these to soak for some hours before baking reduces the glycemic impact of flour. The scientific reason that sourdough is able to do this is that *lactobacilli in sourdough feed on the maltose in flour, producing lactic and acetic acids. These acids then slow the rate at which starch is digested and assimilated* (see *Reviving Culture* for complete discussion).

What is interesting from my research using a buckwheat muffin recipe to which I added varying amounts of sourdough (see Charts 1 and 2 and related comments on the page that follows) is that in all cases, my blood sugar peaked not at 30 minutes after consuming the test samples, but rather at 90 minutes...an entire hour later than what might be expected. And, with an extreme ratio of sourdough used in buckwheat muffins, 75% sourdough and 25% buckwheat flour, my blood sugar (line 3, Chart 1) actually dipped initially after eating. This is probably due to the modulating blood sugar effect not only of sourdough but also of the fat (coconut oil and egg) and protein (egg) in the recipe, since protein and fat also help blunt the blood sugar reaction to carbohydrates. Note in line 5, Chart 2, for example, how spreading a fat like butter on a muffin will limit and delay the blood sugar reaction. Incorporating sourdough, or protein or fat for that matter, helps curb and sustain blood sugar to spare the body from sending oodles of insulin to the rescue. Charts 1 and 2 speak to the power of sourdough to modulate and yet sustain blood sugar; they illustrate in graphic form the satiety and feeling of satisfaction provided when sourdough is added to baked goods.

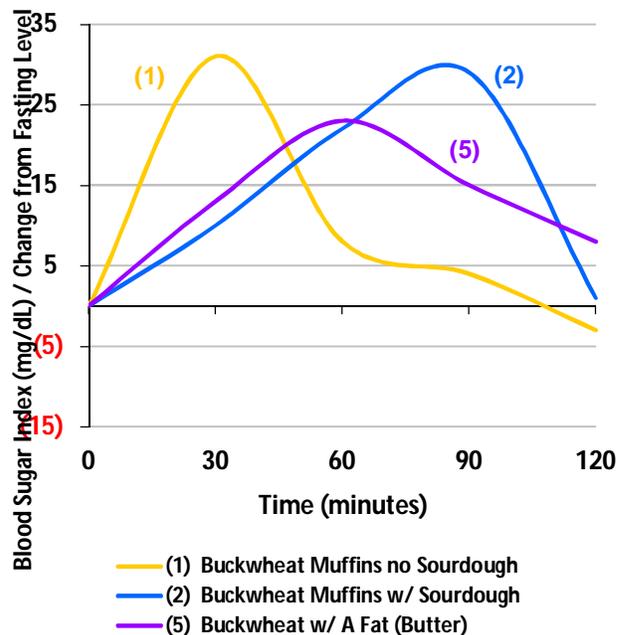
As mentioned earlier, when I did these experiments last fall, I felt that I should go a step further and test sourdough in isolation to try to confirm the timing of these results. I wondered how my blood sugar might react on two separate mornings if, as the first morning meal, I tested sourdough starter baked as "bread" against a white "bread" made with the same type flour, with water and yeast added. Granted, this is not my favorite breakfast, but it was worth giving the time on two mornings, pricking my fingers, and recording my blood sugar reading from a blood sugar monitor to try to answer this question.

**Comments on Charts 1 and 2:** I conducted my own blood sugar tests using a modified recipe for buckwheat muffins to which I added varying amounts of sourdough. Recipes were tested as the first morning meal after a 12 hour overnight fast using a glucose monitor. Sourdough as the major component (75%) of the recipe, with very little added buckwheat flour (25%), curbed my blood sugar so that over the two hours of testing, my blood sugar hovered around the zero line. Universally with every test, my blood sugar peaked not at 30 minutes, which is standard, but at 90 minutes. This suggests the satiety and staying power that sourdough can lend when you add it to your favorite recipes.

**Chart 1: Sourdough's Moderating Role on Blood Sugar: Buckwheat Muffins with Varying Amounts of Sourdough**



**Chart 2: Buckwheat Muffins, With and Without Sourdough; and With an Added Fat (Butter)**



Source: Pathways4Health.org

- 1) (Regular Buckwheat Muffin Recipe: 1/2 cup stone-ground whole wheat, 1/4 cup buckwheat)
- 2) (Regular Buckwheat Muffin Recipe: 1/2 cup stone-ground whole wheat, 1/4 cup buckwheat, 1/4 cup sourdough)
- 3) (Adapted Buckwheat Muffin Recipe: 1 cup sourdough; 1/4 cup buckwheat)

Source: Pathways4Health.org

- 1) (Regular Buckwheat Muffin Recipe: 1/2 cup stone-ground whole wheat, 1/4 cup buckwheat)
- 2) (Regular Buckwheat Muffin Recipe: 1/2 cup stone-ground whole wheat, 1/4 cup buckwheat, 1/4 cup sourdough)
- 5) (Regular Buckwheat Muffin Recipe: 1/2 cup stone-ground whole wheat, 1/4 cup buckwheat)

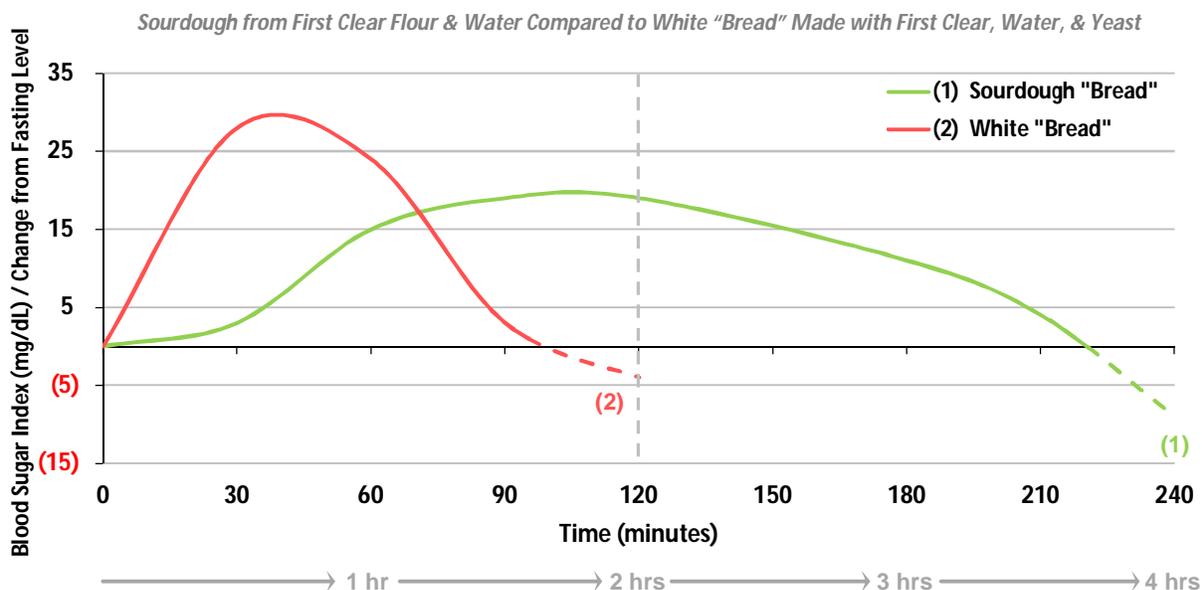
**Note concerning the recipes and procedure used to create the blood sugar curves that are illustrated above.** The "meals" that were tested are variations on an Arrowhead Mills recipe for buckwheat muffins. The original recipe: ¾ cup buckwheat flour; ¾ cup whole wheat flour; 2 tsp. baking powder; ½ tsp. salt; 1 cup water; ¼ cup vegetable oil; 1 egg; and 5-6 Tbs. honey. My test recipe: I cut this recipe in half, used sourdough to soak the liquid and flour ingredients (not the baking powder or salt) for 16 hours, and then mixed in the egg, unrefined coconut oil, salt, and baking powder just before baking.

- 1) **Buckwheat Muffins without Sourdough:** This is the control case, the basic recipe, against which we can then assess the impact of sourdough under 2), 3), and 4).
- 2) **Buckwheat Muffins with Sourdough:** The original test recipe, with ¼ cup buckwheat flour, ½ cup stone ground whole wheat flour, ½ cup water, and ¼ cup sourdough, soaked 16 hours before adding the remaining ingredients. This test illustrates what sourdough might accomplish to curb the blood sugar effect of your favorite recipes if you added it and allowed it to soak overnight with the liquid and flour ingredients before adding the remaining ingredients and then baking.
- 3) **Sourdough with Buckwheat:** 1 cup sourdough (a combination of water and King Arthur First Clear flour); ¼ cup buckwheat flour; 1 tsp. baking powder; ½ egg, beaten; 1/8 cup oil; and salt. This recipe tests what happens to blood sugar using an extreme amount of sourdough.

**Procedure for testing the recipes:** All tests were conducted as the day's first meal after a 12-hour fast using a fixed three ounce serving and measured with a blood glucose monitor. Responses will vary with the individual. These are meant to give you a rough idea. You can have fun testing in your own kitchen.

**Comments on Chart 3:** When sourdough is allowed time to act on the starch ingredients of baked goods prior to baking, the lactobacilli feed on the maltose in the flour, producing lactic and acetic acids. These acids then slow gelatinization and the rate at which starch is digested and assimilated.

**Chart 3: The Power of Sourdough to Curb Metabolic Stress and Sustain Blood Sugar**



Source: Pathways4Health.org

- 1) 2 oz. Baked Sourdough Starter made with First Clear and Water
- 2) 2 oz. "Bread" made with First Clear Flour, Water and Yeast

Testing Sourdough Versus White Bread. Chart 3 traces the results of my 100% Sourdough versus White Bread experiment. Both tests were conducted using a fixed two-ounce serving of bread as the first meal after a 12-hour overnight fast. As would be expected, my blood sugar peaked at 30 minutes (28 points above my starting blood sugar level) after eating White Bread. And within two hours my blood sugar fell below the zero line (initial fasting level). Presumably, in reaction to the excessive blood sugar caused by consuming a solitary carbohydrate, my body sent so much insulin to the rescue that my blood sugar then quickly fell below zero.

The White Bread graph in Chart 3 illustrates what can happen to our blood sugar when we do not take time for a well-balanced breakfast. A carbohydrate breakfast on the run—perhaps a plain bagel, English muffin, or Pop Tart—might trace a similar graphic footprint: The body would respond to a surge in blood glucose with a round of insulin; we would momentarily be energized, only to soon become light-headed and even hungrier than before eating the breakfast snack.

In contrast to the White Bread experience, the morning that I ate 100% Sourdough “bread,” my blood sugar rose slowly, smoothly, and gradually. It peaked and leveled off between 90 and 120 minutes at a reading of 19, one-third below White Bread’s peak. My blood sugar then slowly drifted lower, but it was sustained above its starting point for almost four hours, twice as long as for White Bread.

The test results for sourdough seem to underpin and support the results I first obtained last fall in my test of buckwheat muffins. They also validate other tests I have conducted in the past with my artisanal sourdough bread. Friends who eat my sourdough bread tell me they feel it sustains them throughout a busy morning.

I invite you to join in the fascination of keeping sourdough starter and to experiment by using it in your favorite recipes. Several of my own recipes that follow will give you an idea of how you might incorporate sourdough into recipes. You may want to test your recipes with a blood glucose monitor. Or, then again, you might simply want to use sourdough for its advantages of taste, texture, long shelf-life, health benefits, and “staying power” and just enjoy how you feel!

#### **Reading Resources:**

November/December 2012: *Reviving Culture*

<http://pathways4health.org/2012/10/22/novemberdecember-2012-reviving-culture-and-the-health-benefits-of-sourdough/>

This newsletter includes ideas for purchasing, feeding, and/or growing your own sourdough from scratch.

May 2011: *Monitoring Metabolic Stress*

<http://pathways4health.org/2011/04/18/may-2011-restoring-traditional-carbohydrates-to-control-blood-sugar/>

This article explains blood sugar monitoring in greater detail and blood sugar reactions to a variety of foods, from soda on an empty stomach to balanced meals of complex carbohydrates, proteins, and fats.

Emily Buehler, *Bread Science*

Karel Kulp and Klaus Lorenz, *Handbook of Dough Fermentations*.

Sara Pitzer, *Baking with Sourdough*

Lisa Rayner, *Wild Bread*

Daniel Wing and Alan Scott, *The Bread Builders: Hearth Loaves and Masonry Ovens*

Ed and Jean Wood, *Classic Sourdoughs: A Home Baker's Handbook*

## Recipes for Baked Goods Incorporating Sourdough

### Buckwheat Blueberry Muffins (or Squares)

¾ cup buckwheat flour  
¾ cup stone ground whole wheat flour  
¼ cup sourdough starter  
1 cup water  
2 t. baking powder  
1 egg, well beaten  
½ t. salt  
6 T. honey or maple syrup  
¼ cup coconut oil or butter, melted  
2 t. vanilla  
1 cup dried wild blueberries, dusted with flour  
And ½ cup chopped almonds.

1. Mix the first four ingredients through water and allow to soak for 12 hours at room temperature.
2. Add the baking powder and mix.
3. In a separate bowl, beat egg and add the remaining wet ingredients through vanilla.
4. Gently combine wet and dry ingredients.
5. Fold in blueberries or other dried fruit and nuts.
6. Pour batter into a 8 ½" square well-oiled baking pan. Bake at 350 degrees 25-30 minutes. Batter can be baked as muffins, reducing the baking time to about 20 minutes.

### Gluten-Free Corn/Buckwheat Bread

Follow directions as above, but substitute cornmeal for whole wheat flour.

### Sourdough Cornbread

1 cup corn meal  
1 cup stone ground whole wheat pastry flour  
½ cup sourdough starter  
1 cup water  
1 t. baking powder  
¼ cup coconut oil  
¼ cup maple syrup  
1 t. sea salt

1. Mix together the first four ingredients and let rest at room temperature, 6-8 hours
2. Stir in baking powder.
3. Add remaining ingredients
4. Bake at 375 for 20-30 minutes.

### Sweet Potato Sourdough Cornbread

Follow directions above but add 1 cup mashed sweet potato with Step 3.

### Gluten-Free Sweet Potato Sourdough Cornbread with Pumpkin Seeds

Substitute brown rice flour for whole wheat flour.

Add mashed sweet potato and pumpkin seeds at Step 3.