

Simple bread formulations: Comparison of sucrose and maltose use by leavening *Saccharomyces* yeasts and acidifying *Lactobacillus* bacteria

| | Sucrose | Maltose |
|---|---------|---------|
| <i>Saccharomyces</i> * | | |
| <i>S. cerevisiae</i> (bakers yeast) | + | + |
| <i>S. dairensis</i> (barm sourdough yeast) | - | - |
| <i>S. exiguus</i> (San Francisco sourdough yeast) | + | - |
| | | |
| <i>Lactobacillus</i> ** | | |
| <i>L. brevis</i> (barm sourdough) | - | + |
| <i>L. sanfrancisco</i> (San Francisco sourdough) | - | + |

* p.385. The Yeasts. 3rd edition. Edited by NJW Kreger-van Rij. 1984

** p. 1230. Bergeys Manual, Volume II. Editors PHA Sneath et al. 1986

The yeast and lactic bacteria symbiosis (in sourdoughs)

Our connections to everything in the natural world include the microscopic world of sourdough fermenting microorganisms, the symbiotic yeasts and lactic bacteria. Symbiotic yeasts and lactic bacteria are taken from the air and concentrated in foods such as kefir, natural sourdough starters, sauerkraut and the bloom on raw fruits. The healthy yeasts to ingest are those that symbiotically allow a healthy population of lactic bacteria to flourish along side them in our lower digestive tract.

I. Natural sourdough

The most common lactic bacteria in (whole) wheat sourdoughs are *Lactobacillus brevis*, or a very close relative such as *Lactobacillus sanfrancisco*. The *Lactobacillus* is very fussy about its environment and especially towards the sugar types that it will use as a main energy source. *Lactobacillus brevis* chooses maltose as its main sugar source when in the presence of symbiotic yeasts. Indeed the symbiosis is possible because the sourdough yeasts *Saccharomyces dairensis* or *exiguus* do not use maltose, and effectively leave it all for the lactic bacteria. Such an arrangement means that both yeast and lactic bacteria in this symbiotic relationship can reproduce vigorously. As a result, the sourdough yeast produces great leavening power (large amounts of carbon dioxide), and the lactic bacteria generate great acidifying power (large amounts of lactic and other acids).

Whole wheat flour and enzyme active malt (unheated sprouted grain) provide the rich source of enzymes and nutrients including maltose, needed to generate a natural sourdough populated by symbiotic yeasts and lactic bacteria. Other sugars, such as glucose are generated by the enzymes in a whole wheat sourdough and are sufficiently plentiful to properly maintain the sourdough yeast. (Note that refined flour without enrichment with vitamins and minerals may not be able to support a natural sourdough)

II. Bakers yeast and lactic bacteria

When modern bakers yeast is used as a leavening agent, the system starts out with very few lactic bacteria. Sucrose is generally added with the idea of causing bakers yeast to reproduce rapidly and generate carbon dioxide to leaven the dough. In short-time-fermented bakers yeast bread, the added sucrose is probably the main sugar consumed by the yeast. In such a system the lactic bacteria have little chance of reproducing sufficiently to make significant change to the acidity of the dough.

However when a small amount of bakers yeast is added to dough, and no sucrose is added, the bakers yeast uses part of the considerable amount of maltose present. In doing so the bakers yeast discourages the reproduction of any lactic bacteria present. The result is that although some acidification occurs with a long ferment starting with bakers yeast, it is unlikely to generate the high population of lactic bacteria that would give all the expected benefits of a natural sourdough. Correspondingly, a sourdough starter maintained with added bakers yeast may not develop the full acidity seen with a symbiotic yeast and lactic bacteria mix.

In the German system the sour is generated with lactic bacteria alone, before bakers yeast is added. In this way the flavor complexities, and preservative properties expected are quite similar to those that are produced by a natural sourdough such as the San Francisco sourdough.

Note, however that bakers yeast is a microorganism that has been subjected to much selection and manipulation. It is conceivable that some specially developed bakers yeast variants would be poor fermenters of maltose, and so would favor the simultaneous reproduction of lactic bacteria in a dough where maltose was the predominant sugar source.

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