

Chronic Kidney Disease: Phosphorus and Your Diet¹

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Phosphorus is an essential mineral necessary for normal body functions. It is important for the formation of bones and teeth (for facts about phosphorus see <http://edis.ifas.ufl.edu/pdffiles/FS/FS23700.pdf>). Other functions include storage and use of energy, growth, and repair of cells and tissues. Phosphorus is also needed for kidney function and the regulation of muscle contractions, heartbeat, and nerve transmission.

The Connection between Chronic Kidney Disease and Phosphorus in the Diet

Chronic kidney disease (CKD) is a loss of kidney function over time. The kidneys function to remove waste products and excess water and minerals, such as sodium, potassium, and phosphorus from the body. As kidney function declines, the kidneys are unable to remove extra phosphorus from the body. Phosphorus levels in the blood may increase, especially in the later stages of the disease.

High blood levels of phosphorus (hyperphosphatemia) may lead to adverse effects on bone, kidney, and heart health (Calvo and Uribarri 2013b). When there is too much phosphorus in the blood, the body reacts by leaching calcium from the bones, which can lead to weak bones and the accumulation of calcium deposits elsewhere in the body. Weakened bones are prone to fracture. Calcium deposited in blood vessels can increase risk of heart disease and stroke.

If you are one of the 31 million people in the United States with CKD, you may need to limit your intake of phosphorus. Blood levels of phosphorus are critical to some people with CKD. For healthy people, a mildly elevated blood phosphorus level may increase risk for bone and heart disease (Calvo and Uribarri 2013b). Healthy people are encouraged to avoid a high intake of phosphorus.

Phosphorus Intake

The Recommended Dietary Allowance (RDA) of phosphorus is 700 mg/day for most adults (IOM 1997). A high intake of phosphorus poses health risks. Tolerable Upper Levels, known as ULs, have been set for the healthy population to prevent overconsumption. Healthy adults with normal kidney function, under 70 years of age, should consume less than 4,000 mg/day. Those over 70 years should consume no more than 3,000 mg/day. Average daily intake of phosphorus by healthy adults should not exceed the UL. However, recent evidence suggests that there may be risks to consuming intakes of phosphorus below the UL (Calvo and Urbanni 2013b).

The average dietary phosphorus intake of adult men in the United States is about 1600 mg/day. Women consume about 1200 mg/day (Calvo and Uribarri 2013a). These intakes are much higher than the Recommended Daily Allowance (RDA) of 700 mg (IOM 1997). Current intakes may be even higher as some sources of phosphorus are left out when calculating dietary intakes. For those with CKD and elevated serum phosphorus, usual intakes of phosphorus

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may be too high and dietary restriction may be needed. A common restriction is 800 mg/day. There also may be health benefits for healthy people to decrease phosphorus intake below their current intake.

Foods High in Phosphorus

Phosphorus is found in most foods, including many healthful foods that are higher in protein. There are two forms of dietary phosphorus: “bound” phosphorus found naturally in foods and “inorganic” phosphorus found in food additives. About one half of our dietary phosphorus comes from naturally occurring sources like milk and dairy products, meat, poultry, fish, grains, and legumes (Calvo and Uribarri 2013a). Nuts also provide significant phosphorus. Healthy individuals are encouraged to consume these foods in recommended amounts (USDA and HHS 2015). People with the later stages of CKD may need to limit the number of servings of these foods. As recommended above, if you have chronic kidney disease, it is important to contact your healthcare professional to determine whether you need to restrict any of these foods.

Restaurant meals, fast foods, and convenience foods have added phosphorus. Phosphorus additives modify food texture, taste, and color. Added phosphorus contributes about 500 mg/day to our diet (Calvo and Uribarri 2013a). Some of the common phosphorus-containing additives include phosphoric acid and various forms of phosphates (e.g. calcium phosphate, sodium phosphate, potassium phosphate). Unfortunately, the phosphorus content of packaged food is not listed on the Nutrition Facts label. Instead, shoppers need to check the ingredient list to determine which packaged foods contain phosphorus-containing additives. Limiting foods with phosphorus-containing food additives is a great way of decreasing phosphorus intake.

Managing Phosphorus in Your Diet

For people with chronic kidney disease and elevated blood phosphorus levels, limiting dietary phosphorus intake is important to help maintain normal blood phosphorus levels. The normal range for a phosphorus blood test is 2.4–4.1 mg/dL (NIH 2015).

Monitoring your phosphorus intake is not an easy task, because so many foods contain phosphorus. Read food label ingredient lists carefully for phosphorus additives because these compounds are absorbed more efficiently than the naturally occurring food sources of phosphorus. In general, it is recommended that people with chronic

kidney disease avoid processed foods that contain inorganic phosphorus-containing additives.

However, lowering your intake of phosphorus-containing food additives can be as simple as choosing a different drink or snack. For example, there are many low-phosphorus beverages: coffee, tea, green tea, and flavored water. If you drink sodas, diet versions of Sprite®, 7-up®, ginger ale, orange soda, and root beer are phosphorus-free choices. Colas such as Diet Coke® and Diet Pepsi® contain added phosphorus. Regular sugar-containing sodas are not recommended for a variety of health reasons (USDA and HHS 2015). Light (low calorie) lemonade is also a good phosphorus-free choice. Snack foods can be a significant source of phosphorus because many have phosphorus-containing additives. Fresh fruits make great lower-phosphorus snacks. If processed snack foods are chosen, ensure they are lower in phosphorus. Table 1 lists some lower-phosphorus processed snack foods.

Meal choices are also important for limiting added phosphorus. For example, with breakfast foods alone there are many opportunities to choose lower-phosphorus options. Pancake mixes and frozen waffles have phosphorus-containing ingredients. Fast food breakfasts may also be very high in phosphorus. For example, a fast food bacon, egg, and cheese biscuit may contain almost 500 mg of phosphorus. In comparison, a medium breakfast bagel sandwich made with an egg and vegetable toppings contains less than 250 mg of phosphorus.

Breakfast cereals may be another source of added phosphorus. Check the food ingredient list and choose those cereals without phosphorus-containing additives. Healthy individuals are recommended to consume at least half their grains as whole grains. Those in the later stages of CKD may need to limit whole-grain cereals because these are naturally higher in phosphorus. Because higher-fiber diets are recommended for individuals with CKD, it is important to choose lower phosphorus, higher fiber cereals. Some breakfast cereals with added fiber are low in phosphorus.

Many convenience foods such as refrigerated and frozen dinner entrées and most restaurant and fast foods also contain added phosphorus. Foods prepared from biscuit mixes or frozen doughs are very high in phosphorus! The key to lowering your intake of phosphorus-containing additives is to prepare foods from scratch. Use basic recipes and choose fresh, unprocessed food ingredients. For more information on the phosphorus content of foods see the USDA Nutrient Database at <http://ndb.nal.usda.gov/ndb/search/list>.

Individuals with chronic kidney disease should seek professional dietary advice regarding their diet choices. If you have questions regarding high- and low-phosphorus foods, ask a dietitian. To find a registered dietitian/nutritionist (RDN) in your area, you can visit the Academy of Nutrition and Dietetics RD Finder at <http://www.eatright.org/programs/rdfinder/>.

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Table 1. Examples of lower-phosphorus processed snack foods.*

	Serving	Phosphorus (mg)
Jolly Time Healthy Pop—Low Sodium Butter	1½ c popped	35
Pop-Tarts Mini Crisps—Frosted Brown Sugar Cinnamon	1 pouch	10
Pop-Tarts Mini Crisps—Frosted Strawberry	1 pouch	4
Rice Krispies Treats	1 bar	16
Keebler Right Bites Fudge Shoppe Fudge Dipped Pretzels	1 100 calorie pack	19
Kellogg's Nutri-Grain Cereal Bars—fruit flavors	1 bar	43
Quaker Chewy Granola Bars	1 bar	36
Quaker Chewy Dippys Granola Bars	1 bar	50
Lays Kettle Cooked Potato Chips—Maui Onion	1oz / 15 chips	20
Lays Kettle Cooked Potato Chips—Original	1oz / 15 chips	40
Lays Kettle Cooked Potato Chips—Sea Salt & Cracked Pepper	1oz / 15 chips	40
Lays Wavy Potato Chips—Ranch	1oz / 11 chips	20
Tostitos Artisan Recipes—Roasted Garlic & Black Bean	1oz / 8 chips	40
Tostitos Scoops—Multigrain	1oz / 12 chips	20
Tostitos Tortilla Chips—Multigrain	1oz / 8 chips	40
Tostitos Simply Tortilla Chips—Yellow Corn	1oz / 6 chips	40
Fritos Scoops Corn Chips	1oz / 10 chips	40
Miss Vickie's Potato Chips—Sea Salt & Cracked Pepper	1oz / 18 chips	40
Miss Vickie's Potato Chips—Sea Salt	1oz / 18 chips	40

*Snack foods contain ≤ 120 mg of sodium per serving (120 mg = 5% Daily Value for sodium)