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# Malted Barley Flour for Malnourished Infants

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*This article is in part based on a booklet called 'PowerFlour' by John L. Herlache, MD, and on information posted online by the PowerFlour Action Network*

Porridges are made by boiling traditional starchy foods such as cornmeal, rice, oatmeal, potato, or ground sorghum in water. The water seems to disappear, but in reality the water molecules are inserting themselves into the complex starch structures, causing the food to swell. The result is a familiar thick and sticky product that is more tasty and easier to eat than the dried meal would have been. However, it can be difficult for infants to swallow. Enzymes in malted barley flour (germinated barley seeds that have been carefully dried and ground into a powder) can convert these boiled staple foods into a semi-liquid form that is easier to swallow for infants, for adults suffering from starvation, or for AIDS patients with throat infections.

Cooked porridges can also be made thinner by adding additional water, but water used for this purpose is often dirty and results in diarrhea. In addition, adding liquid means that the porridge has a lower "nutrient density," so more porridge must be consumed to get the same amount of nutrients. This could result in the stomach becoming full before enough food has been eaten to provide adequate nutrition.

More important than liquefaction, the malting process in effect pre-digests much of the porridge, making sugars, amino acids, calories and mineral nutrients immediately available.

The immature digestive system of younger infants cannot produce the enzymes needed to digest some major components of starchy foods, including the starch and protein components. This presents a serious problem if the mother dies or becomes ill, is too malnourished to give enough milk, or quickly becomes pregnant again. Porridge may be one of the few options available to an extremely poor family as a substitute for or supplement to breast milk. (Note that the carbohydrate in breast milk is glucose, not starch, so no digestive enzymes are needed. Proteins in breast milk must be broken down by digestive enzymes, but the necessary enzymes come with the milk.)

Adults suffering from starvation, including people with advanced AIDS, face a similar challenge to infants in that their digestive systems may have ceased to produce the necessary enzymes.

## **What is malted barley flour?**

Malted barley flour is simply sprouted barley grain that has been dried and then ground into a powder. Sometimes it is just called —malt<sup>2</sup> for short. Barley seeds are soaked in water to start the process of germination. As the seeds germinate, enzymes are produced that make sugar, minerals, and amino acids available to the developing seedling. It generally takes two days of soaking for germination to occur. Soaking is continued for an additional four days, at which point the sprouted seedlings are heat dried at carefully controlled temperatures and then ground into a powder. The final product is an almost white powder that is considered safe by the United States Food and Drug Administration. It is also inexpensive. Based on the cost of production in the United States, only US 1.5 cents would supply enough malt flour to make four cups of porridge every day for a week.

The process described above preserves the enzymes in their active state and provides a way to pre-digest starchy foods. The enzymes are the secret behind malting flour. An enzyme is a protein that speeds up chemical reactions many times faster than they would occur without the enzyme.

### **How is malted barley flour used to treat porridge?**

Porridge is made the traditional local way (usually by boiling in water). Add ¼ teaspoonful (1 ¼ ml) of powder to a serving bowl or 4 teaspoons to a gallon of porridge, after the temperature drops to about 70°C (158°F). As you stir the malt flour into the porridge, it will quickly become thinner. Since malt flour breaks down sugars, the result is also a sweeter-tasting liquid that can be fed from a cup.

If you add the malt to the hot porridge right after it is made, the enzymes will be denatured (their 3-dimensional structure will be altered and they will lose the ability to do what you wanted them to do.) The enzymes will not be denatured by heat if they are added after the porridge cools to a temperature of 70°C or less. There are actually a number of different enzymes that have slightly different methods of action. Each enzyme has an ideal temperature where it works the fastest. So as the porridge cools, the enzyme that worked best at the higher temperature begins to slow down but other enzymes in their turn become the most active. By the time the porridge is a comfortable temperature for eating, they have probably each done their special task.

It would be good to use a thermometer at first, but you do not need to be too precise. We find that if the temperature of the porridge is low enough that we can just barely hold the bowl comfortably in our hands, it is probably at about the right temperature. We've always succeeded and have yet to use a thermometer. Successful treatment is visually obvious.

### **Where can I find the right kind of malt?**

There are two kinds of malt, each with unique uses. The kind with enzymatic activity is needed for malting porridges, brewing and some baking uses. To make this kind of malt, the drying and grinding are done with great care so as not to inactivate the enzymes. If enzymatic activity is not important, for example when the malt is used for its special flavor, then higher drying temperatures are used. The high temperatures actually contribute to the flavor of malt. The two general kinds of malt are distinguished as "diastatic" or "non-diastatic" barley malt (or simply "malt powder").

Malt with active enzymes (high diastatic power) could very well be available in the country where you work. Such malt is sometimes referred to as "PowerFlour."



Figure 2: The photos at the left show a bowl of oatmeal before (top) and after (bottom) adding PowerFlour

You might first try grocery stores or health food stores (if the latter are found in your country). If you cannot find it there, check with bakeries or brewing companies, or companies that sell ingredients to bakers or brewers. The enzymes in malt are an essential ingredient in making beer, so any country that makes beer has to be producing or importing malt with active enzymes. However, Dr. Herlache says you would need to do an extra step. "If [you] use brewer's malt, it will have to be ground or milled. The brewers like to have husk particles to help keep the brew flowing. For consumption, this is a problem."

The PowerFlour Action Network [www.powerflour.org](http://www.powerflour.org) (<http://www.powerflour.org/>) supplies trial amounts of Power Flour, the malt with the highest level of enzymatic activity. Brewing-quality malt will do the same thing; it will just require that you use a bit more malt.

Be careful, though. You may be more likely to find non-diastatic malt in stores that sell to the general public, because it is a common flavoring ingredient in food products. In the United States these would include some breakfast cereals and English muffins. That kind of malt would add flavor to the porridge, but nothing else. You may also find a preparation of non-diastatic malt that has been mixed with milk and wheat flour and dried, called "malted milk powder." This is commonly used in malted milk shakes and candy (e.g. malted milk balls or Milky Way candy bars). This, too, has no enzymatic activity.

You could try making your own malting enzyme, though this would be a last resort with commercial products being so inexpensive and superior. Tom Hartzell with PowerFlour Action Network (PFAN) shared the following: "Dr. Noel Vietmeyer

[whose books on underutilized tropical plants first inspired ECHO's seedbank ministry in 1981] told me that several African cultures prepare their own "home grown malt" by sprouting millet, sorghum or barley (Ethiopians grow barley) to make an enzyme preparation for supplementing cassava flour or the like for children who have been weaned. It is very crude and often the mixture is moldy (could they be mycotoxins [i.e. like aflatoxin]?) or fermented." So it is worth the effort to try to find commercial malt.

Tom added, "If you cannot obtain a suitable malt in-country, you might consider importing PowerFlour. [If] you can cover shipping costs and have an on-going ministry, PFAN might be able to provide free product."

### **How does it work?**

Three enzymes present in PowerFlour are especially important: amylases, proteases, and phytases.

Amylases break down large carbohydrates into more simple sugars that can easily be utilized by the digestive systems of infants and severely malnourished adults. Malt flours are assigned a "diastatic power" (DP), which refers to the amount of amylase enzymes present in the flour. Brewer's malt, for instance, has a diastatic power of 100-140 DP. High diastatic malt, such as PowerFlour, has a DP of over 200, so less of the malt is needed to convert the carbohydrates in a given time than would be needed with a malt of lower diastatic power. It is worth noting that enzymes are not used up in the process. They are called "catalysts" because the same enzyme molecule can split hundreds of carbohydrate molecules into sugars until something happens to damage (denature) the enzyme. So a comparable amount of a less powerful malt might achieve the same objective; it would just take more time or you would need to use a bit more malt.

Phytase is the third kind of enzyme. Phosphorus, potassium, iron, copper, zinc, magnesium, and manganese are stored in cereal grains in a complex substance called phytin. The enzyme phytase breaks down the phytin, releasing these essential nutrients and allowing them to be absorbed by the human digestive system. Neither children nor adults can make their own phytase, so the nutrients would just be excreted otherwise.

### **Where can I learn more?**

The PowerFlour Action Network has helpful technical information on its website ([www.powerflour.org](http://www.powerflour.org)) (<http://www.powerflour.org/>), including a scientific study of benefits of Power Flour with malnourished children in Panama. You may write them at PowerFlour International, 600 Moasis Drive, Little Chute, WI, 5414.

John Herlache, MD, has written an exceptionally clear yet detailed 23-page booklet for the PowerFlour Action Network called Power Flour. It can be downloaded from the web at no cost at (<http://powerflour.org/bookletpdf.htm>).