# How Can a Diet Rich in Phosphorus Lead to Phosphorus Deficiency and Other Deficiencies?

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Food's contribution to a person's good health involves three main parts: nutrition, digestion and assimilation. The first involves eating foods that contain the nutrients our bodies need. The second involves the body's ability to break down the food, so that the nutrients are available for use. The third part involves the body's ability to take those nutrients and use them to strengthen and repair the body. Sometimes, even when you are eating the "right" food, digestion is problematic and you will not get the full benefit.

(If you know chemistry, phytic acid has six phosphate groups covalently bound to a ring of carbon atoms.) All seeds contain phytic acid, but soy products and oats contain particularly high amounts. Unless the phytic acid molecule is broken down, either before or during digestion, the phosphorus will be unavailable to the body.

In addition to the bound phosphorus, phytic acid can interrupt the body's ability to utilize minerals found in food. Phytic acid in its "salt" form is referred to as phytate; in this case, phytic acid binds with minerals that include calcium, magnesium, copper, iron and zinc. Unless phytic acid is broken down before or during digestion, regular dietary intake of phytic acid can contribute to mineral deficiencies and bone loss, because these important minerals are bound up in phytate rather than assimilated into the body. Phytic acid can also bind niacin, making it unavailable to the body. A deficiency of this B vitamin can cause pellagra (symptoms include fatigue, sore skin and mental disorders).

The textbook Botany: *An Introduction to Plant Biology* by James. D. Mauseth corroborates this information. Mauseth describes the concentrated mineral storage in seeds. When phytic acid dissolves in plant tissue, it ionizes, losing protons (H+). When the developing seed begins to concentrate the phytic acid, "it puts cations on it rather than returning the protons, and the cations used are Mg2+, Ca2+, Zn2+ and K+. This mineral-holding form is phytin, and it permits the [seed] to not only store . . . phosphate but all these other essential elements as well."

Ruminant animals can break down phytate molecules and use the phosphorus, because rumen microorganisms produce an enzyme (phytase) that releases phosphate from the phytate molecule. However, non-ruminants often lack the phytase enzyme. For them, phytates in the diet can cause problems. [This also means that manure from monogastrics like pigs and chickens contains a lot of potentially available phosphate when the manure decomposes—good for the garden, but bad for the environment if available in excess.] Sally Fallon, author of a

book called *Nourishing Traditions* (https://www.amazon.com/Nourishing-Traditions-Challenges-Politically-Dictocrats/dp/0967089735), had this to share after reading a draft of the article: "Monogastric animals and humans [sometimes] do have phytase in the digestive tract—depending on their intestinal flora and other factors. This is why in studies, some humans will develop mineral deficiencies with high-phytate diets and others will not. Also, there is some phytase in the grains themselves, and depending on the conditions in the gut, some people will be able to activate and use the enzyme to break down the phytic acid."

While cooking helps to reduce phytic acid in food, there are other simple and more effective methods of reducing the level of phytic acid in whole grains. These include soaking grains in water with acid added; lactic acid fermentation (lactobacilli, the "good" intestinal bacteria that produce lactic acid, are a source of phytase); and sprouting. As you read in the last issue of *EDN*, malting enzymes can also be used in porridges to break down phytic acid and phytates.

Sally Fallon, in *Nourishing Traditions (NT*), wrote: "Traditional societies usually soak or ferment their grains before eating them, processes that neutralize phytates and enzyme inhibitors and, in effect, predigest grains so that all their nutrients are more available. Sprouting, overnight soaking and old-fashioned sour leavening can accomplish this important predigestion process in our kitchens. Many people who are allergic to grains will tolerate them well when they are prepared according to these procedures. Proper preparation techniques also help break down complex sugars in legumes, making them more digestible." *(NT*, p. 25)

**Soaking**. "Our ancestors, and virtually all preindustrialized peoples, soaked or fermented their grains before making them into porridge, breads, cakes and casseroles. A quick review of grain recipes from around the world will prove our point: In India rice and lentils are fermented for at least two days before they are prepared as *idli* and *dosas*; in Africa… coarsely ground corn [is soaked] overnight before adding it to soups and stews, and they ferment corn or millet for several days to produce a sour porridge called*ogi*; a similar dish made from oats was traditional among the Welsh; in some [Asian] and Latin American countries rice receives a long fermentation before it is prepared; Ethiopians make their distinctive *injera* bread by fermenting a grain called teff for several days; Mexican corn cakes, called *pozol*, are fermented for several days and as long as two weeks in banana leaves; before the introduction of commercial brewers yeast, Europeans made slow-rise breads from fermented starters; in America the pioneers were famous for their sourdough breads, pancakes and biscuits; and throughout Europe grains were soaked overnight, and for as long as several days, in water or soured milk before they were cooked and served as porridge or gruel."

"Soaking allows enzymes, *lactobacilli* and other helpful organisms to break down and neutralize phytic acid. As little as seven hours of soaking in warm [acidified] water will neutralize a large portion of phytic acid in grains. The simple practice of soaking cracked or rolled cereal grains overnight will vastly improve their nutritional benefits." (*NT*, p. 452).

**Sprouting**. "The process of germination not only produces vitamin C but also changes the composition of grain and seeds in numerous beneficial ways. Sprouting increases vitamin B content, especially B2, B5 and B6. Carotene increases dramatically—sometimes eightfold. Even more important, sprouting neutralizes

phytic acid…; sprouting also neutralizes enzyme inhibitors present in all seeds. These inhibitors can neutralize our own precious enzymes in the digestive tract. Complex sugars responsible for intestinal gas are broken down during sprouting, and a portion of the starch in grain is transformed into sugar. . . .Finally, numerous enzymes that help digestion are produced during the germination process." *(NT*, p. 112)

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