# Nutrition & Chronic Kidney Disease (CKD)

## Renal Pharmacists Network

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## Objectives

Overview of renal nutrition

Practical implications for patient food choices

Medication implications

## The Renal Diet



## The Renal Diet

- No standard renal diet ( generic term)
- Must be individualized and orders are modified by the Renal Dietitian to meet patient needs .
- Considerations:
  - Residual kidney function
  - Lab data
  - Current nutritional status
  - Treatment modality
  - Social/economic factors

## Nutrition Guidelines for Chronic Kidney Disease*

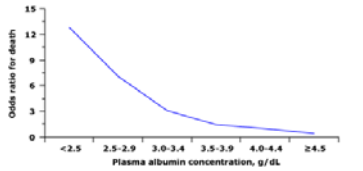
* K/DOQI 2000, EBPG 2007

| | CKD Stages 1-4 | Hemodialysis (conventional) | Peritoneal Dialysis | Hemodialysis (nocturnal) |
|---|---|---|---|---|
| Pro (g/kg) | 0.8 - up to 1.0 | 1.2 | 1.2-1.3 | 1.3-1.5 |
| Na (mg) | 2300 | 2300 | 2300 | 2300 |
| K (mg) | Per labs | 2300-3000 | Per labs | Per labs |
| PO4(mg) | < 1100 | < 1200 | < 1200 | Per labs |
| Fluid | No Restriction | 1L + u/o | Usually no restriction | No restriction |

## Malnutrition in Chronic Kidney Disease

- 23- 76% incidence in HD and 18-50% in PD
- Malnutrition is a strong predictor of morbidity and mortality in kidney disease
- Albumin <40 g/L is the single lab most closely associated with increased probability of death in dialysis patients

Risk of mortality among hemodialysis patients according to serum albumin during maintenance dialysis




Odds ratio for death, adjusted for age, sex, race, and underlying disease, according to the plasma albumin concentration in patients on maintenance hemodialysis. The likelihood of dying was inversely related to the plasma albumin concentration, being greatest at a plasma albumin concentration below 3.0 g/dL (30 g/L). All values are significantly different ($p<0.001$ to 0.03) from the odds ratio of 1.0 at a normal plasma albumin concentration of 4.0 to 4.4 g/dL (40 to 44 g/L).

*Data from Owen, WF Jr, Lew, NL, Liu, Y, et al, N Engl J Med 1993; 329:1001.*

UpToDate

## Protein Energy Wasting (PEW)

- The ISRNM has defined PEW in CKD as a state of decreased body stores of protein and energy fuels (body mass and fat mass)
- Causes are multi-factorial and include nutritional and non-nutritional mechanisms

## PEW -Nutritional Cause

- **Inadequate food intake**
  - Anorexia due to uremia
  - Altered taste sensation
  - Dietary restrictions
  - Inter-current illness and hospitalization
  - Impaired ability to procure, prepare or ingest food

## PEW -Potential Non-nutritional Causes

- **Dialysis Procedure**
  - Removal of nutrients by dialysis
  - Promotion of catabolic state due to inflammatory stimuli (dialysis membrane)
- **Chronic Inflammation**
- **Anemia**
- **Acidosis**
- **Endocrine Disorders, decreased insulin, Vit D deficiency, increased PTH**
- **Volume overload**
- **Co-morbid Conditions:** DM, cardiovascular disease, infection, aging

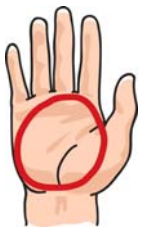
## Protein in CKD

- CKD STAGES 1-4 ↓
  - -decrease uremia
  - -improve acidosis
  - -possibly delay progression
- DIALYSIS ↑
  - -replace losses during dialysis
  - -increased metabolic requirement

## What Kind of Protein?

- Fish, Poultry, Meat, Eggs -> Yes
  - -moderate potassium and phosphorus
- Dairy Products -> LIMIT
  - -high potassium and phosphorus
- Legumes/lentils/nuts/seeds-> Caution
  - -high potassium and phosphorus

## How Much Protein?



## Improving the Nutritional Status of CKD Patients

- Liberalize the diet
  - Accommodate food preferences
  - Involve family and friends
- Supplements
  - Nepro Carb Steady, Ensure Plus, Glucerna
  - Protein Powder
  - IDPN (Intra-Dialytic Parenteral Nutrition)
  - Multivitamins and minerals
  - Zinc for dysguesia
  - Appetite stimulants
- Meal delivery programs
- Home making services

## Nutritional Supplements BCRA

| | |
|---|---|
| Nepro Carb Steady | Kidney friendly and diabetic friendly<br>(lower phosphorus, potassium, sodium, fluid concentrated 2 kcal/ml)<br>Vanilla |
| Ensure Plus | Not kidney friendly<br>(high potassium, high phosphorus)<br>3 flavors |
| Glucerna | Diabetic friendly, not kidney friendly<br>(high potassium, high phosphorus)<br>3 flavors |
| Beneprotein | Instant protein powder (one scoop = 6g protein)<br>(low phosphorus, potassium and sodium) |
| | |

## Phosphate Management

- Diet
  - Limit foods high in phosphorus but not at the expense of protein
- Medication to inhibit GI absorption
  - Take binders as prescribed with meals and high phosphorus snacks
- Dialysis
  - Removal by conventional dialysis- limited
  - Removal by Nocturnal hemodialysis- very efficient

## Types of Dietary Phosphorus

- **Organic phosphorus**
  - **Animal proteins** -organic phosphates intracellular, easily hydrolyzed, 40-60% absorbed
  - **Plant proteins** -mostly in storage form of phytic acid or phytate, humans lack phytase degrading enzyme, 20-40% absorbed
- **Inorganic phosphorus**
  - **Food additives** -salt forms, readily hydrolyzed, 90-100% absorbed

## Foods Naturally High in Phosphorus



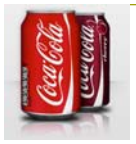

## How many high phosphorus foods?

- 1-2 servings a day:
  - ½ cup milk, yogurt
  - 1 inch cube cheese
  - 2 Tbsp peanut butter
  - 1/3 cup cooked dried beans, peas, lentils
  - 1 ounce nuts

## Phosphorus Additives…a growing trend

- Added to foods during processing
  - As stabilizers, protectants, leavening agents, color and flavor enhancers, tenderizers etc.
  - Estimate 10-30% of dietary phosphate comes from additives
  - It's everywhere

## Hidden Sources







## More hidden sources of phosphorus






## Will not be listed on the Nutrition Facts table

**Nutrition Facts**

Serving Size 172 g

| Amount Per Serving | |
|---|---|
| Calories 200 | Calories from Fat 8 |
| | % Daily Value* |
| Total Fat 1g | 1% |
| Saturated Fat 0g | 1% |
| Trans Fat | |
| Cholesterol 0mg | 0% |
| Sodium 7mg | 0% |
| Total Carbohydrate 36g | 12% |
| Dietary Fiber 11g | 45% |
| Sugars 6g | |
| Protein 13g | |
| Vitamin A 1% • Vitamin C 1% | |
| Calcium 4% • Iron 24% | |

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

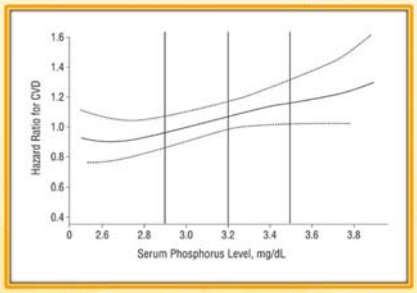
NutritionData.com

## Label Reading

Look for the PHOSPH

- Phosphoric acid
- Monocalcium phosphate
- Sodium acid pyrophosphate
- Sodium aluminum phosphate
- Sodium tripolyphosphate
- Tetrasodium pyrophosphate

## Phosphorus in the Healthy Population




- Serum phosphorus levels were shown to have a continuous association with increasing risk for morbidity and mortality within the reference range.

Dhingra R. *Arch Intern Med.* 2007;167:879-85.

## The Reality of Phosphate Management

- Unfamiliar territory for patients
- Patient's don't always understand where the phosphorus is or why and how to take binders, forget to take binders
- Binders prescribed in fixed doses E.g. Calcium carbonate 500 mg TID
- Many day to day and meal to meal variations
- GI complaints
- Phosphorus is everywhere

## Sodium

- IOM Adequate Intake (AI) is **1500 mg**/day - recommended average daily intake for 9- 50 years old
- IOM Tolerable upper limit (TOL) is **2300 mg**/day –highest limit without risk
- Mean intake for Canadians is **3400 mg**/day
- IOM recommends limiting to lower levels for HTN, DM, CKD, >50 years old, African Americans (in Canada also South Asians)
- Preference for salt is lost/diminished after approx. 1-3 months of restriction.

## Why advising patients to remove the salt shaker is not enough …


## High Sodium Processed Foods





## What happens to sodium when a food is processed?

| | | |
|---|---|---|
| **Cucumber** 7 slices **2 mg** | **Cucumber** with salad dressing **234 mg** | **Dill pickle** 1 medium **928 mg** |
| **Pork** 3 oz **59 mg** | **Bacon** 4 slices **548 mg** | **Ham** 3 oz **1,114 mg** |
| **Tomato** 1 small **14 mg** | **Tomato soup** 1 cup **860 mg** | **Tomato sauce** ¾ cup **1,124 mg** |

## Top 10 Sodium Carriers* % daily intake

*Centers for Disease Control and Prevention USA

| | | |
|---|---|---|
| 1. | Breads and Rolls | 7.4 |
| 2. | Cold cuts/cured meats | 5.1 |
| 3. | Pizza | 4.9 |
| 4. | Poultry | 4.5 |
| 5. | Soups | 4.3 |
| 6. | Sandwiches | 4.0 |
| 7. | Cheese | 3.8 |
| 8. | Pasta and mixed dishes | 3.3 |
| 9. | Meat mixed dishes | 3.2 |
| 10. | Savory snacks | 3.1 |

## How do I Eat Less Sodium?

**Fresh is best!**

## Alternatives to Salt

Seasoning Blends


Low Sodium Snack Foods

## Lower-Sodium Foods

Fresh Foods


Low-Sodium Broths

## Fluid Guidelines

**Hemodialysis:**

- Rule of thumb …**1 liter plus an amount equal to urine** output ( consider less with edema)
- Includes any liquid at room temperature
  - Water, ice, coffee, tea, milk, juice, Jell-O, Nepro, soup etc.
- Do not count the fluid in solid food
- Acceptable IDWG = 3-4 % of target weight

## Fluid Guidelines

**Hemodialysis:**

- **Tips for thirst:**
  - Limit sodium
  - Control blood glucose, if diabetes
  - Freshen mouth with lemon, lime, sour candies, mints, artificial saliva
  - Freeze allowed fruit (E.g. grapes, strawberries)
  - Ice, but count as fluid
  - Check for medications contributing to thirst (E.g. anti-cholinergic side effects of Nortriptyline)

## Potassium Management

Diet
- Limit/liberalize as appropriate

Dialysis
- Hemodialysis monitor serum potassium to assess K bath

Medication
- K supplements or cation exchange resins

## Some High Potassium Foods

| Fruit | Vegetables | Other |
|---|---|---|
| Avocado | Potato | Co-Salt/Nu Salt |
| Banana | Sweet potato | Dairy |
| Orange | Tomato | Nuts and seeds |
| Dried Fruit | Tomato products | Legumes, dried beans |
| Papaya | Squash | Mince meat |
| Nectarine | Spinach | Ovaltine |
| Cantelope | Beets | Potato Chips |
| Kiwi | Taro | Chocolate |
| Honeydew melon | Kale | Granola |
| Prune Juice | Brussel Sprouts | |

## Potassium

- Large amounts of a low potassium choice can result in a high K intake
- Form of food ( fresh vs. dried or boiled vs. baked) will change K content

## How much on restricted potassium?

- 2-3 servings* low/moderate potassium fruits
- 2-3 servings* low/moderate potassium vegetables

*Serving = $\frac{1}{2}$ cup

- No KCl salt substitutes (E.g. Co-salt/Nusalt)
- Limit other high potassium foods

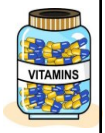
## Potassium

- Hemodialysis acceptable potassium level is 3.5 – 5.5 mmol/L
- Many non food related causes of high K
  - Dialysis bath
  - Adequacy of dialysis
  - Decreased urine output
  - Catabolism
  - Medications
  - Metabolic acidosis
  - Constipation

## What is this fruit? Why should patients with kidney disease avoid it?

## Vitamin & Mineral Supplements

- Need to replace loss of water soluble vitamins during dialysis
- Restricted diets limit intake
- Fat soluble vitamins not recommended, avoid high Vitamin C
- **Renavite** (Vitamins B + C + folate) renal specific vitamin
- May use multivitamin and mineral supplementation for severe malnutrition




## Why is Dietary Compliance Soooo Challenging ?

- Diet is for life
- Culture of eating out/convenience/fast food
- Patients get advice from many sources regarding diet restrictions; contradictory messages
- Multiple co-morbidities requiring diet restrictions-diabetes, healthy heart
- Knowledge deficits

## What would be the most challenging part of the diet for you?