pathways for health

Back of the loaf is the snowy flour,
Back of the flour, the mill,
Back of the mill is the wheat and the sower,
And the sun,
And the Father's will.

…Arabic poet

November/December 2012: Reviving Culture and the Health Benefits of Sourdough

Throughout time, bread, the "staff of life," has been a powerful symbol stretching far beyond the meaning that we associate with bread today. In passages too numerous to count, the Bible mentions bread, manna not only as the source/sustenance of life but also the Word, the will of God. Bread also symbolized covenant, a solemn vow, a supreme commitment. The sacred role of bread can be seen from one of the earliest Old Testament stories when Melchizedek, the King of Goodness, offered bread and wine to Abraham (Genesis 13). And as a symbol of covenant, Psalm 41, "Yea, mine own familiar friend, in whom I trusted, which did eat my bread, hath lifted up his heel against me." In the New Testament, bread fed people in spiritual ways. Christ, the "Bread of Life," serves loaves and fishes to the multitude and a communion meal of bread and wine at the Last Supper.

For centuries, people of many faiths living in civilized yet far less comfortable times than our own today, gathered around a common table to break bread in a shared experience of gratitude and commitment. From these roots spin the contemporary references, "bread winner" as well as someone "short on dough," a person in need of money.

In contrast to the revered position of bread in the civilized world throughout time, bread has recently fallen from favor. Not only and justifiably is bread avoided by people with wheat intolerances, but also by many because it is "fattening." Fattening is a noteworthy idea if the reference is to factory bread—a fractured, unsatisfying product that can lead to cravings for more food, as the body looks for the missing ingredients normally found in whole grains. Another reason to avoid industrial bread is because it is made with denatured flour that has been inflated by baker's yeast to look like bread, then doctored with chemical additives to improve taste, texture and prolong shelf life.

Other factors explain why bread has fallen from its traditional sacred place at the family table: We live in a world of calorie security that fosters few thoughts of gratitude, and our screen-based lifestyle scatters family members so that it is rare when we gather around a common table. Today, fractured foods that do not go rancid have displaced whole foods prepared with care in the home kitchen.

> *"Unlike most bacteria, lactobacilli thrive in the acid environment of sourdough and produce a variety of mild organic acids, alcohols, and many additional compounds vital to the flavor of the dough. One researcher has listed no fewer than fifty-five separate compounds in sourdough—many, of course, in trace amounts."* ….Ed Wood[1]

For some ten thousand years, civilizations employed sourdough not only as a leavening to make bread rise but also to unlock the nutritional goodness of whole grains that with care and patience they ground into flour. From the earliest days, civilizations seemed to have an intuitive sense about sourdough's power to ferment wheat to enhance its digestibility and nutrition.

In recent decades with the introduction of baker's yeast, the art of sourdough bread baking has been lost due to the convenience of mass-produced industrial bread. This shift began to take root in the 1870s when scientists successfully isolated Saccharomyces cerevisiae, yeast that they developed to survive temperature change and to expediently produce carbon dioxide gas to make dough rise rapidly and uniformly.

Saccharomyces cerevisiae, known today as baker's yeast, is a genetically modified form of brewer's yeast. While it makes dough rise, it is a monoculture that cannot live cooperatively over time with the healthy bacteria found in sourdough cultures. This is important, as discussed below, because sourdough bacteria give bread its complex taste, pleasing texture, and health benefits, while also acting as a natural preservative. When commercial bakers switched from sourdough to baker's yeast to adapt bread baking to assembly line mass production, bread became a tasteless fast food. To compensate for the absence of sourdough and time, the food industry improvised by adding back to dough synthetic vitamins, minerals, artificial dough conditioners, flavorings, and preservatives—all in an effort to try to make their chemically bleached flour and water mixture taste like bread.

The Science of Sourdough (*It you are more interested in learning to use sourdough than in understanding the science, feel free to skip to page 4.)*

Sourdough is a gift of nature requiring only the mixing of flour and water. Mixing flour and water not only captures wild yeast and bacteria from the local environment, but it also activates the culture to begin aerobic fermentation whereby yeast begin to produce carbon dioxide and bacteria work to develop complex flavors. Over time with successive feedings of flour and water and mixing, sourdough cultures evolve to produce a stable culture where yeast and bacteria live symbiotically. The high level of acidity from lactic and acetic acid protects the culture from harmful bacteria, and microflora that do not support the culture gradually die away.

[1] Ed Wood, *Classic Sourdoughs*, 9.

the epitome of "Grow Local" and "Slow Food" right in your own kitchen. My Martha's Vineyard culture, for example, would contain local strains quite different from those of a starter kept by a home baker in Chicago or Seattle. Buying a San Francisco culture so that I could replicate the wonderful sourdoughs of the Bay Area would be short-lived, since it would soon be overtaken by microscopic wild life of the Vineyard. Because cultures differ by region, their behavior and taste vary: some rise more rapidly than others, and each has its own coloration of sour, yeasty aroma, and flavoring complexities.

Sourdough Culture is an Ecosystem. Cultures are fascinating examples of microflora too small for the eye to see that work in cooperation to preserve a stable balance between yeast and bacteria. Sourdough culture generally contains one local strain of yeast and between two to four types of bacteria. Contained in a single teaspoon are some 50 million yeast and 5 billion bacteria.

In their symbiotic relationship, neither strain competes for the other's food: Wild yeast, microscopic one-celled fungi, eat the simple sugars fructose and glucose in flour, but since they are not able to break apart maltose into its two glucose molecules, they leave this work and the resulting glucose molecules for lactobacilli to consume as food. As an additional service to the culture, lactobacilli, the major bacteria in most sourdough cultures, produce lactic acid which lowers the pH of the culture to between 4-4.5, a level of acidity that protects the culture from harmful invaders. Like lactobacilli, baker's yeast also thrives on maltose, which is why in the ideal baker's yeast should not be added to a sourdough starter because it would compete with lactobacilli for the same food.

How the ecosystem works. Yeast and bacteria work symbiotically to transform through fermentation any bland mix of flour and water into mouth-watering loaves of bread with texture, aroma and complex flavorings. Yeast contribute bubbles in the form of carbon dioxide gas, as well as flavoring from alcohol and glutamate (which imparts the savory umami taste). Yeast act on flour and water in two stages, *respiration* and *fermentation*. During respiration (also known as *aerobic fermentation*) when yeast have access to oxygen, they produce carbon dioxide gas to help make dough rise. Later, in the absence of oxygen (for example, when starter is capped or dough is covered to limit oxygen) *anaerobic fermentation* begins, which is when yeast produce alcohol and other important flavorings.

Like yeast, sourdough bacteria are single-celled microflora that feed on the sugars, proteins, and fats of whole grain flour to improve dough's texture, nutrition, and acidity to retard spoilage. They also produce their own unique combination of flavors, including the classic sour taste derived from their byproducts, lactic and to a lesser degree acetic acid (vinegar). To allow sourdough to fully develop these complex flavorings from its acids, alcohols, and other compounds requires about 12 hours, so planning, fermenting time and patience are the key factors tied to successfully using sourdough—not hard work.

Enzymes. Enzymes, proteins that exist both in sourdough cultures and in flour, are also important to successful sourdough baking. Enzymes accelerate chemical reactions to enhance fermentation and the development of flavors and texture. Assisted by enzymes, sourdough bacteria produce amino acids (for a savory crust) and a more complete protein profile; increase B vitamins; unlock the minerals in flour for

free nutrients); and, through lactic and acetic acids' ability to slow absorption of carbohydrates, curb the blood sugar spike normally associated with consuming bread. (Discussion of health benefits, below.)

McBread

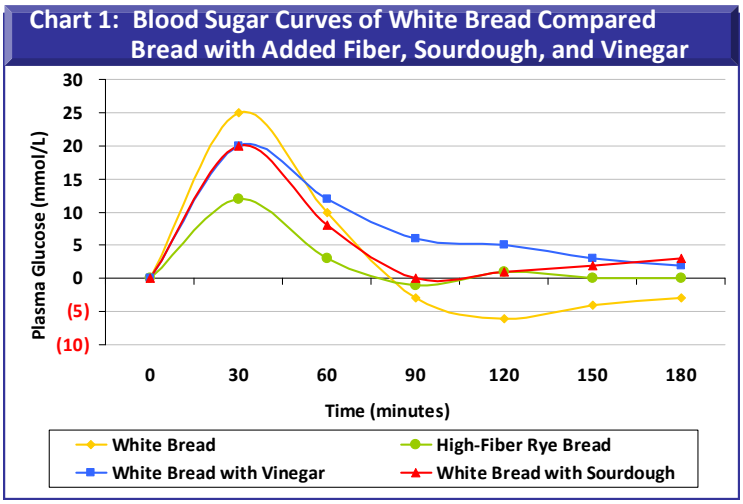
As explained above, using baker's yeast to produce factory bread rules out many benefits that sourdough can bestow. To compensate, food companies add back synthetic vitamins and minerals, as well as dough conditioners, flavorings, and preservatives. For example, Interstate Brands, which makes Wonder Bread, doctors its chorine-bleached white flour/water/salt high-speed dough with more than 25 ingredients in a feeble attempt to duplicate the nutrition, texture and shelf life of traditionally leavened bread made simply from flour, water, starter, and salt. Consider the ingredient lists below:

- Sourdough bread: flour, water, sourdough starter. Salt is added later after fermentation is underway.
- Wonder Bread: wheat flour, water, high fructose corn syrup or sugar, yeast, soybean oil, barley malt, wheat gluten, salt, calcium carbonate, sodium stearoyl lactylate, vitamin D3, vinegar, mono- and diglycerides, calcium sulfate, monocalcium phosphate, yeast nutrients (ammonium chloride, ammonium sulfate), enzymes, yeast extract, wheat starch, calcium dioxide, ferrous sulfate (iron), B vitamins [niacin, thiamine, mononitrate (B1), riboflavin (B2), folic acid], soy lecithin, azodicarbonamide, soy flour, whey, calcium propionate, datem, sorbic acid.

The Health Benefits of Sourdough

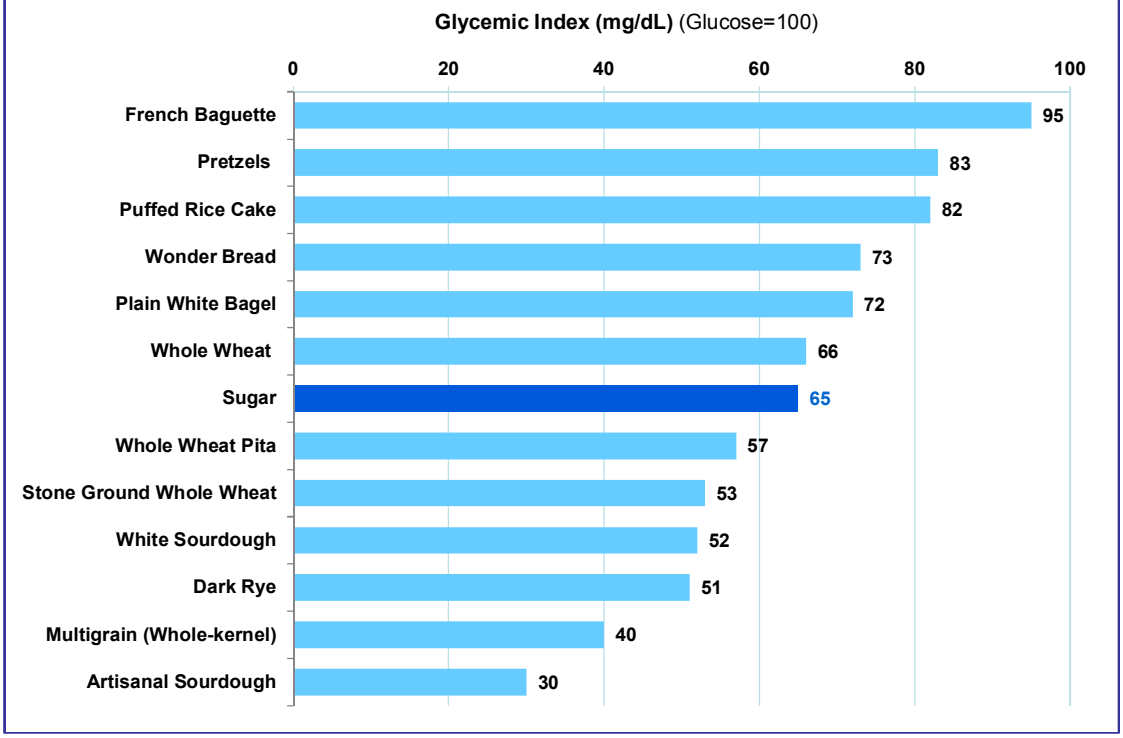
> *"A sourdough is a complex fermentation in which the flour matrix is considerably modified, making the minerals and other nutrients in the bread more assimilable and digestible. New nutrients are created in the process also, as proteins are decomplexed, and as the yeasts proliferate, the important protein lysine, deficient in cereals, is increased. The bacteria synthesize some vitamins also, as in yoghurt. Noteworthy is vitamin B12 (not its analog) that is unknown in bread, but is in my sourdough in good quantity."* …John Downes

The glycemic index of bread. Beyond the benefits of improved texture, taste, and long shelf life, adding sourdough to whole grain flour and allowing these to soak before baking reduces the glycemic impact of bread. Lactobacilli in sourdough eat the carbohydrates in flour, producing lactic and acetic acid. These acids retard the rate of starch digestion to reduce the blood sugar impact and the body's insulin response to carbohydrates (see Chart 1).



of sourdough to *white* bread curbs the body's blood sugar reaction (see Chart 2) so that a slice of sourdough white bread has a substantially lower glycemic index (52) than a slice of commercial *whole wheat* bread (66). In fact, the glycemic effect of a slice of commercial whole wheat bread is on par with sugar (65).

Chart 2: Glycemic Index of Various Breads and Grain Products
(Bread: 1 Slice; Sugar, 10 grams; Other, 50 grams)



Source: Created using data from Textbook of Natural Medicine.

It is also interesting to note that the glycemic index of commercial whole wheat bread is not much lower than Wonder Bread (73). This is because industrially refined whole wheat flour is not 100% whole wheat. Instead, whole wheat is finely ground and stripped of much of its essence, to leave its starch molecules exposed and easy prey to digestive juices, much like white flour.

Whole wheat? A key idea to take away from Chart 2 is to be wary of the health claims touted on a label of supermarket commercial whole wheat bread. [Also be wary of commercial bread labeled "sourdough" unless you buy from an artisanal baker who uses sourdough culture to leaven bread in a long, slow fermentation process; otherwise, the sourdough bread you buy is leavened with yeast, even though it lists sourdough as an ingredient, and it is therefore little different from the high GI breads above.]

The reason lies in the way whole grains are fractured during the industrial milling process to separate the starch energy from much of the rest of the kernel's nutritional essence. In its natural state, a whole grain is composed of the *germ*, the grain embryo that is rich in protein, fragile omega-3 oils, and vitamin E; *bran*, the tough outside covering with protective phytic acid; *aleurone*, the protein layer inside the bran that contains most of the vitamins

s; and the *endosperm*, the starchy food supply for the embryo. In contrast to grains that are stone ground at moderate temperatures, commercial millers grind grains using high-speed rollers, a process that heats flour to between 400 and 500 degrees. In so doing, the starchy endosperm is separated from the heart of the grain's nutrition located in the bran, aleurone, and germ. The result is flour, stripped of oils, with a long shelf life—flour that cannot go rancid.

The USDA does not have strict standards for labeling whole wheat flour. As long as flour contains 51% whole wheat, flour can be labeled as such. Often manufacturers add back bran (which does not go rancid) to give a brown coloration to flour that they label whole wheat. Legitimate whole wheat flour must be stored in a refrigerator or freezer within several days of grinding to prevent rancidity. Be leary of whole wheat flour on grocery store shelves, even flour that is labeled "stone ground." If you want the natural goodness of 100% whole grain flour, you will not find it in supermarkets. The best sources are by mail order from reputable millers (see September/October 2012 newsletter).

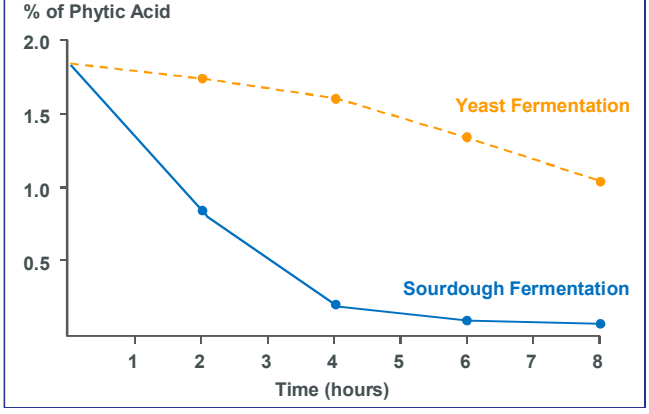
Chart 2 also illustrates the lower blood sugar impact of bread made with legitimate stone ground whole wheat flour (GI, 53). The lower GI is largely attributable to the oils in real whole wheat flour which slow the digestion of the carbohydrate portion of grain. Charts 1 and 2 also indicate that the addition of slow-to-digest whole kernel grains can moderate the blood sugar effect (GI, 40). Adding cooked whole grains to baked goods is an excellent way to add texture and reduce their blood sugar impact.

Charts 1 and 2 also suggest that of all breads available, one of the best choices is to bake your own artisanal sourdough bread made from stone ground heirloom flour or know a good friend who does. Authentic sourdough prepared over several days to allow lactobacilli to fully convert maltose to lactic and acetic acid can significantly reduce the glycemic index (GI, ~ 30). If you do purchase sourdough bread, be wary of loaves that are doctored with vinegar and other flavorings to emulate the real thing.

Sourdough Blood Sugar Testing, a further aside. Before writing this newsletter, 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 (see Chart 1 for a reference). Universally with every test, my blood sugar peaked not at 30 minutes, which is standard, but at 90. This suggests the satiety and staying power that sourdough can lend when you add it to your favorite recipes.

Phytic acid. In addition to containing the blood sugar spike normally associated with carbohydrates, sourdough degrades phytic acid. Recall that phytic acid is found in the bran of whole grains and that it blocks the absorption of minerals such as calcium, magnesium, iron, copper, and zinc as well as the digestive enzymes pepsin and amylase. Reducing phytic acid by soaking flour ingredients with sourdough makes the vitamins and minerals in the aleurone layer (inside of the bran) and the germ of whole grains more bioavailable (see Chart 3).

Chart 3: Reduction of Phytic Acid in Whole Wheat Sourdough Bread



Source: R. Hauspy, "Fabrication du pain au levain naturel," *Nature et Progres.* Paris 1983, 1: 26-28.

Lysine. Sourdough also boosts lysine, the limiting amino acid in grains that prevents them from being a complete protein. Sourdough fermentation can increase lysine levels in wheat by three fold or more,[2] augmenting this missing amino acid. For people who really like rye and want even more lysine, you can also add rye flour when making bread because, of all whole grains, rye is the highest in lysine. When making sourdough bread, I use up to 25 percent rye flour to increase lysine. Because, unlike wheat, the composition of rye proteins does not support a strong gluten network, using more than 25% rye flour results in a weak loaf better suited to pan baking.

Sourdough's potential role in wheat allergies and gluten intolerance. Whether sourdough can be used to resolve wheat intolerances is one of the biggest questions relating to sourdough's potential. Unexplained is the recent rise of celiac disease and vague wheat allergies. Celiac now affects one in every 50 people, a number in stark contrast to the 1 in 1200 of just 30 years ago.[3] One must wonder if our new hybrid dwarf wheat described in the last newsletter and the shift away from sourdough to baker's yeast underlies much of problem posed by wheat today.

Sourdough does appear to hold promise for people who cannot tolerate wheat: Evidence suggests that lactobacilli in sourdough break down wheat gluten to make wheat proteins easier to assimilate by people with wheat allergies and celiac disease. Rafaella di Cagno and her team of researchers produced, with selected strains of sourdough, bread that seemed to be well tolerated by celiac sufferers.[4] It appears that using sourdough fermentation with *heirloom* varieties of wheat can make wheat acceptable to many with wheat sensitivities. *But, for people who suffer from true celiac, no gluten grains are currently safe to eat, even if they have been fermented with sourdough.* We must await more research, but the future role of sourdough for gluten sufferers does hold promise.

Using Sourdough in Favorite Recipes

> *"Bread for myself is a material question. Bread for my neighbor is a spiritual one."*
>
> …Nikolai Berdyaev

> *"I fed my starter last night and plan to make some bread tomorrow. I am so grateful to you for showing me this process. It is very calming for me and it just feels really good. I don't even know how to explain it."* …Nicole Bartlett, School Nurse, Edgartown, MA

[2] *The Natural Tucker Bread Book.*

[3] Jacob Schor, ND, "Sourdough and Celiac Disease."

[4] Raffaella Di Cagno, et al. Sourdough Bread Made from Wheat and Nontoxic Flours and Started with Selected Lactobacilli Is Tolerated in Celiac Sprue Patients. Applied and Environmental Microbiology, February 2004, p. 1088-1096, Vol 70, No. 2.

n taught me how to keep sourdough and make 3-day artisanal sourdough bread, something that has become an enduring and endearing habit. Feeding starter, working with dough on the second day, and baking on the third is rewarding and gratifying. I like to "spread bread" by sharing it with friends in my community. But making sourdough bread requires an investment in time, patience, and equipment. It can be a challenge at first because so many variables contribute the outcome—the starter, flour, geographic conditions, and temperature and humidity that vary with the seasons. In the future, I plan to write a separate piece about making sourdough bread and will post it on the Recipe tab, Slow Food section of my website.

For now, I want to help you get started on the basics of keeping starter and using it in your favorite recipes—muffins and biscuits, pancakes and waffles, and other quick breads. Sourdough will enhance the flavor and texture of them all. And, if you take the time to pre-soak the flour ingredients, you will curb the blood sugar impact and reduce phytic acid to make minerals and enzymes in the flour more bioavailable.

Obtaining a Sourdough Culture. One of the easiest and best sources of sourdough culture is from a friend who bakes often and lives nearby. You can also grow your own, but doing this in the winter months is tricky and it can be a challenge to get a starter to evolve into a stable culture with staying power. If you are interested, see http://www.breadtopia.com/make-your-own-sourdough-starter/.

Established sourdough culture is available by mail order, including King Arthur Flour (1 ounce is just $7.95), Breadtopia (available both in active and dry forms), GEM Cultures (fresh rye and gluten-free brown rice cultures), and Sourdough International (source of cultures from around the globe). See

http://search.kingarthurflour.com/search?w=sourdough%20starter&af=type:products

http://www.breadtopia.com/

http://www.gemcultures.com/bread_leavens.htm

http://www.sourdo.com/

Maintaining a Culture. A culture is a pre-ferment. Growing a culture the day before baking gives any baked product a jump on flavor and nutrition and makes kneading easier.

Materials that you will need:

- A wide-mouth one- or two-quart Ball-type jar with a two-piece lid (to let some air escape);
- Starter, ¼ to ½ cup;
- King Arthur First Clear or other white flour. First Clear has a high-ash (mineral) content which promotes fermentation and the building of flavor by controlling pH levels;
- Water that is free of chlorine.

stion to ask yourself is what do you plan to bake and how much starter will you need for the job? I usually use starter to make two loaves of sourdough bread, each requiring one cup of starter. So, I use a 2-quart jar and begin with ½ cup starter. I then feed the ½ cup starter in three feedings of flour with equal parts water, in progressive fashion. After each feeding of flour and water, stir well, cover loosely with the lid, and allow to double on the countertop.

½ cup starter in a 2-quart jar; yield ~3 cups: 2 cups for bread + ~1 cup left over in reserve

1st feeding: ¼ cup flour (First Clear) and ¼ cup water.

2nd feeding: ½ cup flour and ½ cup water.

3rd feeding: 1 cup flour and 1 cup water. Place in refrigerator overnight for the next day of baking. Or…

¼ cup starter in a 1- or 2-quart jar; yield ~ 2 cups: 1 cup for baking + ~ 1 cup in reserve for later

1st feeding: 1/8 cup flour and water.

2nd feeding: ¼ cup flour and water.

3rd feeding: ½ cup flour and water. Place in refrigerator until the next day, when you use it for baking.

Note: I always pour off any remaining starter and keep it in reserve in the refrigerator as a "safety" should anything happen to my working batch.

Note the pattern for feeding: Whatever amount of starter at the outset, a general rule is to feed it in three progressive intervals… first, *half*; then, *equal*, and finally, *double* the amount of flour and water relative to the amount of initial starter. You do not want to overwhelm the culture at the outset with too much flour since excess food without enough yeast and bacteria to consume it can attract foreign invaders and spoil a culture. A small feeding at first gives the yeast and bacteria time to divide and populate the culture so it can handle progressively larger amounts of flour.

If you forget to feed a culture once it has doubled in size, it will fall back, losing volume. This is a sign that it has run out of food, is hungry, and needs to be fed again. Yeast work more rapidly than bacteria so a culture will reach its full volume before the bacteria have completed their work converting maltose to flavor compounds. Once starter has doubled 3 times to reach its maximum volume, put it in the refrigerator. Bacteria will continue to create flavor, albeit more slowly.

Using starter often: Once you have starter, you want to keep it fed and working for you. A starter that is fed often is "happy" and active. After a week in the refrigerator, the microflora run low on food, and some have died. I like to keep my starter active by feeding and using it at least once a week. Starter can be kept for up to three weeks in the refrigerator, but it may require several feedings to bring it back fully to life.

out oxygen in the refrigerator, it develops a layer of brownish liquid on the surface, "hooch," composed of alcohol and bacteria flavoring compounds. Stir it back in, or pour it off if you seek a milder flavored culture.

Using and substituting starter in your favorite recipes. An easy way to use starter without extra calculation is to add about ¼ cup to a recipe. You can add sourdough to any baked goods for flavor and texture. If you choose to soak the flour and liquid ingredients overnight to reduce phytates and lower the blood sugar impact, be sure to leave out baking soda and mix it in right before baking (baking powder can be included with the ingredients in an overnight soak). [Baking soda helps neutralize the sour flavor of sourdough, if this is something you desire, but other flavors will remain intact.]

Alternatively, if you plan to use a great amount of sourdough, calculate the amount of flour and water in the starter (e.g., a cup of starter contains ½ cup flour and ½ cup water) and reduce the flour and liquid ingredients in the recipe by the same amount.

Books on sourdough often contain conversion rules, but I like to experiment on my own and go by "feel." You may prefer to set guidelines, such as offered by Sara Pitzer in *Baking with Sourdough*:

> "To adapt a yeast recipe, begin with a small amount of starter, about ¼ cup for recipes using less than 6 cups of flour and about ½ cup for recipes calling for more flour. Mix the starter with some of the flour and some of the liquid from the basic recipe you want to convert. Figure that 1/2 cup starter has replaced ¼ cup flour and ¼ cup water. In baking powder recipes figure the same way, but use up to a cup of starter even in recipes calling for only 2 or 3 cups of flour.
>
> Allow the mixture of starter, flour and liquid—the sponge—to stand and bubble for 4 to 24 hours, depending on the sourness you want. With quick breads you can shorten the time so the mixture stands only until it is obviously active, as little as an hour if you are not trying for the sour taste. When ready to bake, proceed with the recipe, adjusting the amounts of flour and water according to the amount of starter you used. Add as much flour as necessary to get a dough you can knead or a batter (for quick breads) that seem about as thick as the recipe was before you adapted it to sourdough. Go through the normal kneading, rising, and shaping steps for yeast breads. For quick breads, pour the batter into the pan and allow to sit until it begins to rise.

Reading Resources:

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*

Sourdough Recipes

Experimenting with sourdough is a fascinating adventure with endless possibility. I have fun pushing sourdough to its upper limits when adapting recipes in order to capture its many health benefits and because I like the moist texture, body, and staying power that it gives to baked goods. I also like the way it satisfies and I enjoy its sour flavor, probably more than would be true of the average individual. The first recipe for cornbread is my own, but the remaining ones are from Sara Pitzer's Baking with Sourdough. This is a concise book on sourdough that has a variety of baked goods recipes using different amounts of sourdough. This array of recipes can give you a sense of how much sourdough you might want to add to a favorite recipe of your own.

Sourdough is an especially welcome addition to cornbread to keep it moist and improve texture. It is also enhances recipes that include maple, banana, and chocolate.

Sourdough Cornbread

1 cup stone-ground cornmeal
1 cup stone-ground spelt flour, or other flour of your choice
2 cups sourdough starter
1 teaspoon baking powder
1 cup water
¼ cup oil of your choice
¼ cup maple syrup
½ t. salt
1 egg, lightly beaten (optional)

Combine dry ingredients. Mix wet ingredients. Combine wet and dry ingredients. Bake in a 375 degree oven for 20-30 minutes.
If you choose to presoak the cornmeal and flour with the sourdough, mix these and let stand overnight. Then add the baking powder, salt, and wet ingredients just before baking.

Sourdough Banana Bread

1 ½ cups sourdough starter
1 cup sugar
1 t. baking soda
1 t. salt
1/3 cup butter
1 beaten egg
1 cup unbleached flour (or whole wheat pastry flour)
1 cup very ripe banana
½ cup chopped nuts

large bowl. When it has begun to bubble, add the sugar, soda and salt to it. Melt and cool the butter and add it, along with the egg, flour and banana, stirring in each ingredient in the order given. When everything is well mixed, stir in the nuts. Pour the batter into a greased loaf pan large enough so that it is no more than two-thirds full. Allow to stand in a warm place for about 20 minutes, then bake in a preheated 350 degree F oven for at least an hour, or until the loaf tests done when poked with a toothpick. You may lay a piece of brown paper or aluminum foil loosely over the top of the loaf if it is getting too brown. Do not under bake; it will be quite most even when fully done. Allow it to cool in the pan for about 15 minutes before taking it out. Then allow the loaf to cool completely before slicing. This banana bread will be even better the second day if you have stored it wrapped in foil or plastic wrap.
For the lunchbox: sandwiches made of banana bread spread with a filling of cream cheese and chopped dates.

Sourdough Skillet Biscuits
2 cups sourdough starter
2 cups all-purpose unbleached white flour (or whole wheat pastry flour)
1 t. sugar
1 T. baking powder
½ t. salt

Let the starter come to room temperature in a large bowl. It won't hurt the starter to stand for a couple hours. About an hour before you want to serve the biscuits, sift the dry ingredients together into the starter bowl and mix to make a firm dough. Pinch off pieces of the dough and gently shape into balls about the size of large walnuts or small eggs. Arrange them in a well-greased 12-inch iron skillet and place in a warm place for 15-20 minutes, or long enough for the biscuits to show signs of rising. Because the baking powder reacts quickly with the sourdough starter, this happens fast. Bake in a preheated 400 F degree oven for about 30 minutes, or until well browned and crusty. Serve hot.

Sourdough Brown Biscuits
2 cups sourdough starter
1 T. honey
½ t. salt
2 T. oil
2 t. baking powder
1 ½ cups whole wheat flour

Put the 2 cups of starter into a large bowl, cover loosely and allow to sit for at least 10 hours in a warm place. When ready to bake, mix hone, salt and oil into the starter. Sift in the baking powder and whole

y bran which remains in the sifter,, but for a heartier biscuit dump the bran right into the mixing bowl with the other ingredients. Mix everything well, but do not over beat.

Knead the dough gently until it holds together, then roll it out to a thickness of ½ to 1 inch, depending on whether you want think crusty biscuits or high, lighter ones. Cut the biscuits out with a cutter or a small can from which both ends have been removed. On a greased cookie sheet, place them close together for soft biscuits or leave them farther apart for more crust.

Cover the biscuits with a dry, lightweight cloth and put them in a warm place for about half an hour, or until you see definite signs of rising. Then bake in a preheated 400 F degree oven for about 20 minutes. Break open one biscuit to be sure they are cooked through. They are ideal served with creamed chipped beef.

Sourdough Pancakes/Waffles

½ cup sourdough starter
1 cup undiluted evaporated milk
1 ¾ cups unbleached white flour (or whole wheat pastry flour)
1 cup water
2 eggs
2 T. sugar
½ t. salt
1 t. baking soda

Combine the first 4 ingredients in a large bowl, cover loosely and allow to stand in a warm place overnight, or for at least 8 hours. Beat together the eggs, sugar, salt, and soda, and stir into the starter combination with a wooden spoon. At this point, don't beat. Bake the pancakes on a lightly greased griddle, turning when bubbles appear. These pancakes are quite fat and fluffy and very tender because of the reaction of the soda with the sourdough. If you want them to be thinner, stir in a little more water as you are adding the egg mixture.

To make sourdough waffles, stir in 2-3 tablespoons of melted butter or cooking oil after all the other ingredients have been added. Bake on a lightly greased waffle iron. The fat added to the batter should help prevent the waffles from sticking provided the iron has been well seasoned.

Variations: Add a quarter cup of toasted wheat germ to the egg mixture to give a nutty taste and increase the food value of the recipe. For even heartier pancakes, add ¼-1/2 cup chopped pecans before baking.

½ cup sourdough starter
1 cup unbleached white flour
1 cup buckwheat flour
2 cups warm water
2 eggs, beaten
2 T. sugar
½ t. salt
½ t. baking powder
3 T. melted butter
½ t. baking soda dissolved in 1 T. water

Mix together first 4 ingredients in a large bowl. Beat well. Cover loosely and allow to stand overnight or for at least 8 hours in a warm place. When ready to bake the pancakes, stir in the beaten eggs, sugar, salt, baking powder and melted butter. Finally, stir in the baking soda dissolved in water. Do not stir again after adding the soda. Bake on a moderately hot griddle, taking care not to let the buckwheats burn.

For darker pancakes with a truly old-time taste, allow the batter to age longer than 8 hours and substitute molasses for the 2 tablespoons of sugar.

Blueberry Breakfast Bread

1 cup sourdough starter
¼ cup soft shortening
¾ cup sugar
1 egg
½ cup milk
1 cup unbleached white flour
½ teaspoon baking soda
½ t. Salt
1 cup blueberries

Bring the starter to room temperature in a large bowl. In another bowl, cream the shortening and sugar together and then beat in the egg and milk. Turn this mixture into the bowl with the sourdough starter and sift in the flour, salt and soda. Mix very well. Gently fold in the blueberries. Pour the batter into a well-greased 8-inch square pan and allow to sit in a warmer place for at least 20 minutes.

Bake in a preheated 375 F degree preheated oven for 45-50 minutes. Do not under bake. Allow to cool completely so that it is not too sticky and gummy.

Molasses-Date Bars

1 cup sourdough starter
1 beaten egg
½ cup butter
¼ cup brown sugar
¾ cup dark molasses
½ t. salt
1 t. cinnamon
¼ t. baking soda
1 1/3 cups unbleached white flour
½ cup chopped dates
2 T. flour

In a large bowl allow the starter to warm up and become active. It should stand at room temperature for 1 to 2 hours. Then add the beaten egg, softened butter, brown sugar and molasses. Beat thoroughly with a wooden spoon. Next, put in the salt, cinnamon and soda. Sift in the flour. Beat the butter until it is lump-free.

Roll the chopped dates in the 2 T. flour or mix them with the flour in a bowl so that they do not stick together. Gently stir them into the batter. Pour the batter into a well-greased 9-inch pan and bake int a preheated 375 F degree oven for about 30 minutes or until the batter tests done when poked with a toothpick.

Allow to cool slightly before cutting into bars, then finish cooling on wire racks and sprinkle with powdered sugar before serving. Like most sourdough products, these taste much better cold than they do while still warm from the oven.

Concluding comment. I hope that these recipes give you an idea of how to use sourdough—first, in terms of the proportions of sourdough to use depending on what type of baked good you are making; second, the time that sourdough needs to rest at room temperature to be activated before being added to ingredients; and third, the time that sourdough and ingredients need to rest on the counter top before baking. Finally, remember that most sourdough baked goods taste much better cold than they do when they have been taken right from the oven. Sourdough bakery goods last a long time and are excellent baked ahead on weekends for lunch boxes and snacks. They easily keep and develop flavor through the week.