So Just What Can I Eat? Nutritional Care in Patients with Diabetes Mellitus and Chronic Kidney Disease

CNE
Continuing Nursing Education

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The balance of nutrition in patients with diabetes mellitus and chronic kidney disease is essential to optimum health outcomes. Multiple nutritional parameters need to be monitored, including energy balance, protein intake (type and amount), mineral control (sodium, potassium, calcium, phosphorus), fluid requirements, and coordination of carbohydrates, to achieve glycemic control in diabetes mellitus. The nephrology nurse benefits by understanding the multiple nutrition parameters required in diabetes mellitus and chronic kidney disease to participate and reinforce the complexities of the daily nutritional challenges in coordination with a registered dietitian. A comprehensive overview of the nutrition parameters in chronic kidney disease and diabetes mellitus is discussed so the question "So just what can I eat?" can be answered with greater confidence.

Beto, J.A., & Nicholas, M. (2009). So just what can I eat? Nutritional care in patients with diabetes mellitus and chronic kidney disease. *Nephrology Nursing Journal, 36*(5), 497-505.

Goal

To provide an overview of nutrient goals for patients with diabetes mellitus and chronic kidney disease.

Objectives

1. List the four primary nutrient goals in kidney-focused nutrition.
2. List the four specific steps set forth by the American Dietetic Association to describe and monitor nutritional care.
3. Explain how understanding the multiple nutrition parameters required in patients with diabetes mellitus and chronic kidney disease helps nephrology nurses reinforce daily nutritional challenges.

The successful management of diabetes mellitus within the challenges of everyday life is an art in itself for patients and their healthcare professionals. Chronic kidney disease (CKD) is increasing as a common, often covert complication of diabetes mellitus. Comparison of the National Health and Nutrition Examination Survey (NHANES) data periods of healthy adults 20 years of age or older showed an increase of 2.3% (5.4% 1988-1994; 7.7% 1999-2004) in moderate glomerular filtration rate (GFR) decline estimating kidney function (Castro & Coresh, 2009). Prevalence of CKD in adults 20 to 59 years of age was statistically higher for those with diabetes mellitus alone (33.8% versus 8.2%) and those with diabetes mellitus and hypertension (43.0% versus 25.3%). In addition, the risk of CKD increased by 39.2% for those 60 years of age and older (Collins et al., 2009). The investment of time and effort to treat and potentially prevent CKD in patients with diabetes mellitus is appropriate. This review will discuss the medical nutrition therapy guidelines applicable to patients with diabetes mellitus both at risk for or diagnosed into stages of CKD with a focus on practical applications.

Nutrition Parameters: So Just What Can I Eat?

So just what can I eat? This is the question we all seek to answer for any patient. If you have ever tried to follow any type of meal plan or give up even one food item for a period of time, you can begin to imagine the complexity and frustration that diabetes mellitus and CKD bring to daily food decisions. Any CKD impairment forces an adaptation by the renal system. Eating less of selected nutrition parameters may help the damaged kidney filter less. As in dia-

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Statement of Disclosure: *The authors reported no actual or potential conflict of interest in relation to this continuing nursing education article.*

This offering for 1.4 contact hours is being provided by the American Nephrology Nurses' Association (ANNA).

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ANNA is a provider approved by the California Board of Registered Nursing, provider number CEP 00910.

This CNE article meets the Nephrology Nursing Certification Commission's (NNCC's) continuing nursing education requirements for certification and recertification.

Table 1.
Selected Macronutrient and Micronutrient Nutritional Parameters for Varying Stages of Chronic Kidney Disease (CKD)

Nutritional Parameter	Preventive	Stages 1 to 4 CKD	Stage 5 CKD Hemodialysis	Stage 5 CKD Peritoneal Dialysis	Post-Transplant
Calories (kcal/kg/d)	Maintain or achieve healthy body weight	Maintain or achieve healthy body weight	Maintain or achieve healthy body weight	Maintain or achieve healthy body weight (include calories from dialysate)	Maintain or achieve healthy body weight
Protein (g/kg/d/) Use idealized or healthy weight	0.8 to 1.0	0.6 to 0.8 50% to 75% HBV	1.2 Greater than 50% HBV	1.2 to 1.3 Greater than 50% HBV	1.0 to 1.2
Total fat (% total calories)	Less than 30%	Less than 30%	Less than 30%	Less than 30%	Less than 30%
Saturated fat (% total calories)	Less than 10%	Less than 10%	Less than 10%	Less than 10%	Less than 10%
Type of fat Cholesterol (mg/d) Omega-3 fatty acids (g/d)	Eliminate *trans* fat Less than 200 1.2 g/d women 1.6 g/d men	Eliminate *trans* fat Less than 200 1.2 g/d women 1.6 g/d men	Eliminate *trans* fat Less than 200 1.1g/d women 1.6 g/d men	Eliminate *trans* fat Less than 200 1.1 g/d women 1.6 g/d men	Eliminate *trans* fat Less than 200 1.1 g/d women 1.6 g/d men
Carbohydrate (% of total calories)	Emphasis whole grains, fruits, vegetables	50% to 60% Achieve target mean A_{1c}	50% to 60% Achieve target mean A_{1c}	Dialysate glucose needs to be factored Achieve target mean A_{1c}	Achieve target mean A_{1c}
Dietary fiber	14 g/1000 kcal	14g/1000 kcal	14g/1000 kcal	14g/1000 kcal	14g/1000 kcal
Sodium (g/d)	Unrestricted; DASH diet	Less than 2.3 g/d	Less than 2.0 g/d	2 to 3 g/d	Less than 3.0 g/d
Potassium (g/d)	Unrestricted	2.0 to 4.0 g/d	2.4 g/d	3 to 4 g/d	Unrestricted unless indicated
Calcium (mg/d)	RDA	1200 mg/d	Less than 2.0 from diet and medications	Less than 2.0 from diet and medications	Unrestricted unless indicated
Phosphorus (g/d)	Unrestricted	0.8 to 1.0 g/d	0.8 to 1.0 g/d	0.8 to 1.0 g/d	Unrestricted unless indicated
Fluid (ml/d)	Unrestricted	Unrestricted with normal urine output	1000 + urine output	Monitored by dialysis adequacy	Unrestricted unless indicated

Note: Use only as guidelines only for assessment: individualization and continual re-assessment required for each patient on continual basis.
HBV = high biological; DASH = Dietary Approaches to Stop Hypertension.

Sources: Bantle et al., 2006; Beto & Bansal, 2004; Giddings et al., 2009; Institutes of Medicine, 2002; NKF, 2000, 2007.

Table 2
Nutrient Goals Matched to Stages of Life for Patients with Diabetes Mellitus and CKD

Stage of Life \ CKD Stage	CKD Stages 2 to 4	CKD Stage 5 Hemodialysis or Peritoneal Dialysis	Transplant
Pediatric	Maintain growth Avoid obesity Retard progression Tight glycemic control	Maintain growth Avoid obesity Seek transplant of kidney and pancreas Tight glycemic control	Maintain growth Avoid obesity Focus on graft survival
Adults	Maintain health, QOL Avoid obesity Retard progression Tight glycemic control	Maintain health Seek transplant Optimize dialysis outcomes Tight glycemic control	Maintain health Avoid obesity Focus on graft survival
Geriatric	Maintain health, QOL Avoid obesity Retard progression Moderate glycemic control	Maintain health Avoid obesity Optimize dialysis outcomes Moderate glycemic control	Feasibility and outcome dependent on risk factors
End-of-life	Maintain QOL Reduce protein to retard progression or reduce uremic symptoms	Evaluate QOL Consider low-protein diet with adequate calories if dialysis not an option or hospice care	Not applicable

Notes: QOL= quality of life; CKD = chronic kidney disease.

betes mellitus management, the metabolic situation is not static. Every change, even seemingly minor, can produce a cascade of accompanying issues. The word “diet” is often associated with negative restrictions and short-term sacrifices. It is more positive to focus on “what I can eat” rather than “what I cannot. eat”

The nutrient intake must be matched to the organ ability. Table 1 outlines general nutrition parameters by CKD stages and replacement therapy, but the application of this complex matrix requires a high level of individualization for effective therapy. This table integrates the clinical guideline recommendations of the American Diabetes Association, the American Heart Association, the American Dietetic Association, and the National Kidney Foundation (Bantle et al., 2006, Giddings et al., 2009, National Kidney Foundation [NKF], 2000, 2007). Calories, protein, fat, and carbohydrates are part of routine education for people with diabetes mellitus, but the focus is primarily on the timing and ability of the body to handle the glycemic load. CKD forces the modification to the degree of organ function, classified by NKF as progressive failure (Stages 1 to 4) or total kidney failure (Stage 5) when dialysis or transplant is necessary for life. Both the amount and type of some nutrients need definition. Restriction of one parameter, such as protein to address elevated serum creatinine, can in turn result in low serum albumin unless the type of protein restricted includes high biological value choices. Furthermore, since patients make food choices based on changing opportunities and motivation scenarios, the nutrition education component is ongoing and evolving.

Individualized Nutrition Goals

There are four primary nutrient goals in kidney-focused nutrition: 1) match dietary intake to kidney output, 2) maintain or achieve glycemic control, 3) maintain or achieve healthy body weight, and 4) manage or decrease nutrient risks. The patient’s stage of life imposes additional goals as shown in Table 2. The overall premise of nutritional care in CKD is individualization to a patient’s specific kidney function, specific treatment modality, and own unique food issues. Other considerations that need to be integrated may include budgetary constraints, shopping and food preparation limitations, knowledge and skill levels, cultural and environmental issues, nutrient deficits, and family support/motivation status. The Center for Medicare and Medicaid Services (CMS) reimburses selected nutrition education services provided by registered dietitians for Medicare patients with CKD Stages 1 to 4 and diabetes mellitus (NKF, 2007). CMS coverage for dialysis mandates and outlines nutrition services of registered dietitians as well. The most effective education is delivered with a common mindset by each healthcare team member reinforcing each other’s area of expertise.

Nutritional Assessment

The first step in planning what a patient can eat begins with a complete nutritional assessment. The American Dietetic Association has recently developed a nutrition care process standardized language initiative which seeks to use specialized terminology to describe and monitor nutritional care. The four specific steps are 1) nutrition assessment, 2) nutrition diagnosis, 3) intervention, and 4) monitoring and evaluation. This process, as in medical care, repeats itself with each patient interaction (American Dietetic Association, 2008). Assessment begins with a nutrition-focused physical examination looking for overt and covert physical findings of nutritional deficiency or toxicity (Kelly, Kight, & Castillo, 1998). A subjective global assessment has also been shown to be an appropriate assessment technique (de Mutsert et al., 2009). This is followed by a 24-hour dietary assessment analyzed by computer software or a food frequency questionnaire. This information is integrated with existing information found in the medical record (such as laboratory values, demographics, and anthropometrics). A nutrition diagnosis is then determined based on the findings. An example of a nutrition diagnosis statement could be, “Excess dietary phosphorus intake related to knowledge deficit as evidenced by a 2-month mean of serum phosphorus greater than 8.2 mg/dL.” The diagnosis of excess phosphorus intake documented by laboratory parameters directs the educational intervention. Monitoring and evaluation are linked to re-assessments, which typically occur monthly in the dialysis population or during clinical visits in patients not on dialysis. A second nutrition diagnosis statement might be, “Inadequate carbohydrate intake related to unmatched insulin dosage as evidenced by two hypoglycemia episodes over the past two weeks.” The intervention would focus on the coordination of insulin dosing to timing of meals and/or snacks to prevent hypoglycemic episodes.

Body Weight Assessment

One of the most controversial areas of nutrition practice is body weight assessment. The determination of percentages of lean tissue, fat or adipose tissue, and fluid weight is complicated in the CKD population. Standardized tables are often ineffective in determining a goal body weight. It is a combination of clinician judgment, normal blood pressure, and weight patterns that help set short-term goals that need continual re- assessment (Schatz, Pagenkemper, & Beto, 2006). Obesity in the general population is becoming more common in the CKD population and may be a causal factor in diabetes mellitus risk (NKF, 2009). Adequate body weight may mask malnutrition particularly in patients on peritoneal dialysis who may absorb excessive calories from dialysate without nutrient density or in morbid obesity with inadequate protein intake. Conversely, a retrospective epidemiological analysis of a large dialysis provider database determined that obesity may provide a survival advantage compared to underweight status in CKD Stage 5 hemodialysis (Kalantar-Zadar et al., 2005). It is postulated higher body weight adipose tissue may provide a caloric source of energy in times of stress compared to underweight low adipose tissues that more rapidly promote protein-energy malnutrition risk. When treated with gastric by-pass options, morbid obesity has been shown in several studies to reduce progression of kidney disease and attain higher levels of glycemic metabolic control in some patients. However, gastric bypass surgery is not without risk. The required commitment to rehabilitation and adaptation of lifestyle post-surgery is extensive. The majority of the weight loss effective is seen in the first year. Long-term outcomes in patients with diabetes mellitus and CKD have not been reported.

Dry body weight, a common goal in patients on dialysis, may provide little or no information on protein requirements since it focuses on body fluid. An obese patient of 105 kg with a high adipose tissue body weight percentage should not receive 1.0 g/kg/protein (105 gm/day), but rather, a calculation reflecting a normalized body weight of closer to 80 kg. Data on serum proteins, dietary patterns, and lean body mass estimations are required to create an individualized nutritional plan. Physical parameters in addition to body weight may include waist and hip circumference, height, calculation of body mass index, technological measures (such as bioelectric impedance), and/or manual measures (such as hand grip, walking tests).

Energy Need Determination

Caloric needs are based on the ability to maintain or achieve a goal body weight. Sufficient calories need to be provided so the protein component of the diet is used for tissue maintenance and repair rather than for energy (Campbell, Ash, Davies, & Bauer, 2008). In diabetes mellitus, calories need to be provided to prevent ketosis, the use of body fat for energy when dietary energy cannot be accessed due to lack of insulin, but not in amounts beyond the daily requirement. Physical activity, which may vary each day, must also be factored in. Essentially, we try to start each day with an empty tank of gas in our body, fill the tank with just enough calories to match what the body needs each day, and repeat the cycle. For most patients, the amount of energy used each day may vary, but the body is quick to adapt to moderate changes in intake by either frugally storing extra calories as fat for use in the future or burning calories more efficiently in times of deprivation. Stored fat, however, is slow to be used for energy due to barriers to the reversal of the metabolic cycle under which it was created and does not require similar insulin needs.

In diabetes mellitus, lack of insulin or shortage due to insulin resistance promotes the storage of fat when serum glucose cannot be used for energy. The optimal strategy is to provide calories throughout the day as the body needs them rather than in one or two bolus meals. This timing of intake is a key factor in energy need determination and diabetic pharmacology. Regular meals in contemporary society are often not a common pattern. Rather, food is ingested in a more random manner based on availability rather than energy need or true hunger. Planning of meals and snacks is essential to distribute and match energy needs to intake. For many patients, this is a huge barrier to compliance.

Special consideration must be given to pediatric patients to allow for sufficient calories to promote growth. Adolescents with diabetes mellitus are often naïve to the risk of future complications of poor metabolic control. Balancing CKD and diabetes mellitus in pediatric patients is complicated by peer pressure and greater risk of hypoglycemia (Buckloh et al., 2008).

Caloric needs are assessed by monitoring gross body weight. Changes in body weight over time, evaluated within the context of body weight determination issues, are tracked. Calories absorbed from peritoneal dialysate need to be calculated into total calorie requirement. Weight gain can occur as a side effect of some medications (such as steroids). Each confounding issue needs to be integrated into the patient care plan.

Protein Requirements

Protein is required to maintain lean body tissue. Too much protein, however, places a burden on the damaged kidney to filter out the waste products commonly seen as serum blood urea nitrogen or creatinine. The nitrogen component of protein must be removed by the kidneys for the protein to be used for energy. Therefore, it is imperative that protein intake is matched to the specific needs of the patient and used for the purpose of tissue catabolism. The amount of protein required is the same as the Recommended Daily Allowance (RDA) of 0.8 g/kg/d of idealized body weight for patients in CKD Stages 1 to 4, which is liberalized to 1.0 to 1.3 g/kg/d with dialysis modalities (Beto & Bansal, 2004). However, most Americans typically eat far more than is required each day. In addition, the popularity of high-protein diets for weight reduction and erroneously perceived as advantageous in athletes creates a true sense of loss in patients when presented with a protein restriction more matched to physiological requirements. Normal kidneys will filter out the excess nitrogen and use the nitrogen-removed protein fragments for energy. In diabetes mellitus, protein restriction necessitates that calorie needs are met by carbohydrate or fat. This, in turn, requires coordination of the calorie distribution with the timing of diabetic medications.

Protein malnutrition, as evidenced by low serum albumin, is common in many patients with CKD. The etiology is often unknown but has been linked to taste changes in uremia, possible zinc deficiency, and chronic inflammatory status. Nutritional supplements, such as commercial protein liquid beverages, can be used but may add to fluid burden. Their cost is often not covered by insurance, which adds to the financial burden. Sufficient calories must be given to prevent protein from being used for energy needs rather than protein requirements. The type of protein is also important. At least 50% of protein consumed should be of high biological value. The higher percentage of essential amino acids promotes anabolism of lean tissues. The highest biological protein food is an egg.

Older adult patients with CKD and diabetes mellitus often require liberalization of diet parameters. Difficulties with chewing, taste, and digestion can affect nutritional intake. Co-morbidities complicate necessary restrictions and require serious thought into prioritizing care goals. Multiple medications coupled with potential drug-interactions challenge coordination of care and often require dosage adaptations to renal insufficiency. If patients choose not to pursue dialysis, very low protein diets with adequate calories may provide an option to delay dialysis; however, these diets require careful monitoring for malnutrition risk.

Carbohydrate and Fat Requirements

Diabetes mellitus superimposed with CKD requires a balance of carbohydrate and fat calories. The planning of carbohydrate distribution does not change in CKD. Patients need to be assessed carefully to match medications for diabetes mellitus with carbohydrate intake. Avoiding simple sugars and carbohydrates is insufficient advice. Evidence suggests tight glycemic control is a treatment cornerstone for preventing complications of neuropathy and delaying progression to nephropathy even in the presence of albuminuria (Bash, Selvin, Steffes, Coresh, & Astor, 2008; Riegersperger & Sunder-Plassmann, 2007). Higher fiber intake is beneficial to promote more stable blood sugars. The daily recommended fiber intake of 14g/1000 kcal is difficult to attain even for healthy non-CKD adults despite higher intake of fresh fruits and vegetables, and whole grains and cereals (Institute of Medicine, 2002). Patients on dialysis may be challenged by the additional fluid and potassium intake that occurs naturally in fruits and vegetables, as well as the additional fluid required to add bulk to the fiber while in transit through the intestines.

The treatment of hypoglycemia (plasma glucose less than 70 ml/dL) in patients with CKD and diabetes mellitus remains the same as without CKD. The American Diabetic Association recommends ingestion of 15 to 20 g of glucose in any form with re-evaluation in 10 to 20 minute for glycemic response (Bantle et al., 2006)

Once the protein and carbohydrate needs have been met, fat becomes the remaining source of dietary intake to meet calorie needs. If a patient is overweight, fat restriction becomes the primary method to reduce total daily calories. Total dietary fat should be 30% or less of total calories. Type of fat is important to lower risk of cardiovascular complications (Giddings et al., 2009). Saturated fat should be less than 10% of total calories and is found primarily in animal sources. A good guide is fat that is solid at room temperature is more saturated (for example, corn oil margarine is more saturated than corn oil; peanut butter is more saturated than peanut oil). Patients should be encouraged to choose low-fat alternatives and trim visible fat prior to consumption. Poultry can be cooked with the skin, but the skin should not be consumed. Cook-chill preparation methods can be used to lower fat content. Simmer, stew, and braise lower-cost, higher-fat meat products, then chill overnight. Remove the visible fat that has congealed on the surface, and reheat for consumption. Getting back to the basics of food preparation is the easiest method to increase the quality of daily intake. However, many patients do not cook at home and do not have the ability to avoid hidden fats in commercial and fast-food sources.

Eggs are an inexpensive and excellent source of high biological value protein; however, the yolk is high in saturated fat and cholesterol. One egg exceeds the daily recommendation for cholesterol, so it is difficult to promote high biological value protein and emphasize good dietary fat. The trend has been to prescribe more statins to address hyperlipidemia while lowering cardiovascular risk rather than severely restricting dietary fat.

Recent emphasis has been placed on omega-3 fatty acids as a good source of dietary fat. The American Heart Association recommends the consumption of 2 to 3 servings per week of fatty fish, such as salmon or tuna. Lean fish, such as cod and tilapia, do not contain omega-3 fatty acids. (Giddings et al., 2009). Almonds have been shown to be a beneficial source of both omega-3 fatty acids and fiber in the diet. A recent study showed that the longer almonds were chewed to produce smaller particles that were swallowed, the higher the amount of fat that were absorbed in the body (Cassady, Hollis, Fulford, Considine, & Mattes, 2009). Other research has shown a "portfolio diet," where nuts replacing the majority of animal protein was beneficial in controlling serum glucose and lipids. Nuts may be an effective between-meal snack that do not promote blood sugar fluctuations (Jenkins, Josse, Wong, Nguyen, & Kendall, 2007). Using alternate fats in the diabetic meal plan (for example, substituting olive oil for butter) may provide further benefits.

Mineral Balance

The primary minerals controlled in patients with CKD are sodium, potassium, calcium, and phosphorus. The extracellular nature of sodium is easiest to understand by correlating fluid retention, blood pressure relationships, and weight gain between dialysis sessions. Sodium is found on food labels and can be readily tasted in most foods. The level of sodium consumption in the United States has risen steadily, primarily because of the use of sodium as a food preservative in many processed foods.

Potassium, the intracellular counterpart of sodium, is not as easy to detect and control. Hyperkalemia can cause irregular heart beat and cardiac arrest. In patients with CKD, the gastrointestinal tract compensates for loss of renal filtration by higher fecal loss. Potassium is seldom found on a food label. Common food sources are citrus juices, bananas, tomatoes, avocados, potatoes, dried beans, and lentils, as well as most fruits and vegetables. Potatoes were traditionally recommended to be peeled and soaked overnight to reduce potassium content. New research has shown that cooking peeled potatoes in a large amount of water can achieve a similar effect. The amount and frequency of the intake of a food are a better guideline than to completely avoid the intake of certain foods. Many patients with diuretic use in the early stages of CKD are encouraged to consume high-potassium foods. Salt substitute should be avoided because it substitutes the sodium component with potassium. Flavoring and seasoning alternatives are a continual educational conversation (Beto & Bansal, 2004; NKF, 2000). Inflammation, infection, and tissue catabolism can release potassium to the extracellular space.

Control of serum calcium, phosphorus, and parathyroid hormone (PTH) is necessary to reduce bone and mineral disorders. Research has inferred that excess oral calcium intake can add to the metabolic burden, promoting calcification of tissues and increasing risk of cardiovascular disease. Many food products today are fortified with calcium to address public health awareness of osteoporosis. Dairy products may need to be replaced by low-fat, non-dairy creamer substitutions to reduce calcium content.

Phosphorus is controlled through oral intake and phosphate-binders. Some phosphate binders contain calcium (such as calcium acetate), which increases metabolic load. The timing of phosphate binders to correspond to phosphorus intake is similar to carbohydrate matching to insulin. An example of a visual educational stepwise analogy would be 1) eat a phosphorus-containing food, 2) match with the appropriate binder amount to "grab" the phosphorus to make it unavailable for absorption (using a visual aid of representative items in a small plastic bag), and 3) removal through the stool intact. "Action" education may help complex issues become more understandable. Phosphates are widely used as food preservatives.

Serum PTH levels are controlled using a combination of phosphate binders, vitamin D, and calcimimetics to increase vitamin D and calcium-sensing receptor response to the metabolic mineral disturbances. This process is beyond the scope of this review but requires a coordinated understanding of the metabolic process to individualize effective therapy to each patient.

Fluid Requirements

What goes in must come out. Intake and output balance with fluid, as with all nutrients in patients with CKD, is essential. Fluid restriction is usually not required until urine output has declined in Stage 5. In some forms of CKD, such as polycystic kidney disease, urine output may continue. In peritoneal dialysis, fluid is influenced by the dialysate absorption. Typically, most patients with Stage 5 CKD must restrict fluid to achieve a "safe" interdialytic weight gain between dialysis treatments. Fluid is hidden in some foods, such as watermelon and ice. The thirst mechanism in uremia is altered, and most patients drink ad lib rather than measuring intake.

Good bowel health is very beneficial for potassium and phosphorus metabolism in patients with CKD. Most patients are eager to discuss and address constipation issues. The addition of fiber to the diet may promote regularity in bowel habits but may also require more oral fluid for effective transit. This additional fluid when given appropriately to promote fiber intake appears to have a lower effect on blood pressure and edema in most patients. Restoring beneficial gut flora through active yogurt cultures or probiotics may be beneficial.

Vitamin Supplementation

Daily supplementation with selected vitamins and minerals is widely practiced in the care of patients with CKD, although no studies specifically provide evidence unique to the population of patients with CKD and diabetes mellitus. There are specific renal formulas available. Combinations can be created from available generic products but may require more fluid intake because of multiple pills rather than a single tablet. Except for vitamin C, most water-soluble vitamins can be used without toxicity. Vitamins A, E, and K should not be supplemented because of respective potential toxicity and clotting issues (Beto & Bansal, 2004, NKF, 2000). Vitamin D can be obtained from oral or intravenous sources, but it is also produced by the skin via ultraviolet light conversion and subsequent thermal isomerization of 7-dehydrocholesterol to vitamin D_3. Recent research has begun to focus on the metabolic pathways of Vitamin D in patients with CKD. Intravenous iron as an intermittent bolus is more commonly used than oral iron to achieve anemia goals. There is no evidence that chromium supplementation has any effect in diabetes mellitus management (Bantle et al., 2006).

Summary

The complexities of the nutritional parameters for patients with diabetes mellitus and CKD are challenging. The primary parameters are calories, protein, carbohydrate, fat, sodium, potassium, calcium, phosphorus, and fluid. Using a positive attitude, one can turn the challenge of the question, "So just what can I eat?" into an educational opportunity for continual conversation with patients. Each day brings new food choices that have to be matched to both diabetes (glycemic) and renal goals. Control can reduce or slow the progression of many disease complications. A registered dietitian aids in the delivery of nutritional services, but the role of the healthcare team, specifically the nephrology nurse, is essential to identify and reinforce each component to deliver optimal care.

Meat of the Matter

- Coordinate with a registered dietitian to set and achieve nutritional goals.
- Match dietary intake with kidney function to limit renal load.
- Coordinate dietary carbohydrate with medication for diabetes mellitus to maintain or achieve glycemic control.
- Maintain or achieve healthy body weight to reduce cardiovascular and diabetic risk.
- Manage or decrease nutrient risks to prevent signs and symptoms of malnutrition.

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Schatz, S., Pagenkemper, J., & Beto, J. (2006). Body weight estimation in chronic kidney disease: Results of a practitioner survey. *Journal of Renal Nutrition, 16,* 283-286.

Additional Reading

Beto, J.A., Bansal, V.K., Hart, J., McCarthy, M., & Roberts, D. for the Council on Renal Nutrition National Research Question Collaborative Study Group. (1999). Hemodialysis prognostic nutrition index as a predictor for morbidity and mortality in hemodialysis patients and its correlation to adequacy of dialysis. *Journal of Renal Nutrition, 9,* 1-8.

CNE

ANSWER/EVALUATION FORM

So Just What Can I Eat? Nutritional Care in Patients with Diabetes Mellitus and Chronic Kidney Disease

Judith A. Beto, PhD, RD; Mary Nicholas, MSN, RN

1.4 Contact Hours
Expires: October 31, 2011
ANNA Member Price: $15
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Posttest Instructions

- Select the best answer and circle the appropriate letter on the answer grid below.
- Complete the evaluation.
- Send only the answer form to the ANNA National Office; East Holly Avenue Box 56; Pitman, NJ 08071-0056; or fax this form to (856) 589-7463.
- Enclose a check or money order payable to ANNA. Fees listed in payment section.
- If you receive a passing score of 70% or better, a certificate for the contact hours will be awarded by ANNA.
- Please allow 2-3 weeks for processing. You may submit multiple answer forms in one mailing, however, because of various processing procedures for each answer form, you may not receive all of your certificates returned in one mailing.

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Note: If you wish to keep the journal intact, you may photocopy the answer sheet or access this posttest at www.annanurse.org/journal

1. What would be different in your practice if you applied what you have learned from this activity?

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GOAL To provide an overview of nutrient goals for patients with diabetes mellitus and chronic kidney disease.

Please note that this continuing nursing education activity does not contain multiple-choice questions. This posttest substitutes the multiple-choice questions with an open-ended question. Simply answer the open-ended question(s) directly above the evaluation portion of the Answer/Evaluation Form and return the form, with payment, to the National Office as usual.

Evaluation	**Strongly disagree**				**Strongly agree**
2. By completing this offering, I was able to meet the stated objectives					
a. List the four primary nutrient goals in kidney-focused nutrition.	1	2	3	4	5
b. List the four specific steps set forth by the American Dietetic Association to describe and monitor nutritional care.	1	2	3	4	5
c. Explain how understanding the multiple nutrition parameters required in patients with diabetes mellitus and chronic kidney disease helps nephrology nurses reinforce daily nutritional challenges.	1	2	3	4	5
3. The content was current and relevant.	1	2	3	4	5
4. This was an effective method to learn this content.	1	2	3	4	5

5. Time required to complete reading assignment: _________ minutes.

I verify that I have completed this activity ____________________
(Signature)