Feature Editor: Stacey Phillips, MS, RD

Organic Phosphorus Versus Inorganic Phosphorus: Empowering Adult Kidney Patients With Nutrition Education

Michelle Bump, MS, RD, CSR, LD

Intended audience: adult dialysis (hemodialysis & peritoneal)

SERUM PHOSPHORUS HAS been directly associated with risk of mortality in dialysis patients.[1] Phosphorus control itself is difficult in the dialysis patient population as multiple interventions must be effective to achieve ideal serum phosphorus levels. Normally, serum phosphorus levels are managed via a three-pronged approach: a phosphorus-restrictive diet, a suitable phosphate binder regimen, and regular dialysis treatment.

A phosphorus-restrictive diet has become more difficult with the use of phosphorus additives in food products. These additives can be used for a multitude of reasons such as improved color or extended shelf life. Phosphorus additives can now be found on the ingredient list on many processed foods such as bottled sodas and teas, frozen meals, protein bars, and processed cheeses. The K/DOQI guidelines recommend a phosphorus restriction of 800-1000 mg per day for patients with end-stage renal disease.[2] Dietary intake of phosphorus is difficult for patients to assess due to the lack of mandated phosphorus amounts on food labels. However, phosphorus in the form of a phosphate-containing food additive may be listed in the ingredients on food products. One study that looked at the phosphorus content of processed meat, poultry, and fish products found that products without a phosphorus-containing ingredient contained 37% less phosphorus than food products with phosphorus listed on the label in the form of a food additive.[3] Food manufacturers are also not required to test for phosphorus amounts in their food products. To further complicate matters, food products can change their formulations and new food products are frequently found on grocery store shelves.

Phosphorus in food products exists in two forms: organic and inorganic. Organic phosphorus, or naturally occurring phosphorus, can be found in animal and plant foods such as seeds, nuts, and legumes. Phosphorus in plants is mostly in the form of phytate which humans are unable to digest thereby decreasing the bioavailability of phosphorus in these foods.[4] Organic phosphorus from both animal and plant foods has an intestinal absorption rate of only 40%-60%.[4] Alternatively, inorganic phosphorus, such as phosphates added to foods during processing, has an absorption rate of greater than 90%.[4]

Educating renal patients on phosphorus additives has shown the potential to improve phosphorus levels.[5] It makes sense for renal dietitians to focus on reducing dietary phosphorus intake from phosphate additives for two reasons: they can be identified on the food product ingredient list (not so with organic phosphorus), and they have a very high absorption rate. It is important that renal dietitians educate their patients on avoidance of phosphorus additives in food products. Rather than make renal nutrition seem further restrictive, dietitians could encourage a healthy, food group–based diet with fruits, vegetables, grains, and protein foods as the foundation. Doing so will naturally decrease the consumption of phosphorus additives thereby potentially improving the phosphorus levels of renal patients.

References

1. Young EW, Akiba T, Albert JM, et al. Magnitude and impact of abnormal mineral metabolism in hemodialysis patients in the dialysis outcomes and practice patterns study (DOPPS). *Am J Kidney Dis.* 2004;44(suppl 2):S34-S38.

2. National Kidney Foundation. K/DOQI clinical practice guidelines for bone metabolism and disease in chronic kidney disease. *Am J Kidney Dis.* 2003;42(suppl 3):S1-S202.

3. Sherman RA, Mehta O. Dietary phosphorus restriction in dialysis patients: potential impact of processed meat, poultry, and fish products as protein sources. *Am J Kidney Dis.* 2009;54:18-23.

4. Kalantar-Zadeh K, Gutekunst L, Mehrotra R, et al. Understanding sources of dietary phosphorus in the treatment of patients with chronic kidney disease. *Clin J Am Soc Nephrol.* 2010;5:519-530.

5. Sullivan C, Sayre SS, Leon JB, et al. Effect of food additives on hyperphosphatemia among patients with end-stage renal disease: a randomized controlled trial. *JAMA.* 2009;301:629-635.

Oregon State University Dietetic Internship Program, School of Biological and Population Health Sciences, Moore Family Center for Whole Grain Foods, Nutrition and Preventive Health, Corvallis, Oregon.

Address correspondence to Michelle Bump, MS, RD, CSR, LD, College of Public Health and Human Sciences, Oregon State University, Oregon State University Dietetic Internship Program, 118N Milam Hall, Corvallis, OR 97331. E-mail: michelle.bump@oregonstate.edu

© *2016 by the National Kidney Foundation, Inc. All rights reserved.*

1051-2276/$36.00

http://dx.doi.org/10.1053/j.jrn.2016.05.002

Not All Phosphorus is Created Equal

Did you know that your body absorbs some phosphorus differently? What does this mean for your phosphorus levels? Knowing which foods have more of an impact on your phosphorus level will help you better control your laboratories. Talk with your renal dietitian to determine your individualized phosphorus goals.

Organic Phosphorus

- This type of phosphorus is naturally present in food.
- Organic phosphorus is found in both animal and plant foods.
- When you eat organic phosphorus, only 40%-60% of the phosphorus is absorbed.
- Taking binders will help you absorb even less of the phosphorus in these foods.
- This type of phosphorus is not found on the food label.

Foods with Organic Phosphorus

Meat, poultry, & fish
Eggs
Dairy products
Grains
Nuts & seeds
Beans
Chocolate

Inorganic Phosphorus (Hidden or Added Phosphorus)

- This type of phosphorus is added to foods during processing for a specific purpose such as improving color, flavor, or stability.
- Common foods that have inorganic phosphorus are many processed, convenience, and fast foods.
- More than 90% of inorganic phosphorus may be absorbed after eating.
- Binders can help decrease the amount of phosphorus absorbed.
- This type of phosphorus is listed on food labels, under the ingredients section.

Common Phosphorus Additives

Dicalcium phosphate
Disodium phosphate
Monosodium phosphate
Phosphoric acid
Sodium hexameta-phosphate
Sodium tripolyphosphate
Tetrasodium pyrophosphate
Trisodium phosphate

Foods with Added Phosphorus

Fast foods
Sodas/colas/bottled teas
Sports and flavored drinks
Frozen meals
Enhanced meats
Cereals
Granola and protein bars
Processed cheeses

Take Your Phosphorus Control to the Next Level

Step 1: Take Your Binders

Since most foods have some phosphorus, you must take your binders with everything you eat. Even if a food is low in phosphorus or only contains organic phosphorus, binders are needed. Talk to your dietitian if you are having problems taking your binders as prescribed.

Step 2: Focus on Food Groups

Foods you find around the outside the grocery store are less likely to have inorganic (added) phosphorus. Fruits and vegetables are naturally low in phosphorus.

Fill up your grocery cart with fruit, vegetables, protein, and grains before adding foods found in boxes, cans, and bottles on the inside aisles of the store. The goal is to have fewer foods with added phosphorus in your cart.

Step 3: Read Food Labels

On your next grocery trip, read the ingredients label on foods you normally purchase. If the letters "phos" are found anywhere in the ingredients list, the food has inorganic phosphorus.

Food manufacturers are not required to test the amount of phosphorus in their foods, but if your food has a phosphorus ingredient, it may have a big impact on your phosphorus laboratories. Look for another food or beverage that does not have phosphorus in the ingredients label or ask your dietitian about a better option.

Step 4: Be An Active Member of Your Health Care Team

Your dietitian can support you with your diet and laboratories, but at the end of the day, you are the most important member of your health care team. Problems will arise sometimes, but your team is there to support you. Take your medications as prescribed, talk to your health care team members often, and ask for help when you need it.