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Management of Dialysis Patients with Celiac Disease

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Although rare, celiac and kidney disease have been reported in the same individual. Because of its rare occurrence (or underdiagnosis), there are no written guidelines for managing these combined diseases. Celiac disease is characterized by inflammation of the small intestine, and in some, malabsorption, after the ingestion of gluten in susceptible individuals. It is managed by life-long avoidance of gluten in the diet. Kidney disease is manifested by fluid and electrolyte imbalance, which also involves life-long dietary restrictions. This article reviews the renal dietary guidelines and provides suggestions on how to combine this with managing celiac disease.

INTRODUCTION

There are reported cases of dialysis patients with celiac disease (CD) (1); however, the true incidence of CD and chronic kidney disease (CKD) has not been established. Celiac disease is sometimes listed as one of the associated diseases of IgA nephropathy. One reference has suggested that immune characteristics associated with CD increase the risk of CKD and moderately increases the risk of any form of glomerulonephritis (1). With 10 years of experience as an outpatient renal dietitian, I have had only one reported case of this disorder. Given that CD is found in 1:125 people, it is probable that some of our patients have had undiagnosed CD. Occasionally, the topic of a gluten-free renal diet has been brought up on the renal dietitian listserve inquiring if nutrition guidelines or handouts to use with CKD patients with newly diagnosed celiac disease exist.

Nutrition management of patients with kidney disease alone is quite complex. Dietary management is achieved by limiting the intake of sodium, potassium, and phosphorus, along with encouraging adequate intake of protein and calories. The goal of nutrition therapy is to prevent complications of kidney disease such as fluid and electrolyte imbalance, renal bone osteodystrophy, metabolic acidosis and malnutrition. Because diabetes mellitus (DM) is the leading cause of end-stage renal disease (ESRD) in the United States, accounting

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for 44% of new cases of ESRD in 2002 (2), blood sugar control through consistent carbohydrate intake is essential for this group. Furthermore, 5%–10% of patients with Type I DM also have CD; therefore, CD may be more prevalent than has been appreciated in this population (3). Adding a gluten-free diet (GFD) for the management of CD in the patient with ESRD will require extensive patient nutrition education.

MALNUTRITION

There is a high prevalence of nutritional disorders in CKD patients. The presence of uremia, inflammation and metabolic acidosis all contribute to the development of malnutrition. Decreased appetite due to taste alterations, strict dietary restrictions and the presence of other medical problems are all contributing factors. The renal diet is deficient in vitamins especially if the "leaching process" (soaking vegetables in water to help decrease the potassium content) is incorporated into the preparation of food. Vitamin and mineral supplementation (B Vitamins, Vitamin C, and Iron) is essential. Protein requirements are higher (1.2–1.5 gm protein/kg); therefore, consuming at least eight ounces of lean meat per day is encouraged. For patients on maintenance hemodialysis and peritoneal dialysis, close monitoring of nutrition parameters including serum albumin, bicarbonate levels for possible acidosis, and management of anemia is part of the standard care these patients receive. The added complication of inflammation and potential malabsorption from CD poses a higher risk of malnutrition to this group. Selection of gluten-free supplements that are low in potassium and phosphorus will need to be considered for patients with inadequate food intake (Table 1). Ongoing investigation with the patient regarding diet tolerance as well as ongoing reinforcement of the gluten free diet will be essential for improved overall nutrient intake and absorption of nutrients should malabsorption be present.

DIET THERAPY

It is important to note that there are foods that are gluten-free, but allowed on a renal diet, and there are foods that are allowed on the renal diet, but are not gluten-free!

Potassium

Normally, the kidneys excrete excess potassium from the body, therefore, with decreased kidney function, CKD patients are at risk for hyperkalemia, or an excess of potassium in the body. Hyperkalemia can result in cardiac arrhythmia, a serious and potentially life-threatening consequence. Potassium restriction varies among CKD patients depending on their laboratory results and mode of dialysis. The goal is to maintain a potassium level of 3.5–5.0 mEq/L. Most patients who are on hemodialysis three times a week will need to limit their potassium intake to 2000–3000 mg (51–77 mEq) per day, whereas patients who are on peritoneal dialysis may liberalize their potassium due to daily removal of this mineral.

Potassium is present in almost all foods, especially fruits and vegetables. Common foods rich in potassium are dark green leafy vegetables (spinach, collards), tomatoes, legumes (lima beans, kidney beans, pintos, black-eyed peas, etc.), bananas, oranges and cantaloupe. Generally, patients who need to limit their potassium are advised to avoid foods that have greater than 180 mg (4.6 mEq) of potassium per serving; however, they must still be mindful of the portion sizes of the *allowed foods* because they contain some potassium, hence if enough of these foods are eaten, hyperkalemia can result.

The most challenging part when it comes to combining a renal diet with a gluten-free diet is the source of starch in the diet. Rice and corn appear to be the safest. Wheat noodles or pasta are allowed on the renal diet, but not on a gluten-free diet. However, the good news is, rice and other types of gluten-free noodles are available. Potatoes and other gluten-free grains (quinoa, buckwheat, and amaranth) are extremely high in potassium (Table 2). CKD patients who need to be on a low potassium diet are advised to "leach" potatoes and other vegetables to reduce the amount of potassium. Leaching involves peeling and dicing the vegetable, soaking it in warm water for at least 4 hours (or overnight in tap water), discarding the water, boiling it and again discarding the water (4). Leaching can remove a significant amount of potassium in vegetables (Table 2); however, it is not known if this process is also effective with grains.

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Table 1
Selected Commercial Gluten-Free Liquid Supplements and Enteral Feedings

	Ross	*Novartis*	*Nestle*
Adult Products			
Tube Feeding Formulas	Glucerna Glucerna Select (3) Jevity 1 Cal Jevity 1.2, 1.5 Cal (1,2,3) Nepro (3) Optimental (3) Osmolite, 1, 1.2, 1.5 Cal Promote Promote with Fiber (2) Suplena TwoCal HN (3)	All tube feeding formulas are gluten free ***EXCEPT*** Boost chocolate malt flavor.	Glytrol Nutren 1.0, 1.5, 2.0 Nutren Fiber NutriRenal ProBalance Renalcal Replete Replete with Fiber
Oral Supplements	Enlive! Ensure Ensure Fiber with FOS (2,3), Healthy Mom Shake, High Calcium, High Protein, Plus, Plus HN, Powder, Pudding (3) Glucerna Shake (3), Weight Loss Shake (3) Hi-Cal ProSure Shake (3)	All liquid oral supplements are gluten free ***EXCEPT*** Boost chocolate malt flavor.	Carnation Instant Breakfast Lactose Free Carnation Instant Breakfast Lactose Free Plus
Pediatric Products			
Tube Feeding Formulas	PediaSure Enteral Formula PediaSure Enteral Formula with Fiber (1,2,3)	All tube feeding formulas are gluten free.	Nutren Junior Nutren Junior with Fiber Peptamen Junior (liquid and powder)
Oral Supplements	PediaSure PediaSure with Fiber	All liquid oral supplements are gluten free.	None
Infant Formulas	EleCare	None	Goodstart Essentials Goodstart Supreme Goodstart Supreme with DHA & ARA Goodstart 2 Essentials Goodstart 2 Supreme with DHA & ARA Goodstart Supreme Soy with DHA& ARA Goodstart 2 Essentials Soy

Others
Nutra-Balance Products (www.nutra-balance-products.com or 800/654-3691)
Re/Gen
Nutra/SHAKE Supreme Nutra/SHAKES are milk-based Nutra/SHAKE Free Lacta/Care is low lactose
High Fibre Nutra/SHAKE Nutra/SHAKE Citrus and Nutra/SHAKE
AXCAN PHARMA (www.axcanscandipharm.com or 800/472-2634)
SCANDISHAKE Milk-based; also comes in lactose-free and sweetened with aspartame
Medical Nutrition USA, Inc. (http://www.pro-stat.com or 1-800-221-0308)
Pro-Stat a concentrated, fortified liquid protein supplement

(1) The patented fiber blend includes oat fiber, soy fiber, carboxymethylcellulose and gum arabic. U.S. Patent 5,085,883.
(2) The oat fiber in Ross products meets the standards for gluten-free ingredients established by the Codex Alimentarius Commission. (Joint FAO/WHO Food Standards Programme, Codex Alimentarius Commission: Codex Standards for Gluten-Free Foods, in *Codex Alimentarius*, vol IX, ed 1, 1981; 9-12.)
(3) NutraFlora® brand FOS are produced by the action of the enzyme isolated from Aspergillus niger on sucrose. Ross has exclusive rights for the use of NutraFlora® brand FOS in adult and pediatric medical nutritional products.

Adapted from table prepared by UVAHS dietetic interns: Brandis Thornton and Carolyn Powell, Spring 2005;
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Available at: http://www.healthsystem.virginia.edu/internet/dietitian/dh/traineeship.cfm

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Fluid and Sodium

Hypertension and the inability to make adequate urine are common problems in the CKD population. Fluids are often limited to 1000–1500 mL/day (1–1.5 quarts) and sodium intake is limited to 2000–2500 mg/day (87–109 mEq/day). Fluid allowance may be readjusted to prevent dehydration in some patients if they experience losses greater than usual. Intradialytic weight gains of about 2–3 kg is acceptable in these patients.

RENAL BONE OSTEODYSTROPHY

Bone disease occurs in the CKD population due to the following pathophysiological processes:

- Decreased production of calcitriol (active form of Vitamin D) by the kidneys
- Decreased absorption of calcium
- Decreased excretion of excess phosphorus from the body.

This phenomenon stimulates the production of parathyroid hormone (PTH) known as secondary hyperparathyroidism, which accelerates bone turnover and bone loss. Long-term effects of these derangements can cause soft tissue calcification and has become a growing concern among CKD patients (5) (Figure 1). Hyperphosphatemia (serum levels persistently >5.0) also appears to be associated with increased mortality, and elevated blood levels of PTH exert significant adverse effects on the function of almost every organ.

Studies have demonstrated that CD patients have a high prevalence of bone fractures, bone muscle pains, osteoporosis and osteomalacia (6). Chronic gastrointestinal disease can affect bone remodeling by altering both systemic and local regulatory factors; which means that bone loss can be induced by alterations in calcium and phosphorus levels, hormones, growth factors and cytokines. Although, bone disease is not uncommon in patients with CD, the underlying pathological mechanisms are still controversial. These mechanisms are considered to play a role: intestinal malabsorption, which can lead to malnutrition, reduced body mass index, calcium and vitamin D deficiency and the presence of inflammation. Cases of secondary hyperparathyroidism, which may be due to hypocalcemia, have been seen in CD patients (7).

Table 2
Potassium Content of Selected Gluten-Free Starch Group

Food	*mg potassium per 1/2 cup*
Amaranth	357 (plain)/67 (flakes) (1)
Buckwheat	391 (plain)/262 (roasted)/74 (cooked) (1)
Whole Corn	280 raw/204 cooked/113 mg (leached) (2)
Flax	683 (whole)/228 (ground) (1)
Millet	195 (raw)/54 (cooked) (1)
Potato (white, w/skin—i.e. baked)	Per 100 grams—approximately 3/4 cup (3) 410–500 (raw)/200–500 (cooked)/ 90–211 (leached)
Potato, sweet	Per 100 grams—approximately 3/4 cup (3) 900 (raw)/600 (cooked)/ 150 (leached)
Oats (4)	334 (1)
Quinoa	629 (1)
Rice, brown long-grain, cooked	42 (2)
Rice, white long-grain, cooked	32 (2)
Rice, wild rice	83 (2)
Sorghum	336 (1)

1. www.nutritiondata.com
2. Bowes & Church's Food Values of Portions Commonly Used
3. Tsaltas, TT. Dietetic Management of Uremic Patients—I. Extraction of Potassium from Foods for Uremic Patients. *Am J Clin Nutr*, 1969;22(4):490–493
4. GF oats are not available—see May 2007 *Practical Gastroenterology* Celiac Article

Phosphorus

The management of renal bone disease involves phosphorus control by limiting phosphorus in the diet to 800–1000 mg phosphorus per day and prescribing phosphate binders with meals (such as Renagel [sevalamer hydrochloride], Fosrenol [lanthanum carbonate], Phoslo and calcium carbonate), and suppressing PTH by initiating vitamin D analogs and, finally, controlling serum phosphorus levels. See Table 3 for gluten status of these commonly used medications.

Rich sources of dietary phosphorus include milk products, legumes, dairy, nuts, organ meats, as well as phosphorus additives in foods (cola, processed foods, bake mixes). Maintaining compliance of the low phos-

Table 3
Common Medications of Dialysis Patients

Medications	*Indication(s)*	*Gluten Free (Yes / No)*
Renagel	Phosphate Binder	Yes
Fosrenol	Phosphate Binder	Yes
Phoslo	Phosphate Binder	Yes
Tums/Calcium Carbonate	Phosphate Binder/Calcium Carbonate	Yes, all forms are GF except the "smoothies" which do contain gluten
Oscal	Phosphate Binder/Calcium supplement	All forms are GF
Atacand	Hypertension	Yes
Metoprolol	Hypertension	Watson Labs—contains potato starch but they don't test for gluten; Apothecon is GF; Par labs doesn't test but they don't put any gluten in their product
Lisinopril/Prinivil	Hypertension	Prinivil is GF but there are many generic versions; Apotex, Mylan, Teva and West-Ward are GF
Furosemide	Diuretic	Watson Labs—contains corn starch but they don't test for gluten; Ivax labs is GF; Sandoz labs is GF
Zemplar Capsules	Vitamin D analog/Hyperparathyroidism	Company cannot say but there are no starches in the products
Nephrocaps	Vitamin /Mineral Supplement	Yes
Nephrovite	Vitamin /Mineral Supplement	Yes

Medications reviewed and approved by Steven Plogsted, Pharm.D, BCNSP.

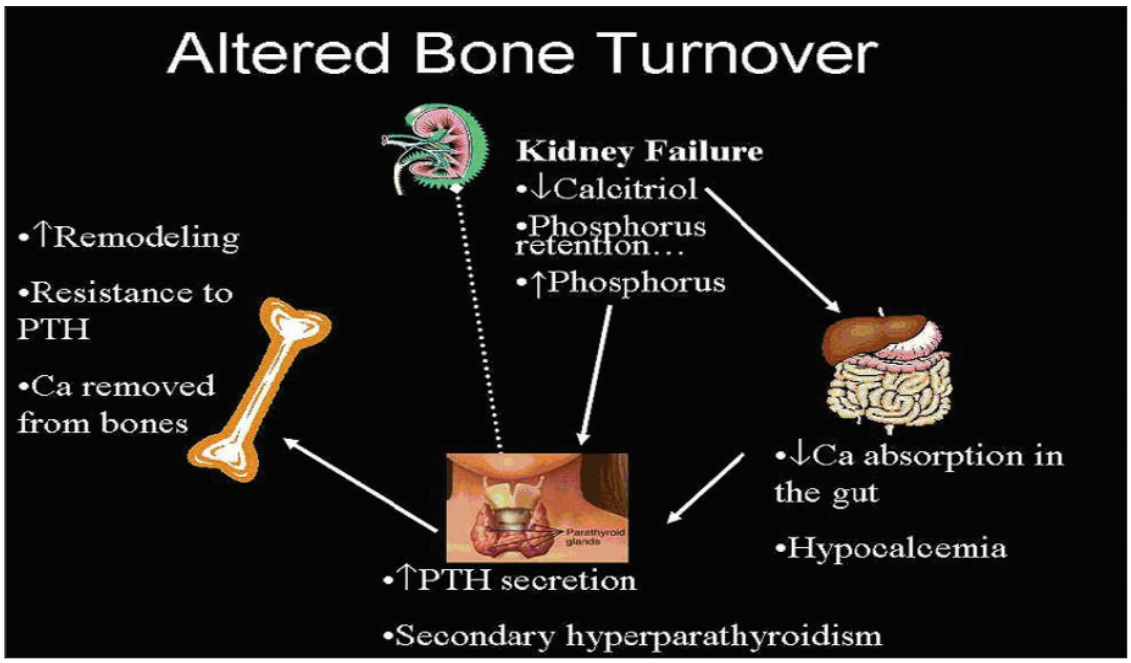

Figure 1. Mechanism behind renal bone osteodystrophy (simplified version from the National Kidney Foundation. K/DOQI clinical practice guidelines for bone metabolism and disease in chronic kidney disease. *Am J Kidney Dis,* 2003;42(4 Suppl 3):S1-S201.

Table 4
Gluten-Free Diet with Renal Restrictions
Remember: Gluten-free does not mean ok on renal diet and ok on renal diet, does not mean gluten-free!!

Food	*Safe Choices*	*Avoid*
Milk/yougurt	***Limit to 1/2 cup/day because it is high potassium and phosphorus:*** Any plain, unflavored milk or buttermilk, yogurt (Yoplait, Columbo, Dannon: without toppings), cream, half and half	Some flavored milks, yogurt—beware of thickener used, malted milk, yogurts with added "crunchies" or toppings
Cheese	***Limit to 1 ounce because it is high in potassium and phosphorus:*** Aged cheese such as Swiss, cheddar, edam, gouda, parmesan, etc.	Some veined cheeses and cheese foods, and spreads; check labels on cottage cheese
Eggs	All plain, cooked eggs	Eggs with some sauces or gravies
Meat, fish, shellfish, poultry	***At least 6 ounces daily:*** Any fresh, plain **untreated** meat, fish, shellfish or poultry, fish canned in brine, vegetable broth or water	Commercially treated luncheon meats, fish, shellfish, self-basting or cured poultry
Nuts/Nut Butters/Seeds	***Nuts and seeds are high in potassium and phosphorus therefore, you will need to avoid***	Dry roasted nuts or butters with gluten containing ingredients
Fruits/Juices	Any plain, fresh, canned, frozen **low potassium fruits** or juices **Low potassium fruits allowed:** Apple, apple juice; Blackberries; Blueberries; Cherries; Grapefruit—but no juice; Grapes; Peaches; Pineapple, pineapple juice; Plums; Strawberries; Tangerines; Watermelon—not more than 1 cup	Canned or dried fruit with filler added or dusted with flour, check pie fillings **High potassium fruits to avoid:** Apricots; Avocado, Guacamole; Banana; Cantaloupe; Dried Fruits: raisin, dates; Guava, guava juice; Honeydew; Kiwi; Mango, mango juice; Nectarines; Orange, Orange juice; Papaya, Papaya juice; Prunes, prune juice; Rhubarb; Tropical Fruit Salad/Cocktail
Vegetables/Beans/ Legumes	Any plain, fresh, canned or frozen **low potassium vegetables including:** Asparagus; Beans (snap, green, waxed), Bean sprouts; Cabbage (except Chinese cabbage like pak choi); Carrots, Cauliflower, Celery, Corn, Cress (water), Cucumber; Eggplant; Garden Peas; Lettuce; Okra, Onion ;Pepper (any variety); Radish; Turnip, white	Vegetables in gluten containing sauce or gravy. Avoid these ***high potassium vegetables:*** Artichoke; Broccoli; Dried beans and peas, other legumes ***Dark Green Leafy Vegetables:*** (collards, spinach, turnip greens) Potatoes, baked potatoes, French Fries, Instant potatoes, mashed potatoes; (Leached potatoes ok see next page) Squash (winter): acorn, butternut; Sweet Potatoes; Tomatoes: 2 thin slices is fine; Tomato juice, tomato sauce, spaghetti Sauces; Soybeans; Parsnips
Potatoes/rice/ starch	Any plain rice: white, brown or wild rice, rice noodles, **plain potatoes are fine but will need to be leached** *(soaking peeled and diced potatoes in warm water for 6 hours or in cold water overnight) Drain and boil soaked potatoes, drain the liquid again*	Commercial rice with flour coating, potato mixes, French fries with gluten carrier, pasta, noodles, wheat starch, unleached potatoes
Grains/flours	Corn (maize), tapioca, sorghum, arrowroot, amaranth*, buckwheat*, millet*, tef*, ragi*, Job's tears, potato*, cornstarch, flax*, soybean* (soya), yeast **Cooking/leaching the above grains may decrease the amount of potassium. Amaranth flakes, cooked buckwheat, millet are lower in potassium* *Teff, ragi, Job's tears nutrient analysis not known to author to this date*	Wheat (durum, semolina, kamut, spelt, farina, triticale), rye, barley, oats, graham, wheat germ, bulgar, cous-cous, low gluten flour, carob-soy flour **Careful: wheat free does not necessarily mean glutten-free** **Plain amaranth, Quinoa, plain buckwheat, plain sorghum, flax *are high in potassium***

Table 4 (continued)
Gluten-Free Diet with Renal Restrictions
Remember: Gluten-free does not mean ok on renal diet and ok on renal diet, does not mean gluten-free!!

Food	*Safe Choices*	*Avoid*
Breads, etc.	Pure corn tortillas, rice wafers, gluten free breads and crackers	Croutons, communion wafers, stuffing
Cereals—Hot/Dry	Cream of rice, cream of buckwheat, hominy, gluten-free dry cereals	Those with wheat, rye, oats or barley (including barley malt), wheat germ, bran, those with malt flavoring. Bran cereals
Soups	Homemade soups with known allowed ingredients, commercial soups if gluten-free, low sodium and allowed ingredients	Check labels carefully
Beverages/sodas	Coffee, tea, sodas: ginger ale, 7-up, Sprite . . . *sodas without "phos" in the ingredient section*	Some flavored instant coffee mixes such as swiss mocha, cappuccino, cocoa, Ovaltine. Colas, Dr. Pepper. Beverages with "phos" in the ingredient section
Soy Drinks	Westsoy Lite Soy Beverage, Westsoy Plus Soy Beverage, Westsoy Non Fat Soy Beverage, Westbrae Rice Drinks	Check labels, those with "rice syrup"
Crackers/chips/ popcorn	Rice wafers, plain cornmeal chips or tortillas, plain popcorn	potato chips
Condiments/jams/ syrups	**These are gluten free but some of these may be high in sodium:** Low sodium mayonnaise, salad dressings, vinegar (except malt vinegar) jam, jelly, honey, pure maple syrup, molasses, French's and Lea & Perrin's original Worchester sauce, white wine Worchester sauce, Hellmann's Honey Mustard, and Tartar Sauce	Commercial sauces, soup base, marinades, coating mixes, gluten containing thickening agents, malt vinegar, Kikoman soy sauce, other high sodium condiments
Seasonings/ flavorings	Any ***plain*** herb or spice, pepper, brown or white sugar, Equal, Sweet N Low	Salt, Lite-Salt, Nu-Salt Seasonings mixes Check labels, if unclear, do not use
Desserts	Sorbet, popsicles, Italian ice, ice cream—limit to 1/2 cup, (check labels), Swiss Miss puddings, Kozy Shack and Swiss Miss puddings	Ice cream with bits of cookies, doughnuts, pretzels, etc.
Fats	Butter, margarine, all pure vegetable oils (including rapeseed/ canola), mayonnaise, cream, Hellmann's mayonnaise, Dijonnaise	Some salad dressings, sandwich spread
Baking ingredients	Yeast, baking soda, baking powder, cream of tartar, and butterscotch baking chips	See grains/flours, Hershey's chocolate are high in potassium and phosphorus
Candies	Rolo caramels	Check labels, be wary of bulk candies-may be a source of gluten These may be gluten-free but have phosphorus: 3 Musketeers, Almond Joy, Andes Mints, Baby Ruth, M&M's, Snickers
	Wine, all distilled liquor including vodka, tequila, gin, rum, whiskey and pure liqueurs, *gluten-free* beer	Beer, ale, lager, drink mixes
	Wrigleys, Trident, Freedent, Dentyne, Clorets, Cinnabursts, Care Free	

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phorus restriction and use of phosphate binders is a major problem among CKD patients.

OTHER FACTORS TO CONSIDER

Patients with CKD often have multiple medical conditions that are associated with a long list of medications; hence, review of all of medications is a routine aspect of care at dialysis centers. For patients with CD, it will be important that all medications be cleared for the presence of gluten. Labels on medications rarely indicate whether it is GF; furthermore, inert ingredients such as starch fillers do not have to be listed on the label at all. Therefore, consulting a pharmacist or calling the manufacturer will be necessary (8). Intake of phosphate binders can range from three to 15 tablets per day depending on the patient's serum phosphorus level as well as the phosphorus content of meals. Calcium carbonate tablets may have "starch" fillers and will not specify the source (corn, wheat, potato or rice). Lanthanum carbonate, a phosphate binder, lists dextrates (hydrated) as one of its ingredients; dextrans can come from corn and potato starch; however, dextrates can come from any starch source. An excellent resource on medications and celiac disease is available (8).

Another thing to consider is the socio-economic status of each patient. Patients with CKD may have limited resources due to inability to work, fixed income (i.e. senior citizen retirement income) and high medical expenses (medications, clinic visits, transportation to and from dialysis). Gluten-free products can be more expensive than the non-gluten containing counterparts. Preparing the product from scratch may be more economical if patient is able; therefore, renal friendly gluten-free recipes should be available. Refer to the April 2007 Celiac Diet article in *Practical Gastroenterology* for suggestions on how to follow a gluten-free diet while on a budget (9).

CONCLUSION

Nutrition education is an important component in the management of complications of both celiac and renal disease. Although overwhelming at first, with careful instruction, the patient can become very adept at combining the restrictions of both of these diets. Table 4 provides a renal—gluten-free diet to aid the dialysis patient with celiac disease a place to start in achieving this goal. ■

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