Diet for Diabetes and Chronic Kidney Disease: Tips for Educators

Introduction

When diabetic nephropathy is diagnosed, the goal is to retain kidney function for as long as possible. To help maintain kidney function, and delay the progression of kidney disease, **optimal blood glucose** and **blood pressure control** are cornerstones of treatment (1). When a person is diagnosed with chronic kidney disease (CKD), a referral to a nephrologist should be initiated, and management by a renal medical care team advocated.

The "Diabetes and Kidney Disease – Kidney Care" section, in Chapter 13 of the Beyond the Basics (BTB) Resource, provides an outline about kidney disease in people with diabetes, with an emphasis on prevention. The purpose of this document is to provide guidelines for adapting the BTB for people with diabetes and kidney disease. It can help registered dietitians' (RD) counsel people with diabetes about their diet for both diabetes and kidney disease. This information can be used in the interim time period before they are able to see a nephrologist and/or dietitian specializing in kidney disease.

Diet counselling by a RD needs to be individualized based on many factors including: kidney function, lifestyle, culture, religion, financial status, other comorbid conditions, treatment goals and biochemical parameters (2). The diet may have to be modified for sodium, protein, potassium and/or phosphorus.

Estimating Kidney Function

The 2003 CDA Clinical Practice Guidelines recommend estimating kidney function using serum creatinine to calculate creatinine clearance (CrCl) with the Cockcroft-Gault equation (1). Glomerular filtration rate (GFR) may also be used to estimate kidney function using the Modified Diet in Renal Disease (MDRD) study equation. Kidney function is often classified into five stages using CrCl or GFR. **A value less than 60mL/min for longer than 3 months is considered chronic kidney disease (CKD).** (3)

Stages of Kidney Disease

See Appendix 1 for Cockcroft-Gault and MDRD GFR study calculations.

CrCl or GFR in ml/minute	Kidney function	Stage
Greater than or equal to 90	Normal	1
89 – 60	Mild decrease	2
59 – 30	**Moderate decrease**	**3**
29 - 15	**Severe decrease**	**4**
less than 15	**Minimal function. Dialysis or transplantation may be required.**	**5**

Sodium

Most people with diabetes and CKD require a sodium restriction to achieve optimal blood pressure control and prevent fluid retention. "Shake the salt habit", located on page 131 of the Beyond the Basics Resource, is a tool that can be used to educate people regarding lowering the sodium in their diet.

Dietary Approaches to Stop Hypertension (DASH)

The DASH diet has been promoted for the treatment of hypertension in people with diabetes (4). When kidney function is normal, or mildly decreased, the DASH diet may be used in the presence of normal serum potassium levels (5). Due to its higher protein, potassium and phosphorus content, it is not recommended for people with moderately or severely decreased kidney function (CrCl < 60 mL/min). For more information regarding the DASH diet see the resource list.

Protein

Restricting dietary protein (0.6 – 0.75 g/kg/d) for people with CKD is controversial due to the intensive counselling and monitoring required to prevent malnutrition. Most renal dietitians aim for the Dietary Reference Intakes (DRI) of 0.8 g/kg/d with at least 50% coming from high biological value protein sources (6, 7). For people with nephrotic syndrome, up to 1.0 g/kg/d may be used (7). A controlled protein diet also helps to control potassium and phosphate content in the diet.

Diet Counselling Guidelines:

1) Choose fresh or fresh frozen meats, poultry, pork and fish most often. Limit salty products like bacon and deli meat.
2) Limit servings to the size of the palm of your hand.
3) The protein sources listed below are high in potassium and/or phosphorus. If the person's serum potassium or phosphate is elevated suggest limiting to one Meat and Alternative choice per day of either:
    a. Legumes (dried beans, peas, lentils)
    b. Cheese
    c. Peanut butter

Vegetarian diet counselling in CKD

Due to the higher potassium content of various vegetarian protein sources a more individualized diet pattern may be required to prevent protein malnutrition and hyperkalemia. The diet recommendations should be based on the person's food preferences, culture and beliefs.

Potassium

The antihypertensive medications angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARB), are preferred agents for treatment of diabetic nephropathy (1,5). Hyperkalemia is a common side effect. People with diabetes who are started on one or both types of the above

mentioned medications may require a dietary potassium restriction. If serum potassium levels are greater than normal, a low potassium diet should be prescribed. In some cases, a higher potassium diet may be required due to high doses of loop diuretics (e.g. furosemide). See Appendix 2 for antihypertensive therapies that affect blood potassium levels.

Diet Counselling Guidelines:

Before implementing a potassium restricted diet a thorough diet history should be performed by a RD to identify major sources of potassium. To avoid unnecessary diet restriction, counselling on a reduced potassium diet can be done in two phases.

1) Initial instruction focusing on:
   a) Choosing lower potassium fruit and vegetables, and their juices. (See Table 1)
   b) Avoiding salt substitutes containing potassium chloride (e.g. No Salt or Half Salt) and avoiding sodium reduced products that use potassium chloride. Recommend no added salt seasoning blends such as "Mrs. Dash™" or "McCormick's No Salt Added™".

2) If serum potassium remains above normal levels:
   a) Limit Milk and Alternatives to one choice (e.g. ≤ 8 ounces of milk) per day or less.
   b) Limit legumes (dried beans, peas, lentils) and peanut butter to one Meat and Alternative choice (7 grams of dietary protein) per day. If the person is vegetarian more may be allowed to meet protein needs.
   c) Limit nuts to one Fat choice per day or less.

Table 1: Common Lower and Higher Potassium Fruits and Vegetables

(See Appendix 3 for a more expanded list including multicultural fruit and vegetables)

	Lower Potassium	Higher Potassium
Fruit	Apples, Blueberries, canned (drained) fruit, Cranberries, Grapes, Mango, Peach (small), Pear, Pineapple, Plum, Watermelon	Avocado, Banana, Cantaloupe melon, Dried fruit, Honeydew melon, Kiwifruit, Nectarine, Orange, Papaya
Vegetables	Asparagus, Beans (green/yellow), Carrots (boiled), Cauliflower, Celery, Corn, Cucumber, Eggplant, Lettuce, Onions, Peas (green or snow, boiled), Peppers	Beets, Brussels Sprouts, Mushrooms (cooked), Potato, Pumpkin, Spinach (cooked), Squash, Sweet Potato, Tomato paste and sauces, Yams

Note: Various resources and renal programs use different milligram cut-off levels to determine what foods are higher and lower in potassium. Therefore, low potassium diet resources may vary. The above table was based on the National Kidney Foundation (NKF) resource which uses a cut-off of 200 mg per (½ cup) serving.

Potassium and Blood Glucose

Hyperglycemia can cause elevated blood potassium levels. Encouraging optimal blood glucose control can help prevent hyperkalemia.

Remind people to choose lower potassium sources of carbohydrates to treat hypoglycemia. (Refer to the "Hypoglycemia and Chronic Kidney Disease" resource.)

Phosphorus

Maintaining normal serum phosphate levels is important for preventing renal bone disease and calcification of the soft tissue in people with CKD (8). Increase in blood phosphate is not usually seen until the later stages of CKD. Referral to a nephrologist is needed to optimize renal bone disease management through prescription of phosphorus binding medications and vitamin D derivatives. Counselling regarding a low phosphorus diet may often be delayed until the client is seen by a multidisciplinary renal team (including a RD).

Diet Counselling Guidelines:

1) Counselling on the above guidelines for sodium, protein and potassium, indirectly reduces phosphorus in the diet.
2) In the earlier stages of CKD continue to encourage the use of fibre rich grains and cereals to promote optimal blood glucose control.
3) The following foods are a source of readily absorbed phosphorus and should be discouraged due to the poor nutrient content:
    a) Beverages that contain phosphoric acid (e.g. regular and diet cola's) or phosphates.
    b) Beer
    c) Chocolate

Glycemic Index (GI)

Many low glycemic index foods are higher in potassium and phosphorus. Below are counselling guidelines that are appropriate for people with elevated potassium or phosphate levels.

Diet Counselling Guidelines:

1) Lower the GI of foods by using lemon juice or vinegar to flavour foods.
2) Breads - cracked wheat or sourdough breads.
3) Fresh fruits - Apples, cherries, pears, plums and strawberries.
4) Grains - parboiled rice, barley and millet.
5) Balance meals with appropriate portions of protein and good sources of mono- and poly-unsaturated fats.

References:

1. Canadian Diabetes Association: 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada.
2. National Kidney Foundation: K/DOQI CLINICAL Practice Guidelines for Nutrition in Chronic Renal Failure. 2000.
3. National Kidney Foundation: K/DOQI CLINICAL Practice Guidelines for Chronic Kidney Disease: Evaluation, Classification, and Stratification. 2002.
4. Reimer, R. “The DASH diet: implications for people with diabetes” Can J Diabetes. 2002;26(4): 369-377.
5. National Kidney Foundation: K/DOQI CLINICAL Practice Guidelines on Hypertension and Antihypertensive Agents in Chronic Kidney Disease. 2004.
6. Dietitians Special Interest Group of the EDTNA/ERCA: European Guidelines for the Nutritional Care of Adult Renal Patients. October 2002. http://www.associationhq.com/edtna/pdf/diet_dietguid.pdf
7. American Dietetic Association: A Clinical Guide to Nutrition Care in Kidney Disease. 2004.
8. National Kidney Foundation: K/DOQI CLINICAL Practice Guidelines for Bone Metabolism and Disease in Chronic Kidney Disease. 2003.

Resources:

National Institutes of Health: Your Guide to Lowering Your Blood Pressure with DASH. April 2006.
http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf

2006 CHEP: Canadian recommendations for the management of hypertension
http://www.hypertension.ca/chep/recommendations2006/CHEP_2006_complete.pdf

Canadian Nutrient File (database), 2005
www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/index_e.htmlAppendix

Appendix 1 – Cockcroft-Gault and MDRD GFR calculations

Online version of these calculations are available at http://www.nephron.com

*Cockcroft-Gault equation (1):

$$\text{Creatinine clearance (mL/min)} = \frac{(140 - \text{age in years}) \times \text{actual weight (kg)}}{\text{serum creatinine } (\mu\text{mol/L})}$$

Multiply the result by 1.2 for men
Normal range is > 90 mL/min, > 1.5 mL/s

*MDRD GFR (abbreviated) equation (3):

Estimated GFR (mL/min/1.73 m^2)

$= 186 \times (S_{Cr})^{-1.154} \times (\text{Age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if African American})$

$= \exp(5.228 - 1.154 \times \ln(S_{Cr}) - 0.203 \times \ln(\text{Age}) - (0.299 \text{ if female}) + (0.192 \text{ if African American})$

* Some clinical situations may produce an over or underestimation of kidney function if estimated using the above equations (3). In these situations, a 24 hour urine clearance should be measured to estimate GFR. These situations include:

  Extremes of age and body size

  Severe malnutrition or obesity

  Disease of skeletal muscle

  Paraplegia or quadriplegia

  Vegetarian diet

  Rapidly changing kidney function

Appendix 2 - Antihypertensive therapies that affect blood potassium levels

Renin-angiotensin system inhibitors

Increases blood potassium

Generic Name	Trade Name
Angiotensin-converting enzyme inhibitors (ACE-I)	
benazepril	Lotensin
captopril	Capoten
cilazapril	Inhibace
enalapril	Vasotec
fosinopril	Monopril
lisinopril	Prinivil, Zestril
perindopril	Coversyl
quinapril	Accupril
ramipril	Altace
trandolapril	Mavik
Angiotensin Receptor Blockers (ARB)	
candesartan	Atacand
irbesartan	Avapro
losartan	Cozaar
telmisartan	Micardis
valsartan	Diovan
eprosartan	Teveten

Combination therapies

ACE-I plus diuretic (HCTZ)	
enalapril / HCTZ	Vaseretic
lisinopril / HCTZ	Prinzide
lisinopril / HCTZ	Zestoretic
quinapril / HCTZ	Accuretic
perindopril/indapamide	Preterax or Coversyl Plus
cilazapril/HCTZ	Inhibace Plus
eprosartan/HCTZ	Teveten Plus
ARB plus diuretic (HCTZ)	
candesartan / HCTZ	Atacand Plus
irbesartan / HCTZ	Avalide
telmesartan / HCTZ	Micardis Plus
valsarten / HCTZ	Diovan HCT
losartan / HCTZ	Hyzaar

Avalide

Diuretics

Loop (increases potassium excretion)	
bumetanide	Burinex
ethacrynic acid	Edecrin
furosemide	Lasix
Beta Blocker and Diuretic Combo (increases potassium excretion)	
pindolol/HCTZ	Viskazide
atenolol/ chlorthalidone	Tenoretic
Thiazide (mildly increases potassium excretion)	
chlorthalidone	Apo-Chlorthalidone, Hygroton, Novo-Thalidone, Uridon
hydrochlorothiazide (HCTZ)	Apo-Hydro, Hydrodiuril, Novo-Hydrazide
indapamide	Lozide
methyclothiazide	Duretic
metolazone**	Zaroxolyn
triamterene/HCTZ	Dyazide, Apo-Triazide
amiloride/HCTZ	Moduret
spironolactone/HCTZ	Aldactazide
Potassium sparing (decreases potassium excretion)	
amiloride	Midamor
spironolactone	Aldactone, Novospiroton
triamterene	Dyrenium

** Metolazone produces a greater and more rapid increase in potassium excretion than other thiazide diuretics.

Appendix 3 - Multicultural Fruit and Vegetables

East Indian Fruit and Vegetables

Lower Potassium Fruit	Higher Potassium Fruit	
Ambada*	Bamboo Fruit	Passion Fruit
Boysenberries	Coconut	Phalsa*
Casaba Melon	Dates	Pomegranate
Clementine (Mandarin Orange)	Dried Green Mango	Sapota
Jambu*	Figs	Seetaphal*
Loganberries	Green Plantain	Tamarind (Dried Amli*)
Loquat	Guava	Tamatillo*
Lychees	Jackfruit	Tangelo*
Passion Fruit	Korukkapalli (Amli*)	
Rose apple	Musk Melon	
Tangerine		
Woodapple		
Zizyphus		
Lower Potassium Vegetables	**Higher Potassium Vegetables**	
Bamboo Shoots	**To Limit:**	**To Avoid:**
Bottlegourd	Bittermelon, Bittergourd	Amaranth Tender
Cluster Beans	Chilies: green and red	Artichoke
Coriander Leaves	Marrow, Summer Squash	Beet Greens
Crookneck Squash*	Turnip	Bok Choy
Fenugreek	Zucchini	Colocasia Leaf
Kankoda		Cow pea pods
Mint		Drumsticks
Mustard leaves		Green mangoes
Pink Beans		Green banana
Ridge Gourd		Lotus Root
Snowpeas		Okra
Spaghetti Squash		Parsnips
Water Chestnuts, canned		Plantain
		Rasam Sambar*
		Taro Roots

***** Indicates the Indian name

West Indian Fruit and Vegetables

Lower Potassium Fruit	Higher Potassium Fruit		
Mammie apple	Ackee	Custard apple	Soursop
Passion fruit	Bread fruit	Guava	Sapodilla
Prickly pear	Carambala (Starfruit)	Jackfruit	Sapote
Tangerine	Coconut	Pawpaw (Papaya)	
Lower Potassium Vegetables	**Higher Potassium Vegetables**		
Bamboo Shoots, canned	Cassava	Okra (Ochara)	
Chocho (Chayote, Christophene)	Callaloo	Plantain	
Collards	Dasheen roots & leaves	Tamarind	
Mustard greens	Eddoe (Coca)	Yucca	
Sago	Green banana		
Watercress (crishes)			

Notes:

1) Whenever possible, peel, chop in small pieces and boil vegetables in a large quantity of water and drain before they are used in a curry.

2) Limit potato to a small amount as it is higher in potassium. Always pre-boil the potatoes.

Chinese Fruit and Vegetables

Lower Potassium Fruit		Higher Potassium Fruit
Chinese Dates (Jujube)	Lychee	Durian
Jackfruit, canned and drained	Mandarin orange	Guava
Kumquat	Mangosteen	Jackfruit, raw
Loquats	Pear (Asian)	Persimmon
		Plantain
		Pomegranate
Lower Potassium Vegetables		**Higher Potassium Vegetables**
Alfalfa sprouts	Jicama	Artichoke
Bamboo shoots, canned	Jew's Ear, soaked)	Beans: mung, yardlong
Bean sprouts	Judas Ear, soaked	Bok choy, cooked
Bitter melon	Mustard greens	Chinese broccoli (Gai lan)
Chayote	Suey Choy (Nappa)	Daikon radish
Coy Sum (Yao Choy)	Long qua (Squash)	Lotus root, cooked
Dandelion greens	Tung choy	Rutabaga
Hairy melon	Water chestnut,canned	Taro (Wu Tao)
	Watercress	