

# Module 1: Hydrothermal processing to promote micronutrient bioavailability in processed food products

Introduction to Hydrothermal Process -  
Reducing phytates to increase bioavailability



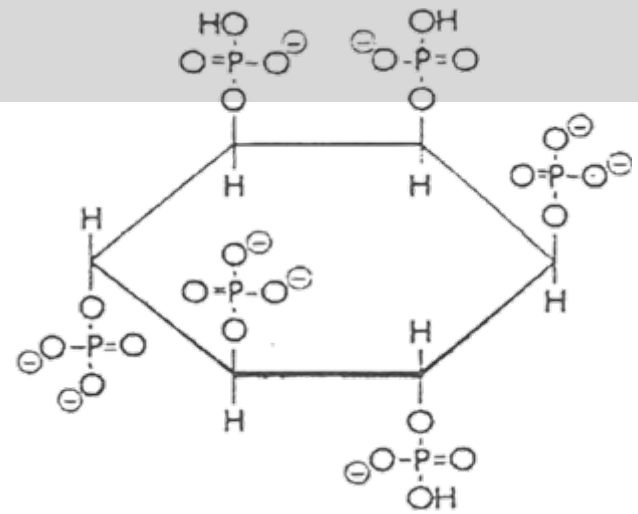
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# Introduction

**Phytic acid** is a natural substance found in plant seeds. When is time for seeding, seeds (like grains and legumes) use minerals and vitamins to grow. Up to 90% of the phosphorus in the seeds, that gives the growing sprout energy, is stored and protected by phytic acid.

Phytic acid also has a strong binding affinity to dietary minerals like **calcium, iron, and zinc**, inhibiting their absorption in our intestines.

Therefore, it is associated with iron and zinc deficiencies and it is often referred to as an **anti-nutrient**. On the other hand, phytate has a positive nutritional role as an antioxidant.



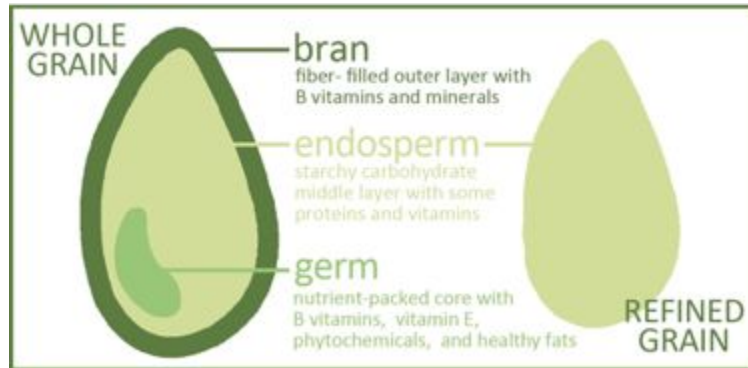
Phytic acid is also known as inositol hexaphosphate, or IP6. When phytic acid is bound to a mineral, is called phytate.

Read more here: Schlemmer U, Frølich W, Prieto RM, Grases F. Phytate in foods and significance for humans: food sources, intake, processing, bioavailability, protective role and analysis. *Mol Nutr Food Res*. 2009 Sep;53 Suppl 2:S330-75. doi: 10.1002/mnfr.200900099. PMID: 19774556.

# How to reduce phytate?

Phytate is quite heat stable and cannot be removed by conventional heat treatment or cooking. What can food companies do to reduce anti-nutrients in their food products? There are a number of techniques to help food processors:

**Milling:** With this method to reduce phytate in cereals comes also reduction of minerals since both are located in the outer layer or in the germ.



**Soaking and decanting:** Some activation of intrinsic phytase can occur even if optimal conditions of temperature, pH and humidity are not achieved. It also depends on plant species and/or if they are intact.

# How to reduce phytate?

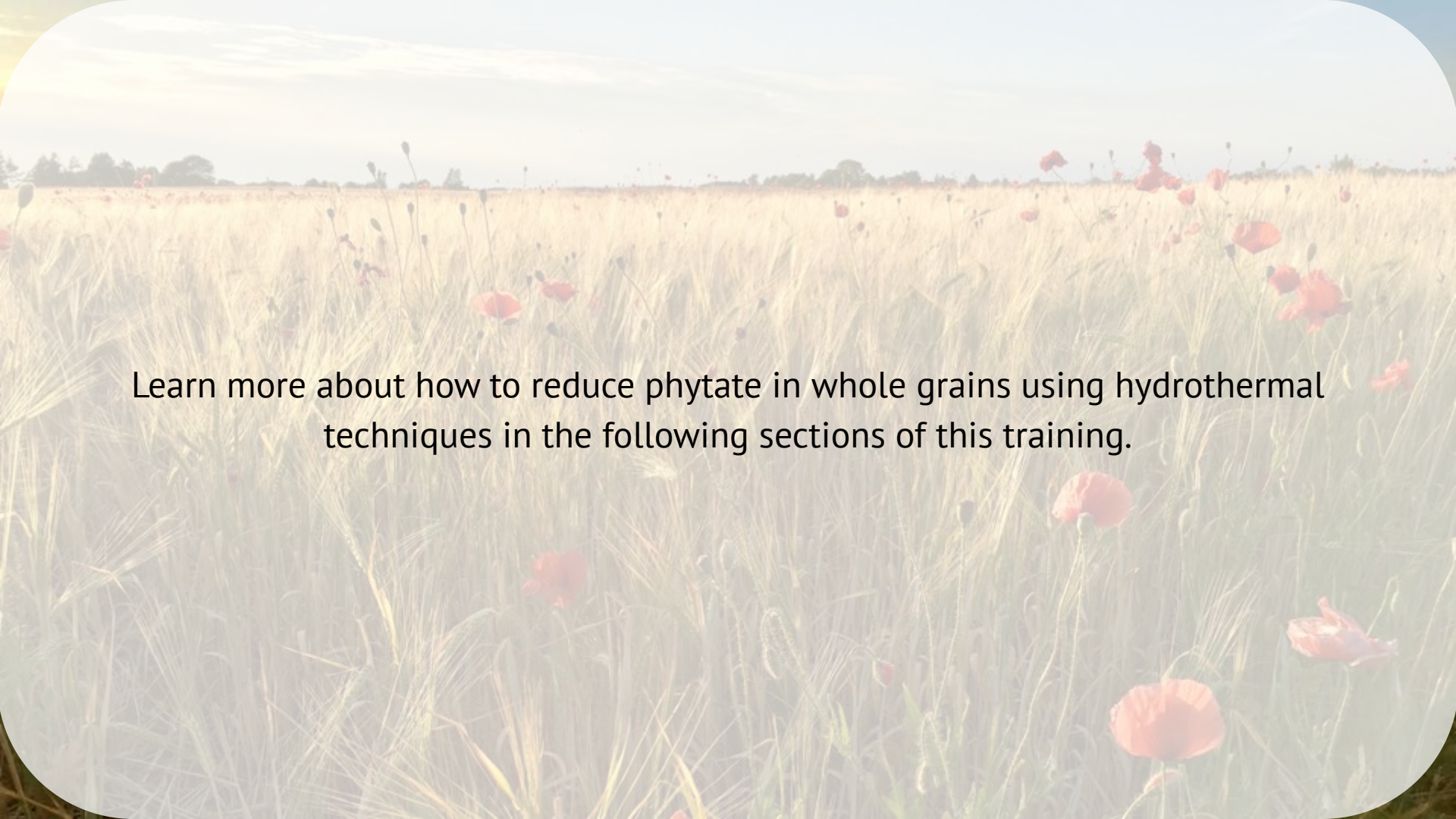
**Malting and germination.** During these processes phytase (a naturally occurring enzyme) is activated and naturally starts to degrade phytate but optimal conditions need to be achieved.

**Fermentation:** In this process microbial cultures from naturally or exogenous microflora hydrolyse phytic acid to lower forms. When pH is reduced by this fermentation, the intrinsic phytases become activated and start degrading phytic acid.

# How to reduce phytate?

**Hydrothermal treatment:** By using right conditions for activating the endogenous phytase, a degradation of phytate by up to 90% can be achieved. Optimal temperature and pH for the specific enzyme is needed in each step of the process.

**Thermal processing:** Modest loss, due to heat stability of phytate, is seen in canning and extrusion when higher temperature is used.

A wide-angle photograph of a field of golden wheat. Scattered throughout the field are several bright red poppies. The sky is a pale, hazy blue with some light clouds. The overall scene is bright and natural.

Learn more about how to reduce phytate in whole grains using hydrothermal techniques in the following sections of this training.