Renal Dietitians
a dietetic practice group of the
eat right. American Dietetic Association

Renal Nutrition Forum

A Peer Reviewed Publication of the Renal Dietitians Dietetic Practice Group

Volume 27 • Number 3

In This Issue

Feature Article

Hidden Phosphorus: A New Challenge for the Nephrology Dietitian

Lisa Gutekunst MSEd, RD, CSR, CDN
Renal Dietitian
Buffalo, NY
E-mail: *lisa.gutekunst@davita.com*

This article has been approved for 2 CPE units and the CPEU insert can be accessed in the Members Only Section of the website from the CPEU Inserts link.

The nephrology healthcare team has struggled to help patients with chronic kidney disease (CKD) control serum phosphorus since the 1960's. It was determined from a National Institutes of Health MedLine literature search that articles linking elevated serum phosphorus levels with secondary hyperparathyroidism (1) and with soft tissue-calcification (2) appear as early as 1966. Associations between "persistently high (over 60) calcium phosphorus product" and cardiac calcification appear as early as 1975 (3). By 1975 sufficient evidence supported the association between elevated phosphorus levels and renal osteodystrophy. The American Dietetic Association (ADA) subsequently issued a recommendation for restricting phosphorus intake in the CKD population in hopes of minimizing and even preventing the bones lesions associated with secondary hyperparathyroidism (4). Today, the nephrology community has shifted the focus to protecting this population from the systemic effects of hyperphosphatemia, such as cardiac calcification.

The National Kidney Foundation (NKF) issued the Kidney Disease Outcome Quality Initiative (K/DOQI) Clinical Practice Guidelines for Bone Metabolism and Disease in 2003 (5). Since that time much emphasis has been placed on achieving serum calcium, phosphorus, calcium-phosphate product (CaxP) and parathyroid hormone (PTH) goals. Medications such as sevelamer hydrochloride, lanthanum carbonate, and calcimimetic agents have helped to acheive the established calcium and PTH goals. However hyperphosphatemia remain an ongoing problem and challenge for the nephrology healthcare team and patients.

In an effort to address this problem, dietitians emphasize adherence with phosphate binder prescriptions and provide extensive instruction on low phosphorus diets. In addition to the basic advice to limit those foods high in phosphorus such as dairy products, legumes, and colas, nephrology dietitians also advise patients to choose low phosphorus protein foods. Despite more options in phosphate binding medications and aggressive diet education, dietitians do not always see the results that they expect. In many cases, the culprit can be traced back to the diet in the form of hidden phosphorus.

With the demand for high quality convenience foods, food manufacturers have increased the use of phosphorus additives. They help ensure the quality and flavor that Americans demand and expect from prepared foods. Traditional products using phosphorus additives include restructured meats (chicken nuggets

Table 1
Non-traditional foods containing phosphate additives

Beverages	• Dr. Pepper Red Fusion® • Hawaiian Punch® All Flavors • Sunny Delight® All Flavors • Hire's® Root Beer • Mountain Dew® Code Red • Mountain Dew® Amp • Nestea Cool® Iced Tea All Flavors • Non-Dairy Creamers All Flavors	• Fruitworks® All Flavors • Aquafina Essentials® • Dansani® Flavored • Tropicana® Fruit Drinks • Fanta® Orange • Slice® Cherry • Some calcium fortified juices • Canned and plastic bottled Iced Tea
Cereal/Breakfast Bars Greater than 100mg/serving	• Kellogg's® Special K-Low Carb • Kellogg's® Complete Bran Flakes • Kellogg's® Cracklin Oat Bran • Kellogg's® Healthy Start - Heart Smart • Kellogg's® Healthy Start - Soy Protein • General Mills® Multibran Chex • General Mills® Oatmeal Crisp Almond	• Quaker® Squares • Quaker® Life - All Flavors • Quaker® Breakfast Bars • Malt-O-Meal® Graham Squares • Milk 'n Cereal® Breakfast Bars • General Mills® Shrek • General Mills® Wheat Chex
Meat	• Frozen Turkey • Hormel Always Tender® Pork • Frozen Beef	• Frozen Chicken • Chicken Nuggets

and hotdogs), processed/spreadable cheeses, "instant" products (puddings and sauces), refrigerated bakery products, and beverages (6). Now foods containing additives extend into all segments of the food pyramid.

Additives appear in products once considered innocuous. Many brands of flavored water now contain a phosphate additive. Canned and plastic bottled iced teas may contain phosphorus. Even some brands of "fresh" meat contain phosphorus additives. Table 1 lists other foods normally considered "safe" for the CKD patient that may now may contain phosphate additives.

Phosphate salts are used for a variety of reasons. They are an inexpensive and effective way for manufactures to ensure the quality of and enhance their products. The U.S. Food and Drug Administration consider phosphate additives Generally Regarded as Safe (GRAS). Table 2 lists the most common phosphate salts used in today's foods and their functions.

Phosphate salts act not only as acids, as in the case of phosphoric acid, but also as buffers. They ensure the creaminess and meltability of dairy products, promote coagulation or prevent coagulation, emulsify, preserve the texture of frozen meats, and increase flavor in lean meats. They also tenderize tough meat, ensure the pliability of refrigerated and frozen bakery products, and can be used to add selected nutrients to a product, such as calcium.

Enhanced meat products are now available in commercial and discount supermarkets nationwide. Enhanced meat is fresh meat that has been injected with a solution containing water and other ingredients. The "other ingredients" consist of a mixture of sodium salts, phosphate salts, potassium salts, antioxidants, and/or flavorings. In appearance, enhanced meat resembles fresh meat, however it differs in nutritional value. Because the meat has been altered from its natural composition, manufactures must affix a food label stating that the meat product has been enhanced. Enhanced meats are significantly higher in sodium compared to fresh, unadulterated meat. On the average, fresh meats contain about 50-75 mg of sodium for a 3 ounce serving whereas enhanced meats contain over 300 mg for the same serving size.

The additional sodium found in enhanced meat products is a concern for individuals with hypertension who follow a low sodium diet. It is common for dietitians to encourage the use of fresh meat over processed meats. Enhanced meats look like fresh meat and are sold right next to fresh, unenhanced meats. Thus many individuals who hope to select the fresh meat end up with the enhanced high sodium meat product.

Enhanced meat products are not new to the American food supply; they have been made in homes and found in supermarkets for a long time. The self-basting turkey is one example of an enhanced product that has been a staple in many American homes

Table 2
List of Phosphate Additives and Their Uses

Phosphate Additive Common Name	Alternate Names	Uses	Products
Dicalcium Phosphate Anhydrous	Calcium phosphate dibasic; Calcium phosphate, secondary; Dicalcium orthophosphate; Dical; Calcium monohydrogen phosphate; Secondary calcium phosphate; DCP; DCPA	Mineral source; dough conditioner	Bakery mixes; yeast-raised bakery products; cereals; dry powder beverages; flour; food bars; infant food; milk-based beverages; multivitamin tablets; yogurts. Used in powder form as an abrasive in toothpaste.
Dicalcium Phosphate Dihydrous	Dicalcium phosphate duohydrate; Calcium phosphate dihydrate; Calcium phosphate,Secondary dihydrate; Dicalcium orthophosphate dihydrate; Dical; Calcium monohydrogen phosphate dihydrate; Secondary calcium phosphate dihydrate; DCPD	Mineral source; leavening agent	Bakery mixes; cereals; dry powder beverages; flour; food bars; infant food; milk-based beverages; multivitamin tablets; yogurt.
Dipotassium Phosphate	Dipotassium monophosphate; Potassium phosphate, dibasic; Dikalium phosphate; Dipotassium hydrogen phosphate; DKP	Nutrient in yeast culturing; sequestrant; buffer.	Yeast-containing products; non-dairy creamers; casein based creamers; processed cheese, meat products, mineral supplements, starter cultures.
Disodium Phosphate Anhydrous	Disodium monohydrate phosphate; Sodium phosphate, dibasic; Neutral sodium phosphate; Dibasic sodium phosphate; Disodium hydrogen phosphate; Disodium orthophosphate; Phosphate of soda; Secondary sodium phosphate; Exsiccated sodium phosphate; DSP; DSPA	Sequestrant; emulsifier; buffering agent; absorbant; pH control agent; protein modifier; source of alkalinity, stabilizer. Is used to adjust pH of cereal and pasta products to maintain quality color in final product. Accelerates the cook time of pasta and quick cooking cereals. Used during production of sprayed dry cheese and nonfat milk powders. Protects the milk proteins from heat dehydration allowing the proteins to remain dispersed during the spray drying process which assists in the solubility of powders upon reconstitution with water. Stabilizes the emulsion to enhance flavor, body and appearance of the final product.	Breakfast cereal;cheese; condensed milk; cream; evaporated milk; flavored milk powders; gelatin; half & half; ice cream; imitation cheese; infant food; instant cheesecake; instant pudding; isotonic drinks; nonfat dry milk; pasta; processed cheese; starch; vitamin capsules; whipped topping.

Information from: ICL Performance Products LP

Table 2, cont.
List of Phosphate Additives and Their Uses

Phosphate Additive Common Name	Alternate Names	Uses	Products
Disodium Phosphate Dihydrous	Disodium phosphate duohydrate; Disodium monohydrogen phosphate dihydrate; Sodium phosphate dibasic dihydrate; Neutral sodium phosphate dihydrate; Dibasic sodium phosphate dihydrated; Disodium orthophosphate dihydrate; Phosphate of soda dihydrate; Seconday sodium phosphate dihydrate; Sorensen's phosphate; Sorensen's sodium phosphate; DSPD	Same as Disodium Phosphate Anhydrous	Same as Disodium Phosphate Anhydrous
Monocalcium Phosphate Monohydrate	Monocalcium phosphate monohydrate; Calcium phosphate, monobasic or primary; Calcium acid phosphate; Calcium biphosphate; MCP, MCPM	Acidulant for foods and beverages; leavening acid; nutrient; dietary supplement; yeast food dough conditioner. Calcium source for fortification or enrichment.	Biscuits; cakes; donuts; muffins.
Magnesium Phosphate	DMPT	Nutritional source of magnesium and phosphorus; pH control agent; dietary supplement; flow aid	Magnesium source in infant formulas and diet beverages.
Monopotassium Phosphate	Acid potassium phosphate; Potassium phosphate monobasic; Potassium biphosphate; Potassium acid phosphate; Potassium dihydrogen phosphate; Sorensen's potassium phosphate; MKP.	pH control agent; buffering agent; acidulant; leavening agent; nutrient source.	Bread; doughs; dry powder beverages; eggs; isotonic beverages; mineral supplements; starter cultures; yeast cultures.
Phosphoric acid	Orthophosphoric acid; Acid monophosphoric	Acidulant; pH control agent; buffering agent; flavor enhancer; sequestrant; stabilizer; thickener; synergist.	Carbonated and noncarbonated beverages.
Sodium Hexametaphos-phate	SHMP; Graham's salt; Sodium phosphate glass	Sequestrant; neutral salt; deflocculant; curing agent; dough strengthener; emulsifier; firming agent; flavor enhancer; flavoring agent; humectant; nutrient supplement; processing aid; stabilizer and thickener; surface-active agent; synergist; texturizer and buffering agent.	Meat; seafood; poultry; vegetables; cream; half & half; ice cream; whey; processed cheese; eggs; table syrup; toppings; beverages.

Information from: ICL Performance Products LP

Table 2, cont.
List of Phosphate Additives and Their Uses

Phosphate Additive Common Name	Alternate Names	Uses	Products
Sodium Tripolyphosphate	Pentasodium triphosphate; Sodium triphosphate; Tripolyphosphate; Sodium polyphosphate; Triphosphoric acid; Pentasodium salt; STP; STPP.	Sequestrant; pH control agent; emulsifier; provides alkalinity; buffering agent; protein modifier; antioxidant; curing agent; flavor enhancer; humectant; thickener and stabilizer; texturizer, moisture retention.	Meat; seafood; poultry; vegetable proteins; processed cheese; sour cream; dips & yogurt; eggs; table syrups; whipped toppings; vegetables; whey.
Tetrasodium Pyrophosphate	Sodium pyrophosphate, tetrabasic; Tetrasodium diphosphate; Sodium diphosphate; TSPP.	Buffering agent; pH control agent; alkalinity source; dispersing agent; protein modifier; coagulant, sequestrant; moisture retention; antioxidant; color stabilizer.	Meat; poultry; seafood; processed cheese; potato products; ice cream; frozen desserts.
Tricalcium Phosphate	Calcium phosphate tribasic; Calcium phosphate tertiary; Hydroxy apatite; Tricalcium orthophosphate; TCP	Anti-caking agent; absorbant; calcium supplement; suspension polymerization agent.	Salt substitutes; dry beverage mixes; dry gravy mixes; spice blends; cereal; bakery mixes; flour; beverages; pharmaceuticals.
Trisodium Phosphate Anhydrous	Trisodium orthophosphate; Sodium phosphate tribasic; Basic sodium phosphate tertiary; Oakite; TSP; TSPA.	Buffer; emulsifying agent; stabilizer; protein modifier; provides "meltability" in processed cheese; quickens cooking time of cooked breakfast cereals; color agent.	Processed cheese and cheese products; cooked breakfast cereals; imitation cheese; isotonic beverages.
Monopotassium Phosphate Anhydrous	Monosodium dihydrogen phosphate; Sodium phosphate monobasic; Sodium biphosphate; Acid sodium phosphate; Sodium phosphate primary; Sodium dihydrogen phosphate; Monosodium orthophosphate; Primary sodium phosphate; MSP; MSPA.	Dry acidulant; buffering agent; emulsifier; leavening agent; protein modifier; sequestrant; gelling agent; color enhancer, flavor enhancer (tartness).	Cola beverages; dry powder beverages; egg yolks; gelatin; instant cheesecake; instant pudding; isotonic beverages; processed cheese; non-cola beverages; liquid egg mixtures.
SAPP	Acid sodium pyrophosphate; Disodium dihydrogen diphosphate; Dibasic sodium pyrophosphate; Disodium dihydrogen pyrophosphate; SAPP.	Emulsifier; formulation aid; humectant; leavening agent, pH control agent; acidulant; buffering agent; coagulant; dispersing agent; protein modifier; processing aid; sequestrant; stabilizer; thickener; synergist; texturizer.	Icing and frostings; processed meat; cured meats; processed chicken products; hotdogs; bologna; non-dairy creamers; processed potatoes; albacore tuna; processed cheese; vegetables; seafood; imitation cheese.
Tetrapotassium Pyrophosphate	Potassium pyrophosphate, tetrabasic; Tetrapotassium diphosphate; Potassium diphosphate; Diphosphoric acid tetrapotassium salt; TKPP.	Buffering agent; pH control agent; alkalinity source; dispersing agent; protein modifier; coagulant, sequestrant; nutrient source; antioxidant; texurizer.	Processed cheese; milk powders.

Information from: ICL Performance Products LP

Table 2, cont.
List of Phosphate Additives and Their Uses

Phosphate Additive Common Name	Alternate Names	Uses	Products
Pentasodium Triphosphate	Sodium triphosphate; Sodium triphosphate; Tripolyphosphate; Sodium polyphosphate; Triphosphoric acid, Pentasodium salt; STP; STPP.	Sequestrant; emulsifier; reduces oxidation; moisture retention; pH control; buffering agent; coagulant; dispersing agent; curing agent; flavor enhancer; humectant; thickener and stabilizer; texturizer.	Meat; poultry; seafood.
Tripotassium Phosphate	Basic potassium phosphate; Potassium phosphate tribasic; TKP	Alkalinity source; buffering agent; emulsifier; nutrient; protein modifier and stabilizer.	Starter cultures; processed cheese; dairy products; bread and dough conditioners; mineral supplements; isotonic beverages; cereals.

Information from: ICL Performance Products LP

around the holidays. Alternately, home chefs who soak their poultry, inject a roast, or marinade their meat before cooking are creating an enhanced meat product.

There are numerous benefits for the consumer as well as the grocer to sell and use enhanced meats. Consumer convenience is the first benefit. Americans are spending less time preparing meals, and, in our "grab and go" society, knowledge about meat selection and preparation is declining (7). Enhanced meat products provide a quick and easy solution to everyday meal planning.

Another benefit is being able to maintain the tissue integrity on an enhanced meat product. With increased awareness of food-borne illnesses, consumers tend to overcook meat (7). This produces a dry and tough product. Enhanced meats maintain their tenderness even under the most extreme cooking conditions.

Purge is a term used to describe the liquid that is released from raw meat as it ages. Many consumers find this unattractive when purchasing fresh meat and tend to shy away from choosing packages with high purge. These packages may be discarded thus resulting in waste and higher consumer prices. Purge also occurs when frozen meats thaw. Phosphate salt enhancers help to reduce the undesirable purge (7).

Phosphate salts also enhance a meat product's color, retain its moisture, and reduce rancidity from oxidation caused by the metals within the meat (7). Meat enhanced by phosphate salts has a longer shelf life, has a more attractive appearance for consumers, and maintains its moisture if over-cooked.

Finally, retailers can see increased profitability with enhanced meats. As discussed above, enhanced meats have less purge, longer shelf life, and longer lasting color resulting in more products being sold than wasted. Additionally, enhanced meats require little, if any, additional labor to bring it from processor to market. Many enhanced meats are package-ready for display while others require repackaging into individual sales units. Since no traditional butchering of the meat is required, labor costs are lower.

Despite federal guidelines requiring manufactures to include a notification statement of enhancement and a nutrition label, most consumers are not aware that they are purchasing an altered product. The notification statement is usually written in small print and often not noticed by the purchaser. If the product has been repackaged into individual selling portions, the store is responsible for affixing the provided nutrition label on each individual packet. This step may be overlooked and missed (8).

Employees and meat managers may not be certain if the product they are selling is enhanced. Some stores rely on central purchasing for their fresh meat inventory. One week they may receive non-enhanced meat; another week they receive enhanced meat. If the label is not on the individual selling unit, neither the public nor the store knows for certain (9).

There are individuals in the food purveyor industry who are concerned about enhanced meat products. In the words of Jeff Lyons, vice president and senior General Merchandise Manager of Costco, Inc., enhancing meat "is a short cut for manufacturers." He believes that there are alternate ways to provide a quality product without enhancing meat. Though Costco does provide some enhanced meat products, their fresh signature line, Kirkwood®, is not enhanced (10).

The impact of phosphate additives on the nephrology population is far reaching and immense. These phosphorus additives are highly absorbable. In a typical mixed diet of grains, meat, and dairy, approximately 40-60% of the dietary organic phosphates are absorbed, whereas phosphoric acid and other polyphosphates and pyrophosphates (inorganic) are almost 100% absorbed (6). Diets higher in these inorganic salts result in higher phosphorus absorption.

To cover the additional phosphate in the diet, patients must take more phosphate binders. Adherence with a phosphate binder prescription is already a challenge in this population. Increasing a patient's dose or adding an additional binder medication only adds to this challenge for the patient and clinician.

With the concern about calcium load and metastatic calcification, the NKF's K/DOQI Guidelines for Bone Metabolism and Disease recommended limiting the use of calcium based binders (5). Sevelamer hydrochloride increases the dietary acid load that can contribute to metabolic acidosis (11), and lanthanum carbonate use is limited to 3 grams/day (12). Binder therapies are often combined to maximize phosphate binding potency. Unfortunately, this only adds to the financial burden of the patient, as they now must pay for more than one prescription to achieve serum phosphorus control.

As more food comes to the market with phosphate additives, food choices and selection for the CKD population may diminish. Further limiting a renal diet can lead to malnutrition (a known complication within this population), non-adherence with all diet restrictions (which can lead to more life-threatening complications), and a breakdown of trust between the patient and the dietitian (dietitians may be viewed more as the "food police" instead of as a partner in healthcare).

Identifying these new, higher phosphorus foods is very challenging as well as daunting. Manufacturers are no longer required to list the phosphorus content on the food label. If the manufacturer does analyze the product for phosphorus, results are sometimes classified as "proprietary" information. Often the analysis is not readily accessible to customer service representatives who may turn over the request for information to one or more different departments. There is still no guarantee that the company can or will locate the information.

Another challenge faced by professionals and consumers is the practice of products being affiliated with one company and manufactured, packaged, and distributed by another company. For example, Country Time Lemonade® is considered a Kraft®-brand food, but some Country Time Lemonade® products are manufactured and distributed through Dr. Pepper/7-Up®. Also, each company formulates its products differently, and within each product, the individual delivery packages may be formulated differently. That is, the ingredients in a bottled iced tea may be different when compared to the same brand of canned iced tea. Nutrition labels listed on a company's website are not always accurate. When accessing a website for a product believed to be low in phosphorus, this author found a picture of the product's nutrition label that listed the phosphorus content as 0% DV. However, in a different area of the website, which provided a detailed description of the product, the phosphorus content was reported to be 230 mg per serving. When questioned, the company responded that they were not required by law to list the phosphorus content of their product. However, they did acknowledge the error and planned to correct it (13).

Regular monitoring of in-store food nutrition labels is the best way to keep abreast of the nutritional content of foods. In researching another article, this author found problems obtaining accurate analyses from widely used resources available to dietitians and patients. In some instances, there were as many as three conflicting analyses for the same product. In trying to clarify these discrepancies, limitations were found with nutrition analysis resources generally used by the public and the professional (14). In 2006, an effort to bring back the phosphorus content to the nutritional label was launched jointly by the NKF's Council on Renal Nutrition (CRN) and the ADA's Renal Dietitians Dietetic Practice Group (15). Together, ADA and NKF CRN conducted an internet survey of nephrology patients which revealed that more than half of the respondents do not buy a food product or beverage if potassium, calcium or phosphorus amounts are not listed on the label. Roughly 80 percent of the respondents indicated that phosphorus should be included on the label.

The NKF and ADA have shared the results of this survey in the form of comments submitted to the Food and Drug Administration (FDA). This was in response to a Federal Register notice requesting data to consider in updating the nutrition facts label (NFL). These comments are posted at http://www.eatright.org/ada/files/NKFADA_Comments.pdf. The results of this survey will be discussed at FNCE 2008 on Sunday, October 26, 2008, at 1:30 pm in the session entitled, "Dietitians Know Best: What We Told the FDA."

In an earlier conversation with the FDA, NKF CRN and ADA were advised that the NFL is designed to address public health issues-at-large, not for the treatment or purpose of specific disease populations, citing the Institute of Medicine's Dietary Reference Intakes for phosphorus (16). One significant issue is that the Nutrition Labeling and Education Act does not direct the FDA nor does it require phosphorus to be included on the nutrition facts label.

Undeterred by these barriers, efforts to bring "kidney friendly" foods to market are underway. Spearheaded by Dr. William Pordy, founder of the Delicious Milk Company, Inc., there is a pioneering effort to encourage manufacturers to make more kidney

Table 3
Shelf stable products that may be considered for a kidney friendly grocery shelf.
(Note: Use certain products in moderation depending on individual diet prescription.)

TYPE OF FOOD	SPECIFIC FOOD	AVAILABLE BRAND
VEGETABLES	Canned Fruit	SM*
FRUIT	Low Sodium Canned Vegetables:	SM*
	Green Beans, Wax Beans, Peas, Carrots, Corn, Asparagus, Beets	
	Rice, White	SM*
MILK/CHEESE	Milk (low phosphorus, low potassium)	DairyDelicious®
MILK SUBSTITUTE	Cheddar Cheese sauce	
	(very low phosphorus, low sodium)	DairyDelicious®
	Rice Milk (non-fortified)	SM*
CEREALS	Rice and Corn Squares	Chex®, SM*
	Corn Flakes	SM*
	Crisped Rice	SM*
	Puffed Rice	SM*
	Sweetend Cereals:	SM*
	Fruit Loops, Frosted Flakes, Sweetened Puffed Corn, Sweetened Puffed Wheat	
	Grits	SM*
	Rice Cereal - Hot	Cream of Rice®
	Wheat Cereal - Hot	Cream of Wheat®
BREADS	Sandwich Rolls	SM*
	Low Sodium Flour Tortillas	SM*
	English Muffins	SM*
	Hamburger Buns	SM*
	Bread Sticks, Plain	Progresso®
	All Purpose, Bread, Cake Flours (not self rising)	SM*
PASTAS	Macaroni	AM**
	Spaghetti	AM**
	Spirals [Fusilli] and Shells	AM**
	Deluxe Macaroni & Cheese Dinner	
	(very low phosphorus, low sodium)	DairyDelicious®
COOKIES	Animal Crackers	SM*
	Shortbread	Lorna Doone®
	Sugar Cookies	SM*
	Lady Fingers	SM*
	Vanilla Wafers	SM*
	Ginger Snaps	SM*
CAKES	Angel Food, Pound, Sponge, and Lemon Cake	Store Made
CAKES, cont.	Apple, Cherry and Blueberry Pie	SM*
	Doughnuts, Plain	SM*
SNACKS	Unsalted Popcorn, Pretzels, Rice Cakes	SM*
	Unsalted Crackers and Melba Toast	SM*
	Jelly Bean	SM*
	Marshmallows	SM*
	Gummies	SM*
	Sugar Free Chewing Gum	SM*
SEASONINGS, SPICES and SPREADS	Sweeteners	White Sugar, Splenda®, Saccharine, Aspartame
	Salt Replacers	Mrs. Dash®
	Pepper, Onion and Garlic Powder	AM**
	Cilantro, Oregano, Dill, Basil, Sage, Paprika,	
	Cinnamon, Nutmeg, Parsley, Rosemary, Curry	AM**
	Mayonnaise and Spreads (not low fat or fat free)	SM*
	Yellow Mustard, Organic Mustard	French's®, Annie's Naturals®
	Low Sodium Salad Dressings	SM*
	Low Sodium Bread Crumbs	SM*
	Hot Sauce	Frank's®, Tabasco®, Diamond®
	Lemon Juice	SM*
	Vanilla, Orange and Almond Extract	SM*
OIL and VINEGAR	Vegetable Oil	SM*
	Olive Oil	SM*
	Corn Oil	SM*
	White Vinegar	SM*
	Balsamic Vinegar	SM*
	Wine Vinegar	SM*
PUDDINGS, TOPPINGS and SYRUPS	Whipped Topping Mix - Dry	Dream Whip®
	Sugar Free Gelatin	SM*
	Light Chocolate Syrup	Hershey®
BEVERAGES	Coffee, Decaffeinated Coffee	AM**
	Regular and Diet Lemon-Lime Soda	AM**
	Regular and Diet Ginger Ale	AM**
	Regular and Diet Root Beer	A&W®
	Orange, Grape and Cherry Drink	Kool-Aid®, Crystal Light®
	Apple, Cranberry, and Grape Juice	SM*

Murphy-Gutekunst L. Hidden Phosphorus: Where Do We Go From Here? *J Ren Nutr.* 17(4): E31-E36, 2007.

friendly food products. Also, enticing food retailers to dedicate a "Kidney Friendly Shelf" in their retail stores would be a win-win arrangement. These would include products that are lower in phosphorus, sodium, potassium, and calcium. Patients with CKD win by having one convenient location to find foods that are appropriate for them and good for kidney health. The grocer wins by keeping current customers, gaining new ones, and delivering products that "address the current issues of condition specific nutrition," says Dr. Pordy (17). Dr. Joseph Vassalotti, Medical Director for the NKF concurred. He stated, "Kidney healthy foods would be an attractive way to avoid the challenge that food labels designed for the general population pose for CKD patients" (18). The food industry is driven by consumer demand, thus information regarding the need and desire for kidney friendly foods must get to industry leaders. Food retailers who have a high demand for these products will in turn ask for more kidney friendly foods from the manufacturer. Retailer information regarding the "Kidney Friendly Shelf," (Figure 1, which can be accessed via www.renalnutrition.org under CPEU Inserts or RNF Archives) and a list of kidney friendly foods (Table 3) to be included on this shelf have been included in this article as tools for healthcare professionals and CKD patients to use.

Education and creative repetition remains the key to serum phosphate control. Empowering the CKD population with knowledge can make a difference when they are faced with limited information about food choices. Without understanding the dangers of foods once thought to be "safe," the population cannot take further control of their healthcare and overall health. Education materials listing hidden phosphorus products can be displayed in waiting rooms. Low literacy posters showing pictures of new high phosphorus foods to limit can be utilized to reach those who cannot read nutrition ingredient labels. "Safe" food lists and pictures offer useful alternatives, and encourage variety and choice among patients.

In addition to these tools, healthcare professionals need to continue educating other healthcare providers on hidden dietary sources of phosphorus. The dietitian is only one part of a CKD patient's healthcare team. Nurses, dialysis technicians, social workers, and physicians can reinforce the dietitian's educational efforts, and aid the dietitian in gaining a more thorough understanding of a patient's lifestyle and needs.

Winning the war on phosphorus control is gained through each individual battle. It is a slow process, but one that benefits the lives of those who we serve as registered nephrology dietitians. ◆

References

1. Stanbury SW, Lumb GA, Mawer EB. Osteodystrophy developing spontaneously in the course of chronic renal failure. *Arch Intern Med.* 1969; 124(3): 274-81.
2. Parfitt AM. Soft-tissue calcification in uremia. *Arch Intern Med.* 1969;124(5): 544-56.
3. Arora KK, Lacy JP, Schacht RA, Martin DG, Gutch CF. Calcific cardiomyopathy in advanced renal failure. *Arch Intern Med.* 1975; 135(4):603-5.
4. Schoolwerth AC, Engle JE. Calcium and phosphorus in diet therapy of uremia. *J Am Diet Assoc*. 1975; 66(5):460-4.
5. The National Kidney Foundation. Bone Metabolism and Disease in CKD. *Am J Kidney Dis*. Vol.43(4), 2004.
6. Uribarri J, Calvo MS. Hidden sources of phosphorus in the typical American diet: Does it matter in nephrology? *Semin Dial*. 16(3): 186-188, 2003
7. The virtual Weber bullet-Enhanced Meat. Available at www.virtualweberbullet.com/enhancedmeat.htm. Accessed April 2005.
8. HyVee, Inc. Store Meat Manager. Personal interview. May 2001.
9. Price Chopper, Inc. Store Meat Manager. Personal interview. May 2001.
10. Costco, Inc. Vice President and Senior General Merchandise Manager. Lyons,Jeff. Personal interview. May 2005.
11. De Santo NG, Frangiosa A, Anastasio P, et. al. Sevelamer worsens metabolic acidosis in hemodialysis patients. *J Nephrol*. 19(S9): S108-114, 2006.
12. Product insert. Fosrenol (lanthanum carbonate), Shire pharmaceuticals.
13. White Wave. E-mail to Lisa Gutekunst MSEd, RD, CSR, CDN. January 12, 2005.
14. Murphy-Gutekunst L, Barnes K. Hidden Phosphorus at breakfast: Part 2. *J Ren Nutr*. 15(3): E1-E6, 2005.
15. Brommage D. Food fortification and nutrition labeling: nutritional significance and methods of analysis. *J Ren Nutr*. 16 (2): 173-175, 2006.
16. Institute of Medicine. 1997. *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride.* Washington, DC: National Academy Press.
17. Pordy, Dr. William. Personal interview. April 4, 2007.
18. Vassalotti, Dr. Joseph. E-mail to Lisa Gutekunst MSEd, RD, CSR, CDN. November 26, 2006.

References Also Cited

Murphy-Gutekunst L. Hidden Phosphorus in Popular Beverages: Part 1. *J Ren Nutr.* 15(2): E1-E6, 2005.

Murphy-Gutekunst L, Barnes K. Hidden Phosphorus at breakfast: Part 2. *J Ren Nutr.* 15(3): E1-E6, 2005.

Murphy-Gutekunst L, Uribarri, J. Hidden Phosphorus-Enhanced Meats: Part 3. *J Ren Nutr.* 15(4): E1-E4, 2005.

Murphy-Gutekunst L. Hidden Phosphorus: Where Do We Go From Here? *J Ren Nutr.* 17(4): E31-E36, 2007.

Murphy-Gutekunst L. Hidden Phosphorus in Popular Beverages. *Nephrol Nurs Journal.* 32(4), 2005.