DIET AND PREVENTION STRATEGIES: KIDNEY INSUFFICENCY with DIABETES

Joan Warner, MS, RD, CDE

April 18, 2012

Thank you to:

- Riti Bhatnagar, MS, RD (works with renal transplant)
- Susan Ware, MS, RD, RPG(adult care renal dietitian)

Overview

- Review: statistics, symptoms, functions, causes
- Strategies to prevent renal insufficiency
- Glycemic Control with Renal Disease
- Diets and supplements with all stages of Renal Disease, including renal transplant

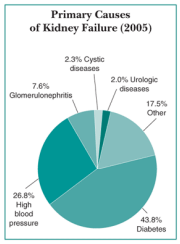
The Burden of Kidney Disease

- Diabetes is the most common cause of kidney failure, accounting for nearly 44 percent of new cases.
- African Americans, American Indians, and Hispanics/Latinos develop not only diabetes, but also CKD (chronic kidney disease), and kidney failure at higher rates than Caucasians.

CAUSES OF KIDNEY FAILURE

43.8% DIABETIC POPULATION

26.8% BLOOD PRESSURE

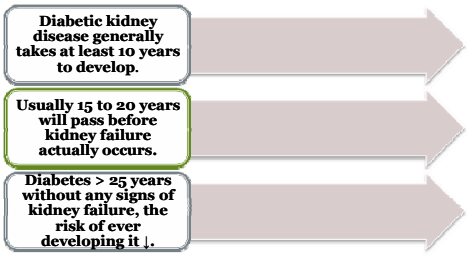


HEALTHY KIDNEYS

- Regulate the body's fluid levels
- Filter wastes and toxins from blood
- Releases a hormone that regulates blood pressure
- Activate vitamin D
- Releases a hormone that directs production of red blood cells
- Keeps blood minerals in balance

Signs of Kidney Disease

- Albumin/protein in the urine
- High blood pressure
- Ankle and leg swelling, leg cramps
- Going to the bathroom more often at night
- High levels of BUN and creatinine in blood
- Less need for insulin or antidiabetic medications
- Morning sickness, nausea and vomiting
- Weakness, paleness and anemia
- Itching



Course of Kidney Disease

Slowing & Preventing Kidney Disease

- **1. Using blood pressure medications if needed.**
- **2. Intensive management of blood glucose**: In the Diabetes Control and Complications Trial (NIDDK): decrease of progression of diabetic kidney disease.
- **3. Diet Modifications.**

Slowing & preventing Kidney Disease

- **4. Avoid too many pain medications**
- **5. Drink plenty of water**
- **6. Prevention urinary tract infections**

Correlated with Prevention Kidney Disease:

- **7. Healthy body weight**
- **8. Exercise** (30 min/day: improve diabetic control, BP control, and heart function,body weight).
- **9. Normal blood lipid levels**

Blood Pressure Control

- A **normal blood pressure**: ~ 120 mm Hg (systolic)/80 mm Hg (diastolic)
- A **high blood pressure**: > 140 mm Hg (systolic)/ > 90 mm Hg (diastolic).
- **Pre-hypertension:** 120-130 mm Hg (systolic)/80-89 mm Hg (diastolic).

Monitoring Glycemic Control

- HgA1C most accurate method to assess chronic glycemic control
- Usual Goal: 6-7%
- Renal insufficiency(stages 1-4) Goal: 6-7%

Determining IBW (ideal body weight)

- Women: IBW=100 lbs. for the first 60 in (152.4 cm) and 5 additional lbs. (2.27 kg) for every in (2.54 cm) after 60 in (152.4 cm)
- Men: IBW=106 lbs. for the first 60 in (152.4 cm) and 6 additional lbs. (2.72 kg) for every in (2.54 cm) after 60 in (152.4 cm)
- *Source: Ireton-Jones, C. Adjusted Body Weight: Why Adjust Body Weight in Energy-Expenditure Calculations? Nutr Clin Pract 2005; 20 (4):474-479.*

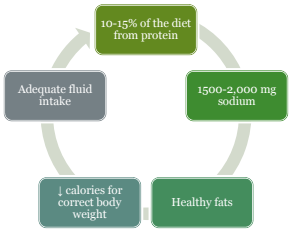
The Mifflin-St. Jeor Equation for Determining REE

- REE (males) = 10 x weight (kg) + 6.25 x height (cm) - 5 x age (y) + 5
- REE (females) = 10 x weight (kg) + 6.25 x height (cm) - 5 x age (y) – 161
- Sources: Dobratz J, Sibley S, Beckman T, Valentine B, Kellogg T, Ikramadden S, Earthman C. Predicting Energy Expenditure in Extremely Obese Women. *JPEN J Parenter Enteral Nutr* 2007;31(3):217-227.

Possible Calculations for Weight Loss:

1. If using REE, subtract the total estimated calorie needs by 500 kcal a day for slow and gradual one pound weight loss per week.
2. IBW x 25-30 kcal/kg
3. Desired weight x 10 x activity factor (1.2-1.75)
4. Activity factors: 1.25 sedentary, 1.50 moderate, 1.75 active.

Diet Prevention to Kidney Insufficiency:



Preventing Kidney Disease- Diet Strategies

- **Protein: 0.8-1.0 g/kg/day**
- **Fluid intake: 30 ml/kg/day (70 kg x 30ml=2100 ml)**
- **Blood glucose control (carbohydrate/fiber, up to 40 g/day)**
- **Sodium 1,500-2,000 mg/day**
- **Weight control and healthy fats**

HEALTHY FATS

Source: U.S. Department of Agriculture, Agricultural Research Service. 2010. USDA National Nutrient Database for Standard Reference, Release 21.

Omega 3 Fatty Acids (EAT MOSTLY)	Omega 6 Fatty Acids (EAT MODERATE)	Omega 9 Fatty Acids (EAT MODERATE)
Flax seeds, chia seeds, hemp seeds, walnuts	Sesame seeds, pumpkin seeds	Almonds, peanuts, cashews, pecans, pistachios, avocado
Flax, and fish oils	Corn, soy, mixed vegetable oils and soft margarine	Olive, canola, safflower, peanut oils

High-Fiber Preventing Kidney Disease Secondary to Weight/DB Control

High Fiber Foods	Amount	Grams of Fiber
All bran cereals	½ c	8-14
Lentils	½ c	7.8
Beans, pinto	½ c	7.7
Beans, black	½ c	7.5
Pear, fresh	1 medium	5.1
Raspberries	½ c	4
Moderate Fiber Foods		
Figs, medium	2	3.8
Nuts, almonds	1 oz.	3.5
Apple with skin	1 medium	3.3
Apricots, dried	10 halves	2.6
Cranberries	½ c	2.6
Broccoli	½ c	2.5
Lower Fiber Foods		
Rice, white	½ c	1-2
Bread, white	1 slice	1
Pancake	4 inch	1
Lettuce, leaf	¾ c	1
Cheese	1 oz.	0

Sodium Content of Common Foods

Source USDA National Nutrient Data Base for Standard References, Release 17.

Food	Amount	Sodium, mg
Broccoli	1 c cooked	20
Brussels sprouts	1 c cooked	23
Carrot	1 raw	49
Peanut butter	2 tsp.	50
Celery	1 cup raw	96
Cheddar cheese	1 oz.	176
Cottage cheese	½ c	470
Tomato juice	1 c	654
Tomato Soup	1 c	939

Prevention Diet Example

- 70 kg (.8-1 g protein/kg) = 56-70 g protein
- 30 kcal/kg (2100kcal)
- 68 g protein, ~13% calories from protein

68 g protein, 2100 kcal

Breakfast	Calories	Fat grams	Protein grams	Carbohydrate grams
Wheat Toast, 2 sl.	160	2	6	30
Apple slices (one large).	120	0	0	30
Peanut Butter, 2 TB.	90	10	8	2
Sugar-free Jam, 2 TB.	50	0	0	12

68 g protein, 2100kcal

Lunch	Calories	Fat grams	Protein grams	Carbohydrate grams
Corn Tortilla, 2 med.	236	4	5	45
Chicken 2 oz., or Black Beans, ½ c.	60-125	0	14	17
Salsa, 2 TB.	10	0	0	0-5
Spinach Greens, 2 c.	7	0	0	0-5
Olive/Salad Dressing, 3 TB.	234	26	0	0-5

68 g protein, 2100kcal

Dinner	Calories	Fat grams	Protein grams	Carbohydrate grams
Baked Tilapia, 2 oz.	80	2	14	0
Brown Rice, 2/3 c.	154	1	6	31
Steamed Broccoli-Carrots, 1 ½ cups.	40	0	4	10
Olive oil, 2 TB.	216	24	0	0

68 g protein, 2100kcal

Snacks	Calories	Fat grams	Protein grams	Carbohdyrate grams
Fresh Pear, lg.	120	0	0	30
Fresh Apple, lg.	120	0	0	30
Low carb. yogurt, 6 oz.	60	1.5	6	5
Whole-grain cereal 2/3 c.	220	5	5	32

KIDNEY INSUFFICIENCY

Glycemic Control w/Kidney Insufficiency

Key Points

- Blood glucose levels can fluctuate widely due to the effects of both ESRD and different types of dialysis.
- A1C goal for renal insufficiency stage 1-4: 6-7%
- A1C goal for renal insufficiency stage 5: 6-8%
- Hemoglobin A1C can be falsely high in ESRD, but it is still a reasonable measure

HgA1c accuracy can be affected by renal insufficiency due to:

1. elevated concentrations urea
2. iron deficiency
3. EPO (erythropoietin)
4. hemodialysis
5. peritoneal dialysis

Other reasons for inaccuracy not r/t kidney function:

6. recent transfusion
7. metabolic acidosis

Alternative tests for ESRD

- More accurate:
- 1) Beronate-agarose affinity chromatography
- 2) Thiobarbituric acid method

Key Points for ESRD Glycemic Control-Medications

- Diabetic drugs excreted by the kidney, so patients in ESRD are at greater risk of hypoglycemia
- Insulin is the cornerstone of treatment, since most oral diabetes drugs are contraindicated.
- If oral antidiabetic drugs are indicated: glipizide, sitagliptin, and saxagliptin are the ones that are considered more acceptable.

Key Points for glycemic control-Insulin

- Insulin doses are lowered in those with low glomerular filtration rates.

Guideline:

1. GFR between 10 and 50 mL/min, the total insulin dose should be reduced by 25%;

2. GFR below 10 mL/min, insulin dose should be decreased by 50%

Stages of Kidney Disease

- The National Kidney Foundation (NKF) has divided chronic kidney disease into five stages to create a guideline to identify and treat each level of kidney disease.
- The first four stages focus on ways to preserve kidney function for as long as possible, while the final stage—kidney failure—reviews treatment choices.

Stages of Kidney Disease

- **Stage 1** with normal or high GFR (GFR > 90 ml/min)- usually no symptoms, but > normal levels of creatinine or urea in the blood and/or blood or protein in the urine
- **Stage 2** Mild CKD (GFR = 60-89 ml/min) like above – no symptoms, but, >creatinine or urea and/or blood or protein in urine
- **Stage 3** Moderate CKD (GFR = 30-59 ml/min)- complications include elevated blood pressure, anemia, early bone disease, fluid retention etc.

Stages of Kidney Disease

- **Stage 4** Severe CKD (GFR = 15-29 ml/min), fatigue, sleep problems, fluid retention, dark colored urine, nausea, and/or loss of appetite. Preparing for dialysis, but not there yet.
- **Stage 5** End Stage CKD (GFR <15 ml/min), all symptoms above and more, and dialysis is needed.

Renal Insufficiency Diets

Acute Kidney Injury
Chronic Kidney Disease
Nephrotic Syndrome
Hemodialysis
Peritoneal Dialysis
Transplant

Diets Included in the first four stages of kidney disease:

- Acute Kidney Injury Diet
- Chronic Kidney Disease Diet
- Nephrotic Syndrome Diet

Acute Kidney Injury

Three major causes:

- **A drop in blood flow to the kidneys.** Heavy blood loss, an injury, or a bad infection reduces blood flow to the kidneys.
- **Damage from medicines, poisons, or infections.**
- **Blockage that stops urine from flowing out of the kidneys.** Kidney stones, a tumor, an injury, or an enlarged prostate gland.

Diet Acute Kidney

- **Protein g/kg: 0.6-0.8 (≥50% HBV)**
- **Energy kcal/kg: 35-50 kcal, based on stress and nutrition status (prevent wt.loss)**
- **Na+ g/day: 1-2 g/day, based on BP, edema, replacement need of losses**
- **K+ g/day: Maintain serum K < 5. Replace losses in diuretic phase - so usually no restriction (>4 g)**

Phosphorus mg/day	**WNL**
Calcium g/day	**WNL**
Fluid	**Output Plus 500cc**
Vit./Mineral	**renal**

Minerals/Fluid

- **ACUTE KIDNEY**

Fluid Restriction often

Chronic Kidney Disease (CKD)

- Defined as GFR ≤ 60 ml/min. for ≥ 3 months.
- Factors that affect kidney function in addition to blood glucose control, diet, medication damage etc., also include age, and possibly heart disease.
- For those with CKD heart disease-major cause of death.

Diet for CKD

- Protein g/kg: 0.6-0.75 g/kg ≥ 50% HBV
- Energy kcal/kg: 25-35
- Na+ g/day: Varies from 1-2 g+/day
- K+ g/day: Usually unrestricted unless serum level is high

Chronic Kidney Disease

Avoid licorice for blood pressure control (mostly black, but if the red contains licorice root extract, avoid that too)

Chronic Kidney Disease

Phosphorous mg/day	800-1,000
Calcium g/day	DRI +
Fluid	Usually unlimited
Vit./Minerals	Renal

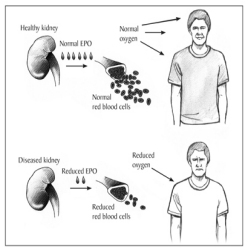
- Minerals and fluid

Vitamins for Renal Insufficiency

- Nephro-vite and Renaplex Contain: Vit.C 60-100mg, B6 2 mg, folate 1.-5 mg, B12 3 ug, vit. E 15, zinc 15 mg
- Hectoral and Zemplar the metabolically active forms of vitamin D- for prevention and treatment of secondary hyperparathyroidism associated with chronic kidney disease(CKD)

Medications for Red Blood Cells Production

- **Epogen for pre-dialysis**
- **Arenesp for dialysis**
- ***Work by stimulate RBC – bone marrow***
- **If Hbg ≥ 11 can't have unless paying out of pocket**
- **Kidneys: erythropoietin, a protein that stimulates the production of red blood cells**



Phosphate Binders

- Alu-Cap: aluminum hydroxide
- Renvela: sevelamer carbonate (omit if SBO p.)
- Tums: Calcium carbonate
- Fosrenal: lanthanum carbonate
- Phoslo: Calcium acetate
- Citrical: Calcium citrate

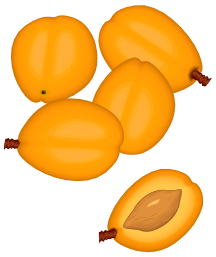
Nephrotic Syndrome

- **Nephrotic syndrome** is a group of symptoms that include protein in the urine, low blood protein levels, high cholesterol levels, high triglyceride levels, and fluid retention.
- **Many possible causes**: cancer, genetic disorders like polycystic kidney disease, auto-immune disorders like systemic lupus, poorly controlled diabetes, infections, some medications.

Nephrotic Syndrome

Protein g/kg	**0.8-1.0**
Energy Kcal/kg	**25-35 <30% fat and Healthy Fats**
Na+ g/day	**1-2 g**
K+ g/day	**Usually no restriction**

- High potassium: apricots



Nephrotic Syndrome

Phos. Mg./day	**WNL**
Calcium	**WNL**
Fluid	**Maintain balance**
Vit./Minerals	**Renal**

Lower fat

SUMMARY
Stage 1-4 Diets: AKI, CKD, Nephrotic Syndrome

- 60-70% carbohydrate w/recommendation of up to 40 g fiber/day
- Maintain normal BMI
- Protein between .6 to .8 g/kg (AKI, CKD)
- Protein between .8-1 g/kg (Nephrotic Syndrome)
- <30% fat (<10% saturated fat)

Stage 5 Kidney Treatments

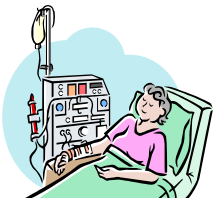
Hemodialysis

- Most common type of dialysis
- Blood goes through filter that removes wastes and extra fluids.
- Patient needs fistula for blood access to the filtration dialysis unit

Hemodialysis

Protein g/kg	≥1.2 ≥50% HBV
Energy kcal/kg	30-35 if>60 years 35 if<60 years
Na+ g/day	<2 g
K+ g/day	2-3 g adjust to serum levels

- Adjust per patient's labs



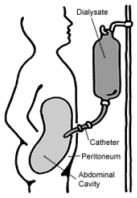
Hemodialysis

Phosphorus mg/day	800-1,000
Calcium g/day	<2 w/binder
Fluid	Output + 1,000 cc
Vit./Min.	Rec. Brands

- Monitor mineral serum levels

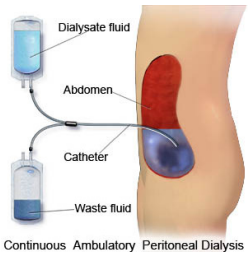
Peritoneal Dialysis

- Uses a membrane inside the peritoneal cavity as a filter to clear wastes and extra fluid.
- 3 Phases: Fill, Dwell, Drain
- CAPD: continuous ambulatory dialysis
- CCPD: continuous cycling peritoneal dialysis



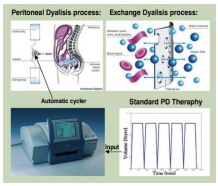
CAPD (continuous ambulatory dialysis)

- Dialysate solution stays in peritoneal cavity for 4-6 hours, drained, then refilled with fresh solution. Usually exchange solutions 4 x day.
- Most commonly used.



CCPD (continuous cycling peritoneal dialysis)

- A pump machine fills and drains the dialysate from peritoneal cavity. Process takes 10-12 hours.



Peritoneal Dialysis

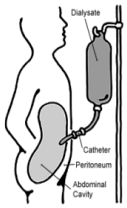
- **RISKS:**
- INFECTION around the catheter site or of the lining of the abdominal wall
- **NOT RECOMMENDED:**
- In people with scarring or leaks of lining of wall in the abdominal wall, or if there is active inflammatory bowel disease.

- **BENEFITS**
- Fewer dietary or fluid restrictions, absence of sticks, independence to normalize daily routines, decreased dependence on blood pressure meds

Peritoneal Dialysis

Protein g/kg	≥1.2-1.5 ≥50% HBV
Energy kcal/kg	30 if>60 years 30-35 if<60 years
Na+ g/day	2
K+ g/day	3-4

Consider decreased appetite in many renal patients



Peritoneal Dialysis

Phos. mg/d	800-1000 mg
Calcium g/d	<2.0 g w/binder
Fluid	Maintain Balance
Vit./Min.	Same as HD w/ add B1 due to loss

Dialysate Solutions

- 1.5%: 15 X 3.4 kcal X L X .60 CAPD or .40 CCPD
- 2.5%: 25 X 3.4 kcal X L X .60 CAPD or .40 CCPD
- 4.25%: 42.5 X 3.4 kcal X L X .60 CAPD or .40 CCPD

- To determine calories and carbohydrate grams

Peritoneal Dialysis

- If excess fluid, need higher concentrations
- Can increase blood glucose
- Sometimes higher dextrose can decrease appetite

- CAPD Example of a 4.25% solution: 42.5 x 3.4 kcal x 4 x .60 (CAPD) = 347 kcal (102 g carbohydrate)

- CCPD Example of a 4.25% solution: 42.5 x 3.4 kcal
- x 4 x .40 (CCPD) = 231 kcal (68 g carbohdyrate)

Decrease carbohydrate as needed:

- ~60-40% diet carbohdyrate
- <30% fat (<10% saturated fat)
- Fiber individual

Monitoring with Peritoneal dialysis

- Monitoring glucose also important in non-diabetics
  - → up to 19% can develop diabetes

Survival after 3 years of peritoneal dialysis is inversely correlated with poor glycemic control

Transplant Diet

- Less restrictions than the ESRD diets
- Better appetite after transplant-often unwanted weight.
- In addition, certain anti-rejection medications may cause increased appetite, weight gain, elevated blood glucose levels, decrease muscle mass and some minerals, and increase fluid retention.

Typical anti-rejection medications

- Prednisone (steroid)
- Imuran (azathioprine)
- Prograf (tacrolimus)
- CellCept (mycophenolate)
- Gengraf (cyclosporine)

- **Side effects can include: fluid retention, protein loss, calcium and magnesium loss, elevated blood glucose and weight gain**

Transplant Diet

- Low fat or non-fat diary products.
- Lean cuts of meat, poultry no skin, and fish cooked without adding fat.
- Increase fiber, carbohydrate, and decreased processed foods to help reduce total calories, sodium, and prevent diabetes.
- Grapefruit & pomegranate cause cyclosporine blood levels to increase, so consuming grapefruit is also not recommended.

Suppressed Immune System

- **Avoid**:
  - Raw or undercooked meat, poultry, eggs, fish, and shellfish
  - Unpasteurized milk and chilled fruit juices
  - Raw sprouts (like alfalfa)
  - Soft cheeses made with raw milk
  - Hot dogs and luncheon meats that have not been reheated to steaming hot
  - Refrigerated pates and meat spreads
  - Refrigerated smoked fish and pre-cooked seafood, such as shrimp and crab
- Remember to wash hands

References-Glycemic Control

- 1.National Institute of Diabetes and Digestive and Kidney Diseases: United States Renal Data System: USRDS 2005 Annual Data Report. *Bethesda, MD: National Institutes of Health, 2005.*
- 2.Wu MS, Yu CC, Yang CW, et al *Poor pre-dialysis glycemic control is a predictor of mortality in type II diabetic patients on maintenance hemodialysis. Nephrol Dial Transplant 1997; 12:2105–2110.*
- 3.Morioka T, Emoto M, Tabata T, et al. *Glycemic control is a predictor of survival for diabetic patients on hemodialysis. Diabetes Care 2001; 24:909–913.*
- 4.McMurray SD, Johnson G, Davis S, McDougall K. *Diabetes education and care management significantly improve patient outcomes in the dialysis unit. Am J Kidney Dis 2002; 40:566–575.*
- 5.Oomichi T, Emoto M, Tabata T, et al. *Impact of glycemic control on survival of diabetic patients on chronic regular hemodialysis: a 7-year observational study. Diabetes Care 2006; 29:1496–1500.*

References cont.

- 6.Williams ME, Lacson E, Jr, Teng M, Ofsthun N, Lazarus JM. *Hemodialyzed type I and type II diabetic patients in the US: characteristics, glycemic control, and survival. Kidney Int 2006; 70:1503–1509.*
- 7.Tzamaloukas AH, Yuan ZY, Murata GH, Avasthi PS, Oreopoulos DG. *Clinical associations of glycemic control in diabetics on CAPD. Adv Perit Dial 1993; 9:291–294.*
- 8.Tzamaloukas AH, Murata GH, Zager PG,Eisenberg B, Avasthi PS. *The relationship between glycemic control and morbidity and mortality for diabetics on dialysis. ASAIO J 1993; 39:880–885.*
- 9.Kalantar-Zadeh K, Kopple JD, Regidor DL, et al.
- *A1C and survival in maintenance hemodialysis patients. Diabetes Care 2007; 30:1049–1055.*
- 10.Kovesdy C, Sharma K,Kalantar-Zadeh. *Glycemic control in diabetic CKD patients: where do we stand? Am J Kidney Dis 2008; 52:766–777.*

References- Renal Diets

- 11. Kopple JD, Massry SG, eds. Nutritional Management of Renal Disease. Philadephia: Lippincott Williams & Wilkins; 2004.
- 12. NKF K/DOQI Clinical Practice Guidelines for Nutrition in Chronic Renal Failure. Am J Kidney Dis. 2000;35:6(suppl 2):S1-S140.
- 13. Camel SP. Nutrition management of the adult renal transplant patient. In Stover J. *A Clinical Guide to Nutrition Care in End Stage Renal Dis*ease. 2nd ed. Vol 2. Chicago: American Dietetic Association, 1994: 57-67.
- 14.McCann L., et al. *Guide to Nutrition Assessment of the Patient with Chronic Kidney Disease*, 4th Edition, National Kidney Foundation, Inc. Satellite Healthcare, Inc., Mountain View, CA, 2009.
- 15. Mitch WE, Klahr S. *Handbook of Nutrition and the Kidney* 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2005.