

## Malt breads

Sourdough leavened whole grain sweet malt porridge breads



A wide range of sweeter and softer sourdough whole grain bread types is possible by making a portion of the whole grain flour into a porridge and treating it with enzyme-active malt. The malt treatment produces sugars that enhances fermentation and browning of the crust, as well as some sweetness in the final bread, a tender crumb, favorable changes in the dietary fiber components and enhanced release of antioxidant phenolic compounds.

### About malt

Malt is the name given to grains such as barley, wheat or rye, which are sprouted until the main shoot (plumule) is about three quarters of the length of the grain, and the roots are very obvious and considerably longer than the plumule. Sprouting to this stage takes 3-4 days at 50–60°F (10-16°C). The sprouted grain can be dried at warm room temperature to preserve the enzymes and their activity. The roots and shoots dry out and are chipped off. This specially sprouted and dried grain is known as *enzyme-active malt*, or *diastatic malt* for one of the enzymes called *diastase*. If malt is roasted at higher temperatures it is used for roasted grain flavor and color only, since the heat will likely have destroyed the enzyme activity. To be called *malt* the sprouting of the grain, is specifically carried out as just described.

During the sprouting, besides the production of enzymes, there is also a considerable increase in vitamin content compared with the original dry grain. In particular, vitamin C is barely detectable in the dry grain but increases considerably in the sprouted grain. Perhaps the form and amount of vitamin C present in malt, accounts for my own observation that added vitamin C makes little or no difference to the bread texture of these sweet malt porridge breads.

Some malt enzymes that are useful in bread-making include *alpha-amylase*, *phytase*, *pentosanases* and *polyphenoloxidases*.

Several kinds of *amylase* breakdown starch into the smaller sugar units from which the starch is built. However, *alpha-amylase* is of particular interest because in sound grain there is very little, but in malt the amount of *alpha-amylase* is dramatically increased. It is particularly able to degrade cooked (gelatinized or damaged) starch.

*Alpha-amylase* can also degrade intact starch and if left unchecked the degradation can liquify much of the starch, by the time it is baked. The heat of baking eventually stops the reaction. However, in a sourdough leavening system, the dough becomes acidified to pH 4 before baking. It is this acidity that prevents overproduction of sugars and over-degradation of the starch structure during the early stages of baking. Sufficient time is therefore needed to acidify the dough enough to halt the starch degradation, before it is too much converted. The remaining breakdown product is *dextrin*, which provides good water retaining and anti-staling properties in the final bread. The smallest sugars are mostly used up by the sourdough microorganisms. Enough larger sugars remain to give sweetness to the bread. Another limit to this activity is the result of choosing to have no more than say 10% of the total flour made into a sweet porridge. The idea of allowing at least some of this enzyme activity to happen ahead of mixing with the starter and making the dough, is to provide an early supply of nutrients for the microorganisms.

The *phytase* present in malt can likely act on the bran in the whole grain flour porridge, and so release valuable amounts of iron, zinc, magnesium and potassium from the phytic acid, which is probably complexed with these metal ions. *Myo*-inositol, which is part of the B-vitamin complex, and phosphate ions are also likely released from the phytic acid into the porridge.

Pentosans make up much of the dietary fiber in the many cell walls of the outer aleurone and bran layer of grains as well as in the larger cells of the endosperm. Water-soluble pentosans are prebiotic; they provide nutrients for the sourdough microorganisms. Because the soluble pentosans are gummy, they have beneficial water holding capacity in the final dough. However, the insoluble pentosans are seen simply as insoluble fiber. The effect of *pentosanases* is to release soluble pentosans from the insoluble pentosans and so to soften the bread crumb structure with their gumminess. Also, by assisting in the breakdown of cell walls, *pentosanases* improve the accessibility of the other cell components, including antioxidant polyphenols, as well as the starch and protein for fermentation and dough structure. The sodium in common salt is seen as a mild inhibitor of *pentosanases*, so it is advantageous to allow this malt enzyme to function in a simple porridge before any salt added.

The *polyphenoloxidases* work in concert with the *pentosanases*. As the cell wall pentosans are broken down, polyphenolic compounds are released from the cell walls and made available for degradation by the *polyphenoloxidase* to the smaller phenolic compounds. These released smaller phenolic compounds show higher anti-oxidant ability than when they are bound up by the fiber, and they are easily absorbed when eaten in the final bread. Polyphenolic compounds are also released from dietary fiber in the gut and so absorbed. Absorbable plant phenolic compounds are valuable in the diet, since they protect against cardiovascular disease and the related obesity and diabetes, by incorporation into the interior walls of the blood vessels. A great many phenolic compounds are available from whole plant foods, including whole grains; it is this group of compounds that is seen to particularly protect the interior surface of blood vessels and keep them healthy. Severe covid symptoms are associated with unhealthy blood vessels. It is interesting to note that *ferulic acid* is a major phenolic compound in whole wheat and also in whole rice (brown rice), whole corn, whole oats and other whole grains. From this we can see that by eating only refined grains, we would be deprived of a significant source of protection against the metabolic diseases associated with unhealthy blood vessels.

You can read more about the protective effect of plant phenolic compounds at [www.pubmed.gov](http://www.pubmed.gov). As background it is useful to know that some important pentosans in wheat are known as *arabinoxylans*, and that the most prevalent *phenolic acid* in wheat is *ferulic acid*. Another name for *pentosanase* is *xylanase*. It looks very much that people who are consuming enough whole grain foods, will have enough *ferulic acid* in their system to have a good chance that they will be protected from the most severe effects of covid! Here are some articles that lead to this conclusion.

[https://www.npr.org/sections/health-shots/2020/11/05/917317541/clots-strokes-and-rashes-is-covid-19-a-disease-of-the-blood-vessels?utm\\_source=npr\\_newsletter&utm\\_medium=email&utm\\_content=20201108&utm\\_term=4947911&utm\\_campaign=health&utm\\_id=49493282&orgid=](https://www.npr.org/sections/health-shots/2020/11/05/917317541/clots-strokes-and-rashes-is-covid-19-a-disease-of-the-blood-vessels?utm_source=npr_newsletter&utm_medium=email&utm_content=20201108&utm_term=4947911&utm_campaign=health&utm_id=49493282&orgid=)

<https://pubmed.ncbi.nlm.nih.gov/33077275/>

<https://www.nytimes.com/2020/11/26/health/dr-mary-fowkes-dead.html?searchResultPosition=2>

<https://pubmed.ncbi.nlm.nih.gov/31448280/>

### *Malt sources*

Enzyme active or diastatic malt is produced in quantity for brewers of beer. This means that the best sources are maltsters directly, or through their distributors. For home bakers, microbrewery supply stores sell wheat malt.

Note that barley malt is the usual malt for beer. However, barley is malted in the husk, which must be removed before it is suitable for use in bread. (Remember that *husk* or *hull* is the stiff chaff covering on grains in the field, whereas the *bran* is an edible thin skin on the outside of the grain itself.) For bread, hull-less barley types could be specially malted for use in bread, but currently this is not normal practice by maltsters. You can of course make your own malt from hull-less barley.

Fortunately, most wheat and rye varieties are naturally hull-less and are malted for making specialty beers. Both wheat and rye malts are therefore also available for bread-making.

Malt, for use in supplying enzyme activity for breadmaking must be enzyme active or diastatic. If malt has been roasted it will not supply enzyme activity.

### *Porridge and bread*

*Porridge* is simply a cooked mixture of milled grain and water. Practically any grain can be used and milled to a wide range of textures from fine flour to coarse flakes, to provide a correspondingly wide range of porridge textures, both savory and sweet. Flours, as opposed to grits or grains, will cook fastest and make porridge with the smoothest texture. Single pass stone and impact milled dry whole grain flours with fine bran and germ particles will produce the finest texture porridge and the finest texture in bread.

Examples include *oatmeal porridge*, and *polenta* which is a cornmeal porridge. Ancient Roman *puls* was a *porridge* made with available wheat or barley meal, and also with starchy chestnuts or buckwheat. *Puls* was the most basic of ancient Roman foods among those who did not have access to bread ovens or who could not afford to buy bread and before the introduction of potatoes and corn! Cooked breakfast cereals and

cooked cereals for babies are all porridges even though they are often given other names, like *pap*. Middle Eastern and Indian sweet puddings made with rice and durum wheat grains and flour are also fundamentally porridges. Packaged dessert puddings such as British custard powder, or American chocolate pudding mixes, are generally a corn flour base for fine textured and flavored porridge, to be made up with milk instead of water. Surely the *pastry cream* made by pastry chefs is an elaborated porridge.

Most amazing is perhaps *samanoo* which is made specially for the Persian New Year. *Samanoo* is a porridge sweetened by the action of malt; no sugar is added. I learned about *samanoo* from a friend after preparing sweet porridge for bread, in my own way, for a year or more. For *samanoo* the mixture of porridge and malt that I make would be further cooked on the stovetop, after allowing the sweetness to develop, instead of using it directly in bread dough. The concept is indeed ancient.

The timeline for the introduction of leavened bread following porridge making, is surely blurred by the realization that a porridge, especially a malt sweetened porridge would ferment very easily if left out in the warmth of summer. In my own experience, the explanation given to me as a child for the existence of bread leavening was that it was originally found in a naturally fermented porridge. Only later, was I taught that the ancient Egyptians were the inventors of leavened bread; no doubt it was the Egyptians who first recorded the process. Very interesting, is the revelation that Ethiopians in the Upper Nile, to this day make their sourdough fermented teff injera with a portion of the flour cooked to a porridge.

### *Making a sweet malt porridge*

The ancients in Europe no less than modern people, must have wanted sweetness in their porridge as a change from purely savory flavors. The discovery that sprouting grains become sweet must have been an early major discovery. Only a short time later no doubt, it was realized that some ground up sprouted grains could be added to a warm porridge, which would become distinctly sweet on standing.

In the recipes for bread here, I simply mix whole wheat flour with four times its weight of cold water. Mixing or perhaps whisking this to a smooth slurry is easy. For home baking the amounts used are small, so that cooking the porridge in a small saucepan over medium to high heat while constantly stirring, produces a fully cooked porridge in just a few minutes. The porridge once made, can also be fairly rapidly cooled by standing in a bowl of cold water. On a larger scale, or to make porridge with less stirring, the flour can be mixed to a smooth paste with a small amount of cold water, while the remainder of the water is heated almost to boiling. The hot water is gradually added to the flour paste with constant stirring to avoid lumps, and this mixture is returned to the saucepan and brought to a boil with constant stirring until cooked. No doubt chefs have mastered larger scale porridge making and can be consulted.

A *spurtle* is definitely the tool of choice for all the stirring and beating involved in making a sweet porridge at home. The *spurtle* is little more than a stick in appearance and the fancy looking turned notches on the handle seem like decoration, whereas when you handle and use the spurtle you will find that they anchor the fingers and palm of your hand very neatly. Gripping a stick would be tiring, gripping a *spurtle* is comfortable. This also shows how you would choose a spurtle; it should be according to the way in which you can handle it, rather than just the way it looks.

### *Some practical notes about making whole wheat sourdough bread at home*

- Making bread is predictable by weighing ingredients with a digital scale that reads out in grams down to 0.1grams, and by using a constant temperature dough proofing box or cabinet.
- Freshly milled whole wheat flour has the best flavor. Fine milling, including fine milling of the bran, in a single pass stone mill or impact mill produces the finest textured bread.
- Temperature changes of 18°F (10°C) will change the rate of fermentation by 2-3 times. Thus, a fermentation step taking 4 hours at 86°F (30°C) will take 8-12 hours at 68°F(20°C). Dough temperature must be steadily maintained for a predictable outcome. In winter equipment might need warming and the dough might need to be made up with water at the required dough and environmental temperature. In summer, equipment and dough formulation water might need to be cooled.
- The predictability of sourdough breadmaking is also due to the use of a consistently produced mature sourdough, saturated in microorganisms.
- Bakers percent (%) = ingredient amount compared with total base amount of flour in a recipe, as 100%
- Ovens that are only somewhat larger than the size of your load of loaves are best. A small electric pizza-toaster oven works well for a single loaf and may in fact be better than a cavernous home oven intended for the Thanksgiving turkey. In any case it is good to equilibrate the oven temperature ahead of baking. Reason for this is that the air temperature may indeed be as shown on the thermometer, but the walls of the oven and baking stone, may take 30 minutes more to be fully heated. With pre-heated baking stone and oven walls, the baking can occur with radiation from the oven structure, direct conduction from the hot air and steam and convection.
- Humidity in the oven can be managed by placing a tray of water below the oven baking shelf, before heating the oven. The tray of water is left in place while the oven is heated and through the entire bake time. Extra care is needed when opening an oven filled with steam in this way: Have the venting fan above the oven switched on, and open the oven door only enough to vent the steam upwards, before opening the door fully to either place the bread in the oven or remove it after baking.