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Foods with added phosphate cause spike in blood, even in people with healthy kidneys

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Phosphates artificially added to dairy and cereal products appear to cause bigger spikes in blood phosphorus levels than naturally occurring phosphates, potentially putting harmful stress on kidneys. Too much dietary phosphate stiffens blood vessels, enlarges the heart and is bad for bones, but a new study by Houston Methodist researchers suggests it matters where the phosphates come from.

The scientists' report will appear in the August 2015 issue of the *American Journal of Clinical Nutrition* (early online).

"The study suggests people should be more aware of what they eat," said Linda Moore, director of clinical research programs for Houston Methodist Hospital's Department of Surgery and the report's lead author. "The Institute of Medicine recommends 700 milligrams of phosphate per day and we think that's a good number. What we were seeing in this study was twice the consumption of that amount for a lot of people. Too much phosphate is concerning to people who are healthy—but it is of special concern to people who already have kidney damage or chronic renal disease."

Phosphorus, an element, is crucial for life. It helps form the backbone of DNA and RNA, is heavily involved as energy currency within and between cells, helps translate hormone signals into changes in cell behavior, and can even be a pH buffer. It occurs in many forms in the body, very commonly as phosphate. Phosphates are molecules of phosphorus and oxygen (PO43-) and are added to many foods as salts.

Phosphates can be preservatives, thickening agents, and leaveners. As with anything, it seems, too much phosphate can be a bad thing.

Over the last 10 years, a stream of correlative studies has cast pallor over phosphates as a food additive. Most of the studies have reported a positive, strong relationship between the consumption of phosphate (in any form) and various morbidities, kidney failure in particular. The more phosphates people consume, the more likely they are to experience blood vessel changes that can lead to decreased kidney function.

"Excess phosphorus has adverse effects on patients who already have kidney disease but can also cause kidney problems," said Wadi Suki, M.D., the report's principal investigator. "High phosphorus in blood is associated with increased patient mortality, increased blood vessel stiffening, as well as increasing the rate of calcium deposition in heart valves. This calcium comes out of bones and, therefore, weakens bones as well as damaging kidneys."

What hasn't been studied up until now is whether phosphates artificially added to food have the same impact as similar amounts of phosphates that are naturally-occurring.

"Pancake and 'quick bread' mixes and processed cheeses often contain a lot of inorganic phosphate, so those should be consumed less frequently," said Moore, a former chairperson of the National Kidney Foundation, Council on Renal Nutrition. "We are seeing an increase in the proportion of Americans who have kidney disease, but no good explanations why. We thought that it might matter how the phosphates exist in different foods, and how we absorb them."

The effect of these added phosphates can be interpreted by how much they raise the serum phosphorus. Controlling for kidney function and for all other types of foods eaten, one serving of dairy products with

inorganic phosphate additives (e.g, 1 ounce of processed cheese) will increase the serum phosphorus by 0.07mg/dL and one serving of cereals or grains (a 1/2 cup portion) with added phosphates will increase the serum phosphorus by 0.01mg/dL.

The researchers drew on patient data from the National Health and Nutrition Examination Survey (NHANES), a U.S. Centers for Disease Control and Prevention project that combines survey and laboratory data. They gathered patient data from 2003 to 2006 to determine what foods people were eating and how these foods affected blood phosphorus levels. Foods were rated and phosphate content quantified based on Academy of Nutrition and Dietetics guidelines. Blood phosphate levels were determined from lab tests performed within 24 hours of the first recorded meal. Kidney function was estimated from blood creatinine levels.

The researchers controlled for body-mass index, kidney function, sex, race, and other factors. They saw the most significant increases in blood phosphate levels occurred in people who ate dairy foods and cereal/grain-based foods that contain artificially added phosphates. The researchers termed this phosphorus "inorganic phosphorus." A less pronounced but significant increase in blood phosphate levels occurred in people who ate dairy foods without artificially added phosphates.

Predictably, kidney function impacted the degree to which phosphate levels increased. When removing kidney function as a control, the researchers found people with poor kidney function appeared to have higher blood phosphate levels, suggesting less ability to expunge excess phosphate from the blood.

Suki added, "A general rule is that if you aren't sure which foods contain added phosphate, the outside aisles at supermarkets are better than the ones in the middle."

Currently, the FDA does not require food producers to distinguish between naturally occurring and artificially added phosphates on labels. In fact, the FDA does not require food producers to quantify the amount of phosphate at all.

"We believe the FDA can reconsider how it requires food producers to describe phosphorus and phosphate additives," said Suki, a former president of the American Society of Nephrology. "An educated consumer can make better dietary choices."

Provided by Houston Methodist