

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

Introduction to Nutritive Food Product Development -
Enhancing Micronutrients' Bioavailability



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Nutrient density

Plenty of the strains of **ancient grains** contain **high concentration of micronutrients** and hence are **naturally bio-enriched**.

Ancient grains have high contents of minerals like iron and zinc as well as vitamins like carotenoids, lutein and lycopene.

Many of today's processed foods lack nutritional density and there is a clear need to improve the nutritional quality of processed food products, particularly for companies focusing on low-income customers.

Many of these low-nutrient processed foods are paradoxically made using locally available traditional grains, most of which are naturally nutrient rich. How is this happening?

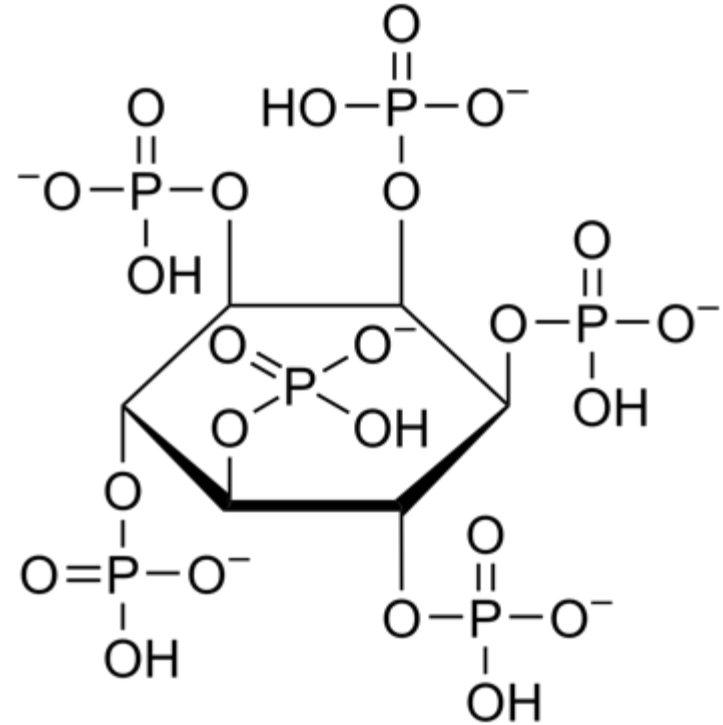
Anti-nutrients / phytic acid

With high amounts of minerals in the grains follow high amounts of **phytic acid**.

Phytic acid is an **anti-nutrient** with a strong binding affinity to the dietary minerals like iron, zinc, calcium and magnesium.

When minerals bind to phytic acid, they form insoluble precipitates which are badly absorbable in the intestines and therefore contribute to mineral deficiencies.

A molecule of phytic acid



What is bioavailability?

Bioavailability is the technical term used to communicate the fact that not 100% of nutrients ingested will be absorbed, irrespective consumed in the form of food, additives or supplements.

The supply of nutrients to the human body thus not only depends on the amount of the nutrient in a food, but also on its bioavailability. Understanding nutrient bioavailability helps to optimize diets and set appropriate nutrient recommendations.

The bioavailability of macronutrients, i.e. carbohydrates, proteins and fats, is usually high with more than 90% of the amount ingested being absorbed. On the other hand, micronutrients can vary widely in the extent to which they are absorbed and utilized after ingestion.

Read more: Schonfeldt, Hettie & Pretorius, Beulah & Hall, Nicolette. (2016). [Bioavailability of Nutrients](#). Encyclopedia of Food and Health. 10.1016/B978-0-12-384947-2.00068-4.

Enhancing bioavailability

To reduce anti-nutrients and **enhance bioavailability of minerals**, food companies need to incorporate some processing methods:

- Fermentation of grains and legumes with lactic acid bacteria
- Sourdough fermentation of bread
- Soaking of grains and legumes
- Malting of grains
- Hydrothermal process

For example, by adopting **a hydrothermal processing** of whole grains, food companies can create products that reach the **iron absorption of red meat** and increase **zinc absorption up to 400%**.

More detailed information is provided in section “Introduction to Hydrothermal Process”

[Read more: Plant food anti-nutritional factors and their reduction strategies: an overview.](#) Mrinal Samtiya, Rotimi E. Aluko and Tejpal Dhewa

Enhancing bioavailability

Success with grains processing would likely transform Africa's native cereals into big-time, high-value worldwide foods.

Read more: Gibson R S. Lead Article: Implications of phytate in plant-based foods for iron and zinc bioavailability, setting dietary requirements, and formulating programs and policies. Nutrition Reviews Vol. 76(11):793–804



A wide-angle photograph of a field of tall, golden-yellow grass. Scattered throughout the field are numerous red poppies, some in full bloom and others as buds. The background shows a distant treeline under a clear, light blue sky. The entire image is framed within a rounded rectangle.

How food products are consumed at household level can also contribute to increase absorbability of nutrients. This is why **communicating to consumers** is so important to combat hidden hunger.

Learn more about how food companies can better communicate to consumers in the next chapter of the training.