NUTRITION FOR KIDNEY HEALTH

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Objectives

As a result of completing this training, you should be able to:

- ❑ Identify nutrition-related factors associated with changes in Chronic Kidney Disease risk.
- ❑ Describe the focal points of Medical Nutrition Therapy for Chronic Kidney Disease (CKD) and End Stage Renal Disease (ESRD).
- ❑ Educate patients with various nutrition-related tools for the management of kidney disease and complications.

Topics we will review today:

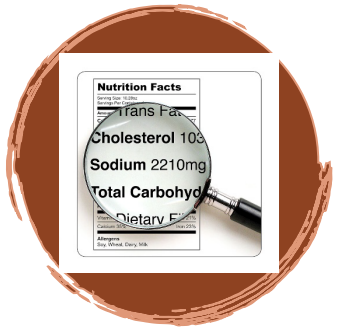
- ➢ Kidney Health
- ➢ Chronic Kidney Disease
- ➢ End Stage Renal Disease

Kidney Health

Eating Well for Kidney Health

Water instead of sugar-sweetened beverages

Plant-Based Diet low in red and processed meats



Lower Sodium Intake

No Smoking

Healthy Weight Status and Physical Activity

Diabetes and Hypertension Control

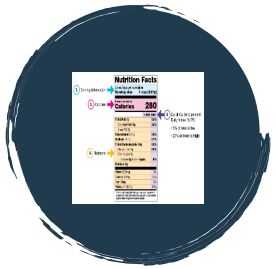
- Dietary risk factors
- Lifestyle risk factors
- Dietary protective factors
- Lifestyle protective factors

Plant-based Diet

- What is it?
- Patterns
- Benefits
- Foods and nutrients
- How to get started

Chronic Kidney Disease

Chronic Kidney Disease
Focal Points



Calories

Protein

Sodium

Potassium

Phosphorus

Supplements

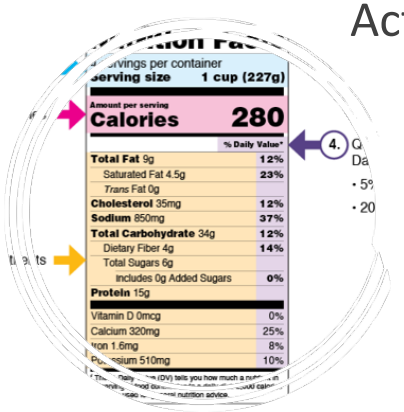
New KDOQI (2020) guidelines on **dietary patterns** and **food groups**:

- "In adults with CKD 1-5 not on dialysis or post transplantation, with or without dyslipidemia, we suggest that prescribing a **Mediterranean Diet may improve lipid profiles** (2C)."
- "In adults with CKD 1-4, we suggest that prescribing **increased fruit and vegetable intake may decrease body weight, blood pressure, and net acid production** (NEAP) (2C)."
- "In adults with CKD 1-4, we suggest **reducing net acid production** (NEAP) through **increased dietary intake of fruits and vegetables** (2C) in order to reduce the rate of decline of residual kidney function."

Chronic Kidney Disease
Calories

Considerations:

- Guideline: **25-35 kcal/kg** for CKD 1-5D (KDOQI 2020)
  - Affected by: age, sex, level of physical activity, body composition, weight status goals, CKD stage, and concurrent illness or presence of inflammation.
- Current weight status – miscalculations with under/overweight
- Nutritional Assessment
  - Dietary intake: Appetite, Quality of calories, Satiety, Taste alterations.
  - Body composition, body weight changes, anthropometric measurements, nutrition-focused physical findings, biochemical data.
  - Other factors to assess for CKD 3-5D or post transplantation: medication use, knowledge, beliefs, attitudes, behavior, access to food, depression, cognitive function (O).



Actual/adjusted/standard/ideal weight ?

↓

Use your clinical judgment

- Obesity management in CKD → Individualized

- Methods of dietary intake assessment:
  - 3-day food record is preferred for CKD 3-5D (2C)
  - Alternatives: 24-hour food recalls, food frequency questionnaires, nPCR for CKD 3-5 (O) or CKD 5D (2D).

Chronic Kidney Disease
Protein

Considerations:

- Guideline for adults with CKD 3-5 who are metabolically stable (KDOQI 2020):
  - 0.55-0.6 g/kg OR
  - 0.28-0.43 g/kg + keto acid analogs
  - with diabetes: 0.6-0.8 g/kg → for better glycemic control
- Sources/Type: Animal vs Plant
  - "In adults with CKD 1-5D (1B) and post-transplant (OPINION), there is insufficient evidence to make conclusions about the effects of protein type (plant vs animal) on nutritional status, calcium or phosphorus levels, or the blood lipid profile."

- Keto acid analogs: Nitrogen-free precursors of amino acids.
  - Determinants:
    - Cost
    - Availability
    - Patient preference
    - Clinician judgment

- Protein restriction → Caloric restriction
- Protein-energy wasting → Supplementation

Protein – Patient Education

Protein

Tips for People with Chronic Kidney Disease (CKD)

What Is Protein?

Protein is in many foods that you eat. Protein can be found in foods from animals and from plants. Most diets include both types of protein. Protein provides the building blocks that help maintain and repair muscles, organs, and other parts of the body.

Animal-protein Foods

- Meat, such as pork, beef, chicken, turkey, duck
- Eggs
- Dairy products, such as milk, yogurt, cheese
- Fish

Plant-protein Foods

High Protein

- Beans, peas, lentils
- Soy foods, such as soy milk, tofu
- Nuts and nut spreads, such as almond butter, peanut butter, soy nut butter
- Sunflower seeds

Low Protein

- Bread, tortillas
- Oatmeal, grits, cereals
- Pasta, noodles, rice
- Rice milk (not enriched)

Why Is Protein Important for People with CKD?

When your body uses protein, it produces waste. This waste is removed by the kidneys. Too much protein can make the kidneys work harder, so people with CKD may need to eat less protein.

Animal protein includes all of the building blocks that your body needs. Plant proteins need to be combined to get all of the building blocks that your body needs.

How Do I Eat the Right Amount of Protein?

Your dietitian will tell you what amount and types of protein are right for you. Here is some general information about protein types and serving sizes:

- Eat smaller portions of meat and dairy. This will also help you lower the amount of phosphorus in your diet, because phosphorus is found in meat and dairy foods.
  - **Meat, poultry, and fish:** A cooked portion should be about 2 to 3 ounces or about the size of a deck of cards.
  - **Dairy foods:** A portion is ½ cup of milk or yogurt, or one slice of cheese.

- Plant proteins should make up the rest of the protein that you eat. A serving is:
  - ½ cup of cooked beans
  - ¼ cup of nuts
  - a slice of bread
  - ½ cup of cooked rice or noodles

What if I Am a Vegetarian?

There are many good sources of protein for people who do not eat meat or dairy foods. Talk to your dietitian about how to combine plant proteins to be sure you are getting all of the building blocks your body needs.

Notes:_____

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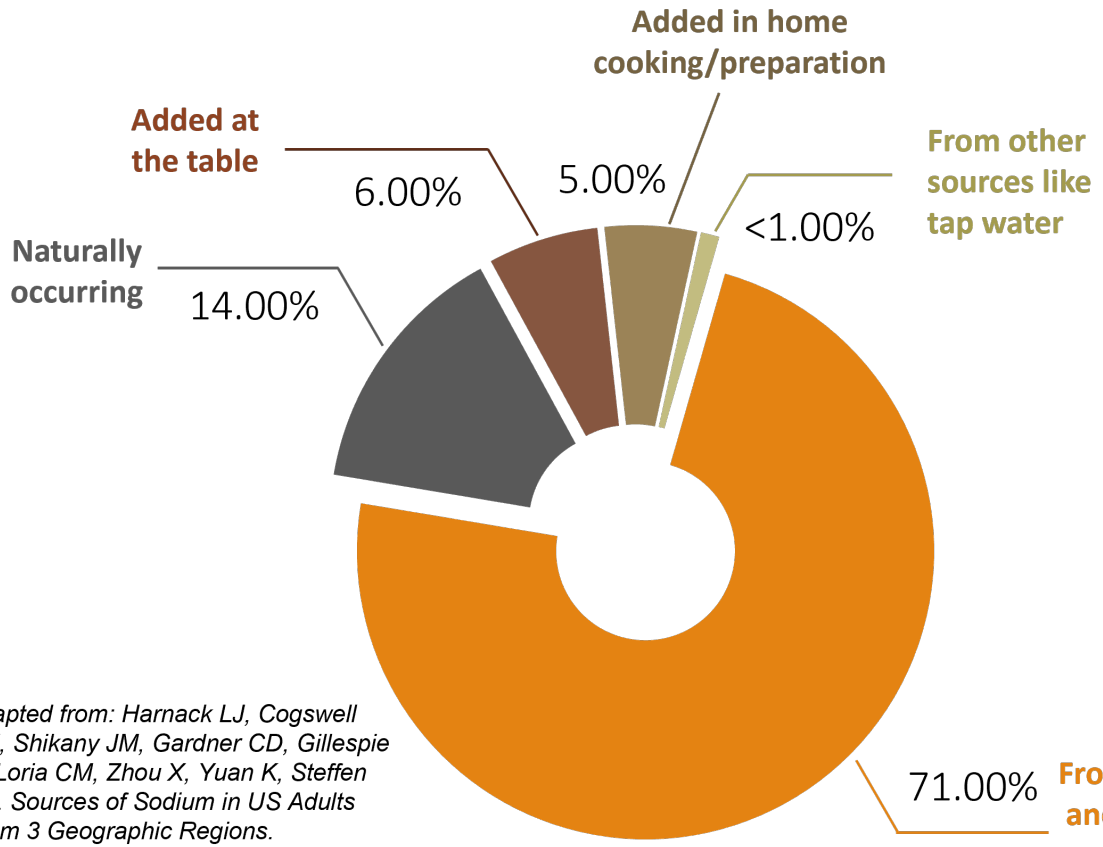
NIH National Institute of Diabetes and Digestive and Kidney Diseases

Chronic Kidney Disease
Sodium

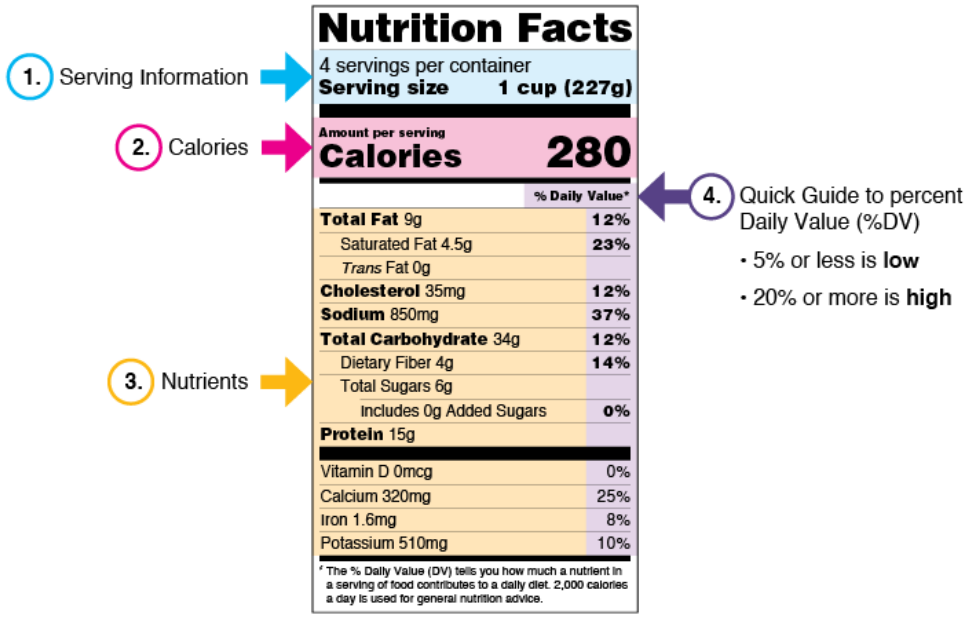
Considerations:

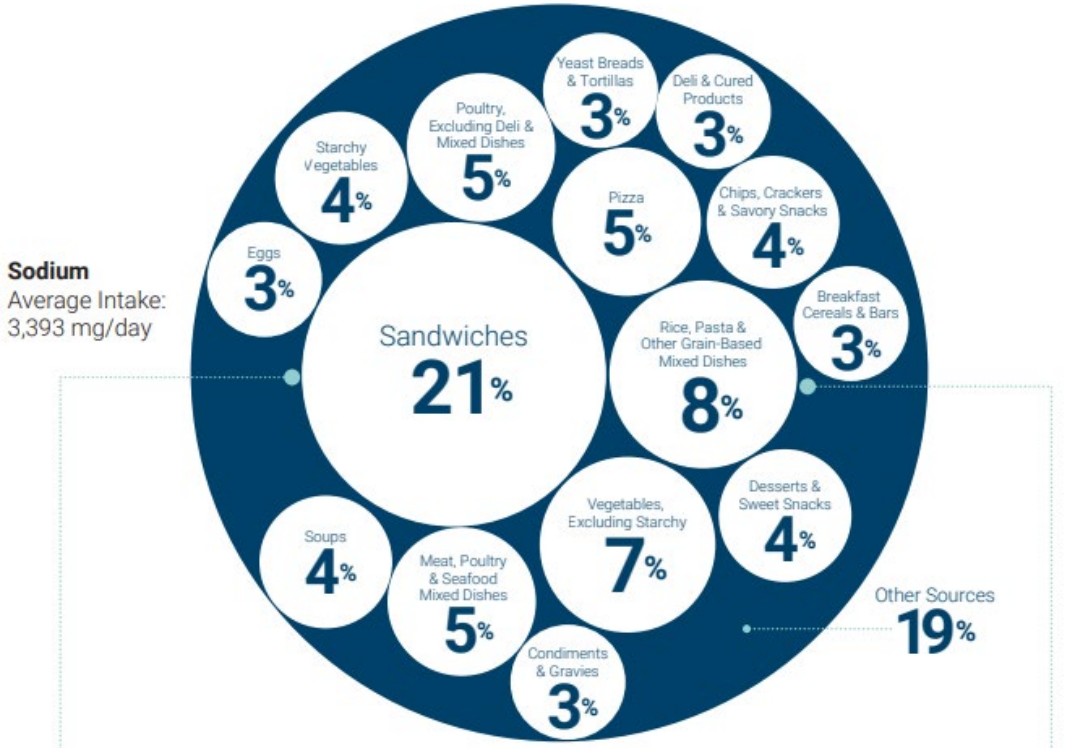
- Average intake for Americans: 3393 mg/d
- Guideline: <2300 mg/d (KDOQI 2020)
- Examples of significance in CKD: volume control, BP management, effectiveness of RAAS blockers, thirst management, proteinuria and albuminuria decreases
- Sources
- Teaching tools

Chronic Kidney Disease
Sodium



Adapted from: Harnack LJ, Cogswell ME, Shikany JM, Gardner CD, Gillespie C, Loria CM, Zhou X, Yuan K, Steffen LM. Sources of Sodium in US Adults From 3 Geographic Regions. Circulation. 2017 May 9;135(19):1775-1783.





Sodium – Patient Education

Sodium

Tips for People with Chronic Kidney Disease (CKD)

What Is Sodium?

Sodium is a part of salt. Sodium is found in many canned, packaged, and "fast" foods. It is also found in many condiments, seasonings, and meats.

Why Is Sodium Important for People with CKD?

Eating less sodium helps lower blood pressure and may slow down CKD. Talk with your provider about the right blood pressure goal for you.

One of the kidneys' important jobs is to filter sodium out of the body and into the urine. Damaged kidneys cannot filter as well as healthy kidneys can. This can cause sodium to stay in your body and make your blood pressure go up.

How Much Sodium Should I Eat Every Day?

Most people need to eat less sodium than they are eating. Aim for less than **1,500 milligrams** of sodium each day. Much of the sodium you eat does not come from a salt shaker. Sodium is added to the prepared foods you buy at the supermarket or at restaurants.

Foods *Lower* in Sodium

- Fresh or frozen fruits and vegetables
- Rice, noodles
- Cooked cereal without added salt
- Fresh meat, poultry, seafood
- Low-fat, low-sodium cheese
- Unsalted nuts
- Low- and reduced-sodium frozen dinners, peanut butter, salad dressings
- Air-popped popcorn

1

Foods *Higher* in Sodium

- Bacon, corned beef, ham, hot dogs, luncheon meat, sausage
- Bouillon, canned, and instant soups
- Boxed mixes, like hamburger meals and pancake mix
- Canned beans, chicken, fish and meat
- Canned tomato products, including juice
- Canned and pickled vegetables, vegetable juice
- Cottage cheese
- Frozen meals
- Frozen vegetables with sauce
- Olives, pickles, relish
- Pretzels, chips, crackers, salted nuts
- Salt and salt seasonings, like garlic salt
- Seasoning mix and sauce packets
- Soy sauce
- Salad dressings, bottled sauces, marinades
- Some ready-to-eat cereals, baked goods, breads
- Ready-to-eat boxed meals and side dishes

How Do I Lower the Sodium in My Diet?

- Buy fresh foods more often.
- Cook foods from scratch, instead of eating prepared foods, "fast" foods, frozen dinners, and canned foods that are higher in sodium.
- Use spices, herbs, and sodium-free seasonings in place of salt. Check with your health care provider about using salt substitutes.
- Rinse canned vegetables, beans, meats, and fish with water to remove extra sodium.

2

Sodium – Patient Education (continued)

Sodium

Always read the Nutrition Facts label to compare foods. Choose foods with the lowest Percent Daily Value (%DV) for sodium. The %DV lets you see if a food is high or low in sodium. **5% or less is low and 20% or more is high.**

- Check the label on fresh meats and poultry. Sodium additives can be used to make meat last longer.

- Look for foods labeled: sodium free, salt free, very low sodium, low sodium, reduced or less sodium, light in sodium, no salt added, unsalted, and lightly salted.

Nutrition Facts
Serving Size: 1 cup (228g)
Servings Per Container: 2

Amount Per Serving
Calories: 260 **Calories from Fat:** 120
% Daily Value*
Total Fat 13g 20 %
Saturated Fat 5g 25 %
Trans Fat 2g
Cholesterol 30mg 10 %
Sodium 660mg 28 %
Total Carbohydrate 31g 10%
Dietary Fiber 0g 0 %
Sugars 5g
Protein 5g
Vitamin A 4% • Vitamin C 2%
Calcium 15% • Iron 4%
* Percent Daily Values are based on a 2,000 calorie diet.

There may be more than one serving in the package, so be sure to check serving size.

This number tells you the % DV for sodium in one serving.

Check the Ingredient Label for Added Sodium

- Salt (sodium chloride)
- Monosodium glutamate or MSG
- Baking soda (sodium bicarbonate)
- Baking powder
- Sodium nitrate
- Sodium sulfite
- Sodium phosphate
- Sodium alginate
- Sodium benzoate
- Sodium hydroxide
- Sodium propionate

Sodium

NOTES

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Chronic Kidney Disease — Potassium

Considerations:

- When is modification appropriate?
  - In the presence of hypo/hyperkalemia → Identify contributing factors
- Guideline: Individualize (KDOQI 2020)
  - Previously: 2000-3000 mg/d or 2000-4000 mg/d
- Sources: Animals, Plants, Additives, Salt substitutes
- Bioavailability – seems to be lower in plant-based diets
- Food preparation can alter potassium content:
  - Rinse, peel, cut in small pieces, boil for 10', drain, boil for 10', drain, cook.
- Binders

Effects of Hypokalemia:

- Muscle weakness, twitching, cramps, paralysis
- Cardiac arrhythmias
- Lower insulin production, Glucose intolerance

Effects of Hyperkalemia:

- Cardiac arrhythmia or cardiac arrest
- Muscle weakness

Potassium – Patient Education

Potassium

Tips for People with Chronic Kidney Disease (CKD)

What Is Potassium?

Potassium is a mineral that helps your nerves and muscles work the right way.

Why Is Potassium Important for People with CKD?

In some people with CKD, the kidneys may not remove extra potassium from the blood. Some medicines also can raise your potassium level. Your food choices can help you lower your potassium level.

How Do I Know My Potassium Is High?

People often do not feel any different when their potassium is high. Your health care provider will check the level of potassium in your blood and the medicines you take. The level of potassium in your blood should be between **3.5 to 5.0.***

How Do I Lower Potassium in My Diet?

- Eat smaller portions of foods high in protein at meals and for snacks: meat, poultry, fish, beans, dairy, and nuts.
- Use spices and herbs in cooking and at the table. Salt substitutes often contain potassium and should not be used.
- **Potassium chloride** can be used in place of salt in some packaged foods, like canned soups and tomato products. Limit foods with potassium chloride on the ingredient list.
- Drain canned fruits and vegetables before eating.
- If you have diabetes, choose apple, grape, or cranberry juice when your blood sugar goes down.

Eat These Foods	Instead of These Foods
• White rice	• Brown and wild rice
• White bread and pasta	• Whole wheat bread and pasta
• Cooked rice and wheat cereals	• Bran cereals
• Rice milk (not enriched)	• Cow's milk

*Normal ranges may vary.

1

How Do I Lower Potassium in My Diet? (continued)

- Choose fruits and vegetables that are lower in potassium. Have very small portions of foods that are higher in potassium, like one slice of tomato on a sandwich, a few slices of banana on cereal, or half of an orange.

Fruits and Vegetables *Lower* in Potassium (200 mg or less*)

FRUITS

- Apples/apple juice/applesauce
- Apricots (canned)/apricot nectar
- Berries
- Cranberry juice
- Fruit cocktail
- Grapes/grape juice
- Grapefruit/grapefruit juice
- Honeydew melon
- Lemons and limes
- Mangoes
- Papayas
- Pears
- Peaches
- Plums
- Pineapple
- Rhubarb
- Tangerines
- Watermelon

VEGETABLES

- Alfalfa sprouts
- Bell peppers
- Bamboo shoots (canned)
- Broccoli (fresh)
- Cabbage
- Carrots
- Cauliflower
- Celery and onions (raw)
- Corn
- Cucumber
- Eggplant
- Green beans
- Kale
- Lettuce
- Mushrooms (fresh)
- Okra
- Summer squash (cooked)

*Potassium level is based on one serving. One serving of fruit is one small piece; ½ cup fresh, canned, canned, or cooked fruit; ¼ cup dried fruit; or ½ cup juice. **One serving of vegetables** is ½ cup fresh or cooked vegetables, 1 cup raw leafy vegetables, or ½ cup juice.

2

Potassium – Patient Education (continued)

Potassium

Fruits and Vegetables *Higher* in Potassium (More than 200 mg*)

FRUITS

- Apricots (fresh)
- Bananas
- Cantaloupe
- Dates
- Nectarines
- Kiwi
- Prunes/prune juice
- Oranges/orange juice
- Raisins

VEGETABLES

- Acorn and butternut squash
- Avocado
- Baked beans
- Beet and other greens
- Broccoli (cooked)
- Brussels sprouts (cooked)
- Chard
- Chile peppers
- Mushrooms (cooked)
- Potatoes
- Pumpkin
- Spinach (cooked)
- Split peas, lentils, beans
- Sweet potatoes, yams
- Vegetable juice
- Tomatoes/tomato juice/tomato sauce

*Potassium level is based on one serving. **One serving of fruit** is one small piece; ½ cup fresh, canned, or cooked fruit; ¼ cup dried fruit; or ½ cup juice. **One serving of vegetables** is ½ cup fresh or cooked vegetables, 1 cup raw leafy vegetables, or ½ cup juice.

Potassium

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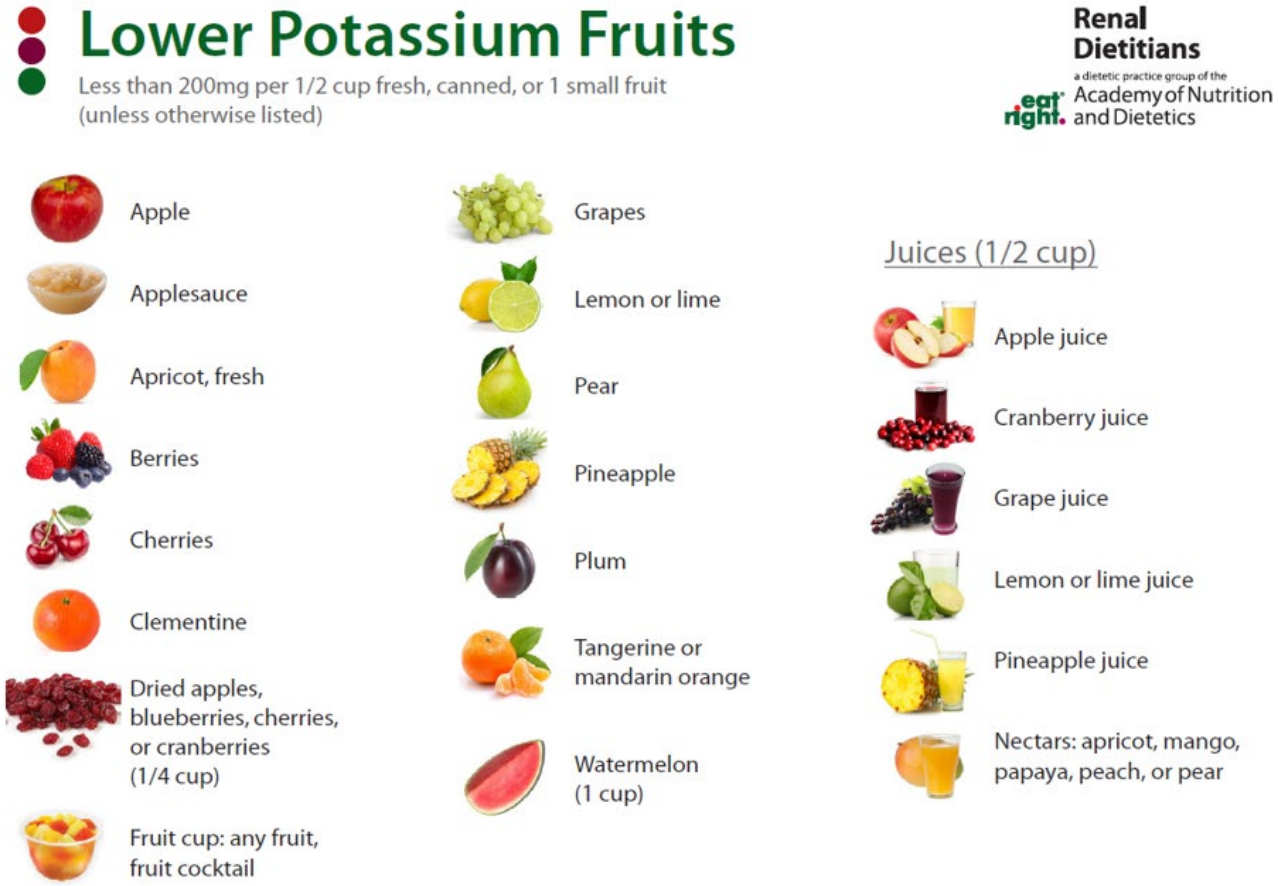
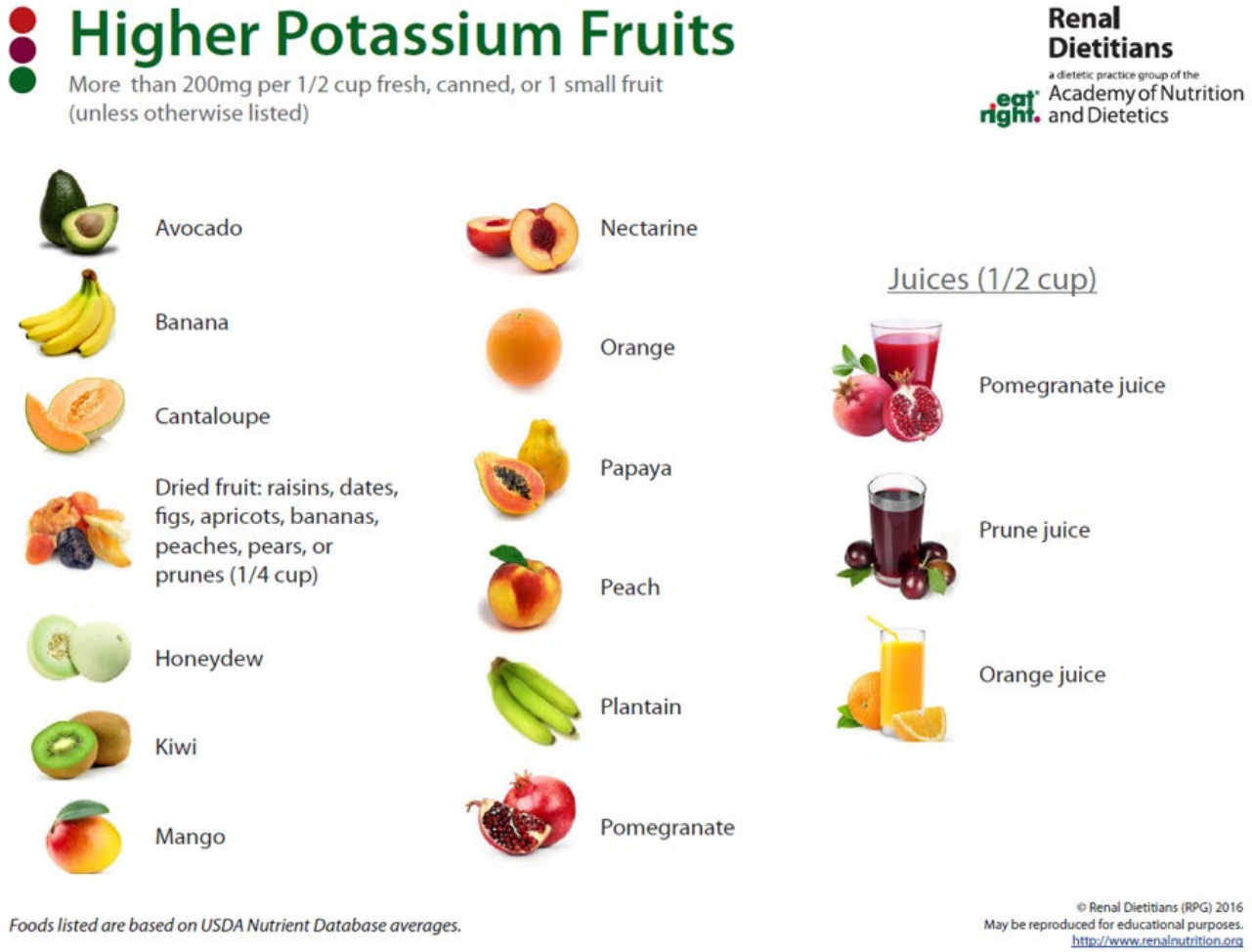
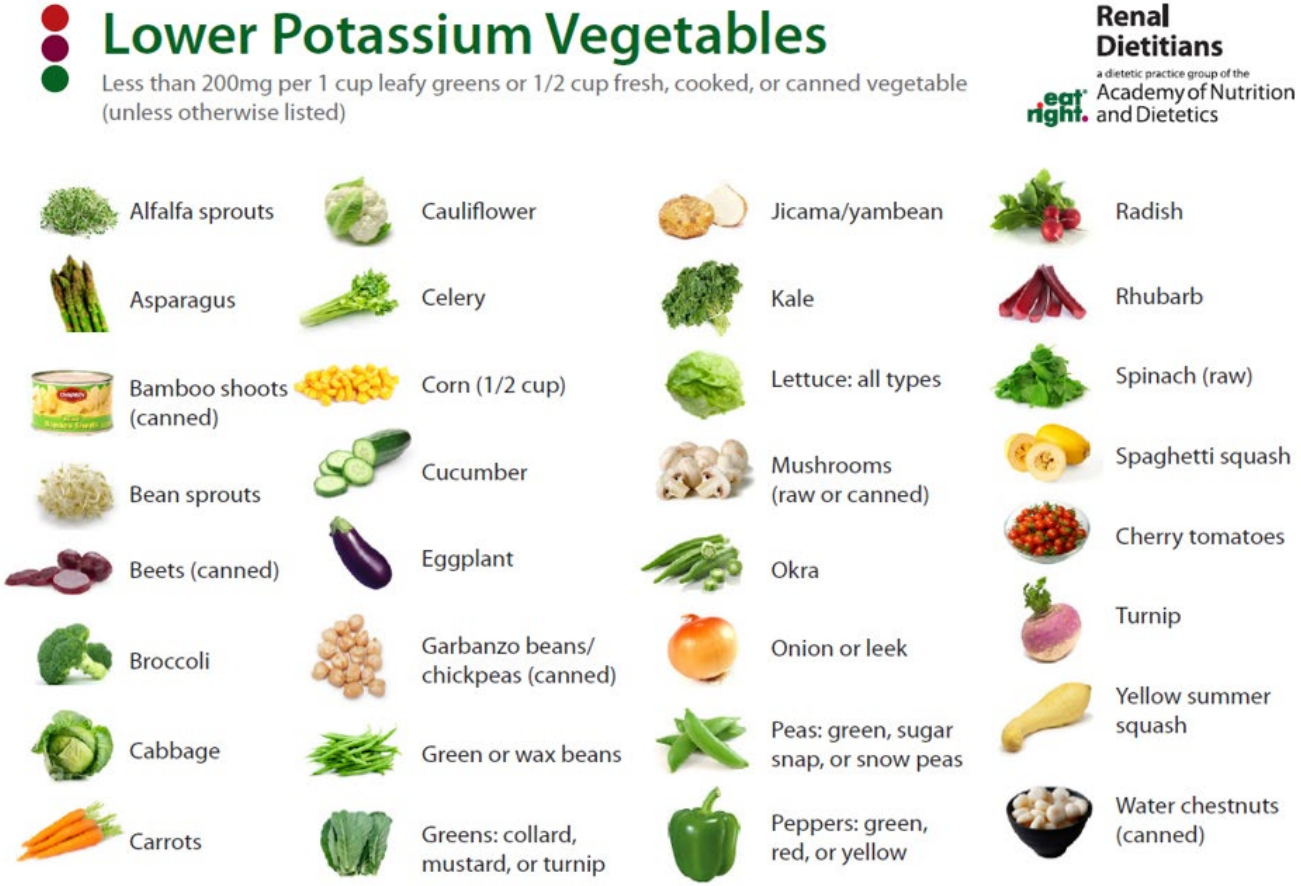
Potassium – Patient Education (continued)



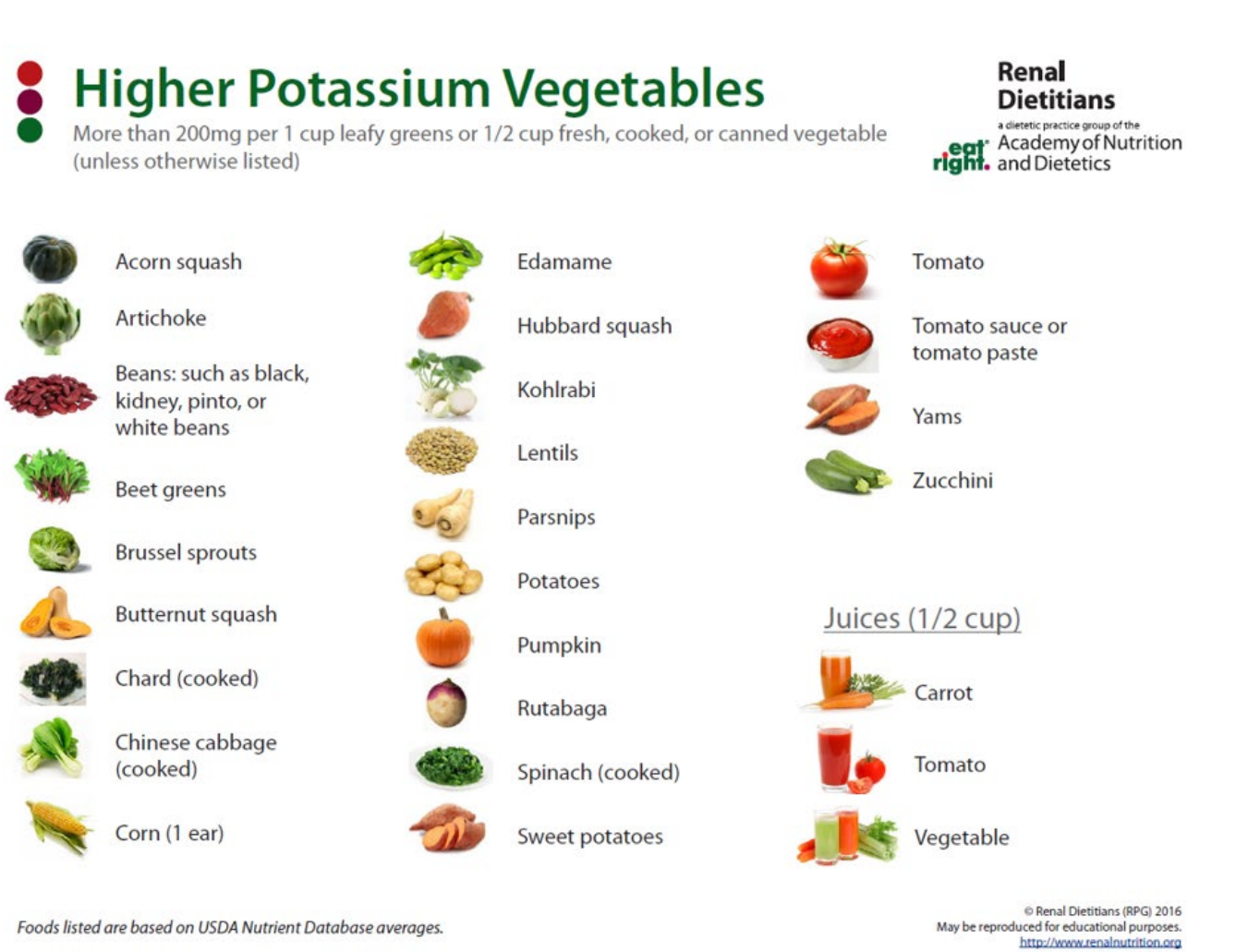
Potassium – Patient Education (continued)



Potassium – Patient Education (continued)



Potassium – Patient Education (continued)



Chronic Kidney Disease — Phosphorus

Considerations:

- When is adjustment appropriate?
  - Elevated serum phosphate levels, PTH above target range (KDOQI 2003)
- Guideline: Adjust dietary intake (KDOQI 2020)
  - Previously: 800-1000 mg/d (KDOQI 2003)
- Sources : Animals, Plants, Additives
  - Protein restriction→ Phosphorus reduction
- Bioavailability: Additives>Animals>Plants
  - Look for “PHOS” in ingredients list
- Binders

Dysregulation of phosphate metabolism:

- Cardiovascular Disease
- Mineral & Bone Disorder
  - Abnormal metabolism of calcium, phosphorus, PTH, vitamin D.
  - Impaired bone growth, fractures.
  - Vascular and soft tissue calcification.

Phosphorus – Patient Education

Phosphorus

Tips for People with Chronic Kidney Disease (CKD)

What Is Phosphorus?

Phosphorus is a mineral that helps keep your bones healthy. It also helps keep blood vessels and muscles working. Phosphorus is found naturally in foods rich in protein, such as meat, poultry, fish, nuts, beans, and dairy products. Phosphorus is also added to many processed foods.

Why Is Phosphorus Important for People with CKD?

When you have CKD, phosphorus can build up in your blood, making your bones thin, weak, and more likely to break. It can cause itchy skin, and bone and joint pain. Most people with CKD need to eat foods with less phosphorus than they are used to eating.

Your health care provider may talk to you about taking a phosphate binder with meals to lower the amount of phosphorus in your blood.

Foods *Lower* in Phosphorus

- Fresh fruits and vegetables
- Rice milk (not enriched)
- Breads, pasta, rice
- Corn and rice cereals
- Light-colored sodas/pop
- Home-brewed iced tea

Foods *Higher* in Phosphorus

- Meat, poultry, fish
- Dairy foods
- Beans, lentils, nuts
- Bran cereals and oatmeal
- Colas
- Some bottled iced tea

How Do I Lower Phosphorus in My Diet?

- Know what foods are lower in phosphorus (see page 1).
- Eat smaller portions of foods high in protein at meals and for snacks.
  - **Meat, poultry, and fish:** A cooked portion should be about 2 to 3 ounces or about the size of a deck of cards.
  - **Dairy foods:** Keep your portions to ½ cup of milk or yogurt, or one slice of cheese.
  - **Beans and lentils:** Portions should be about ½ cup of cooked beans or lentils.
  - **Nuts:** Keep your portions to about ¼ cup of nuts.
- Eat fresh fruits and vegetables—if you have not been told to watch your potassium
- Many packaged foods have added phosphorus. Look for phosphorus, or for word with PHOS, on ingredient labels, like the one below. Choose a different food when the ingredient list has PHOS on the label.

Ingredients: Potatoes, Vegetable Oil (Partially Hydrogenated Soybean Oil), Salt, Dextrose, Disodium Dihydrogen Pyrophosphate…

Examples of Foods that May Have Added Phosphorus

- Fresh* and frozen uncooked meats and poultry
- Chicken nuggets
- Baking mixes
- Frozen baked goods
- Cereals, cereal bars
- Instant puddings and sauces

*Ask the butcher to show you which fresh meats do not have added phosphorus.

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Phosphorus – Patient Education (continued)

Renal Dietitians
a dietetic practice group of the Academy of Nutrition and Dietetics
eat right.

Making Sense of Phosphorus

Phosphorus is an important mineral that your body uses for energy and overall health. What you eat and drink can affect the amount of phosphorus in your blood. To lower your risk of heart disease, weak bones and death, choose foods and drinks with natural phosphorus and avoid phosphate additives.

Phosphorus in Foods and Drinks

Natural Phosphorus
Phosphorus occurs naturally in meats, dairy, grains, and vegetables. About half of this natural phosphorus is absorbed.

Added Phosphorus
Phosphorus is also added to many foods and drinks as a preservative. Nearly all of added phosphorus is absorbed. Foods and drinks with added phosphorus can be more harmful to your health than those with natural phosphorus.

How Much Phosphorus is in Food and Drinks?
When selecting a food or drink, look at what *kind* of phosphorus it has. The amount of phosphorus may be included on the Nutrition Facts, but this won't tell you how much is natural or how much is added.

Registered Dietitians/Nutritionists (RDNs) recommend starting with the list of ingredients. If an ingredient has the letters "**phos**," you know for sure that phosphorus has been added. If that's the case, limit these foods and drinks.

Did You Know?
Even if phosphorus is not listed on the Nutrition Facts, the food or drink may still contain added phosphorus. Read the ingredient list to find out.

take action!
Read the **Ingredients** to find out if a food has added phosphorus. Look for ingredients with "**phos**" in the name, such as:

- **Phos**phoric acid
- Sodium **phos**phate
- Dicalcium **phos**phate

Sodium	Less than	2,400mg	2,400 mg
Total Carbohydrate		300g	375g
Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

* Intake of trans fat should be as low as possible

INGREDIENTS: WHOLE WHEAT AND WHEAT FLOUR, SALT, SPICES, RICE FLOUR, WHEY, CORN STARCH, LEAVENING (SODIUM BICARBONATE, SODIUM ALUMINUM PHOSPHATE, MONOCALCIUM PHOSPHATE), BEET POWDER, PAPRIKA, CALCIUM SULFATE, NON-FAT MILK POWDER, EXTRACT OF PAPRIKA, DEHYDRATED EGG YOLK, CARAMEL COLOR (TREATED WITH SULFITING AGENT), AND GARLIC POWDER.

What Foods Are Highest in Added Phosphorus?

The foods with the most added phosphorus are usually processed foods, packaged foods, and fast food.

HIGHER PHOSPHORUS PROTEIN	BETTER CHOICES
Processed meats like bacon, ham, hot dogs, chicken nuggets or strips, bologna, salami, or sausage	All-natural chicken, turkey, fish or seafood
Breaded or fried meats, chicken, fish, or seafood	Lean and fresh beef, lamb, pork, veal, or wild game
Organ meats, such as kidney or liver	Cottage cheese with no "**phos**" ingredients
	Whole eggs or egg whites
	Tofu, Beans, lentils
HIGHER PHOSPHORUS DAIRY	**BETTER CHOICES**
Non-dairy creamers, enriched almond or rice milk	Unenriched almond- or rice milk
Processed cheese, such as American	A small amount of natural cheese, such as Brie, Feta, Swiss, cheddar, or mozzarella
Processed cheese spreads and dips, such as Velveeta™, Cheez Whiz™, fat-free cream cheese or sour cream	Regular or low-fat cream cheese, Neufchatel, or sour cream
Ice cream, pudding, yogurt, or frozen yogurt	Sherbet, sorbet, fruit ice, or Popsicles
HIGHER PHOSPHORUS FAST FOOD	**BETTER CHOICES**
Grilled or fried chicken, including nuggets, sandwiches, strips, or wings	Fish filet sandwich (no cheese)
Pizza, tacos, or hot dogs	Hamburger (no cheese)
Any sandwiches with ham, American cheese, or bacon	Tuna or egg salad sandwich (no cheese)
French fries, other fried potatoes, biscuits, or macaroni & cheese	Side salad without cheese
	Coleslaw, apple slices, applesauce, grapes, or carrots

Phosphorus – Patient Education (continued)

HIGHER PHOSPHORUS BAKED GOODS	BETTER CHOICES
Biscuits, brownies, cakes, muffins, pancakes, pastries, or waffles that are ready-to-eat or made from a dry mix Refrigerated or frozen dough for biscuits, cookies, pastries, or sweet rolls	Fresh loaf bread, buns, dinner rolls, bagels, English muffins, pitas, or small croissants without "**phos**" ingredients Reduced-salt popcorn, pretzels, or tortilla chips
HIGHER PHOSPHORUS DRINKS	**BETTER CHOICES**
Beer or wine Any drink that has "**phos**" listed in the ingredients: Coke™, Pepsi™, Dr. Pepper™, energy or sports drinks, most bottled or canned coffees, teas, and flavored waters, Crystal Light™ grape, fruit punch, orange or raspberry flavors	Water Drinks without "**phos**" ingredients: 7-Up™, Sprite™, Sierra Mist™, root beer, orange soda, other sodas, fresh squeezed lemonade, fresh-brewed coffee or tea (made from coffee beans, coffee powder or tea bags) AriZona™ teas, Pure Leaf™ teas, Snapple™ teas, Crystal Light™ (lemonades, tea and green teas, and all "pure" flavors)

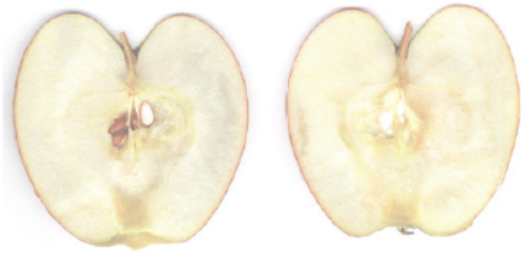
review

- Which is more harmful to my health: natural or added phosphorus? (*Circle one*) Natural or Added
- What do I look for in the ingredients to see if a food contains added phosphorus? "____".
- If the food label does not include the amount of phosphorus, where can you look to find out if there is any added phosphorus?

  _____
- *True or False?* Processed foods, fast food, and packaged foods are usually higher in added phosphorus? (*Circle One*) True or False
- What are a few foods or drinks with higher phosphorus that I will have less often?

  _____
- List a few lower-phosphorus foods or drinks that I can enjoy instead.

  _____



Tips to Limit Phosphorus

do less	do more
Limit processed meats and chicken.	Select fresh meats and home-cooking instead of convenience foods or packaged foods.
Limit dairy products such as cheese, ice cream, and milk to the amount recommended by your RDN, and avoid processed or imitation cheeses.	Choose soft drinks or other bottled beverages without "**phos**" in the ingredients.
Limit fast food and restaurant foods since many are high in added phosphorus.	Read the list of ingredients on all packaged foods, and limit foods with "**phos**" ingredients.

Ask your RDN for tips making healthier choices.

goal summary

I plan to:

1. _____
2. _____
3. _____

Inclusion of brand names does not represent endorsement by RPG, the Academy of Nutrition and Dietetics, or its Foundation.
Additional kidney-related resources can be found at: www.renalnutrition.org.

Chronic Kidney Disease
Vitamins – Minerals – Supplements

Guidelines (KDOQI 2020):

Iron supplementation

- CKD 3-5D or post transplantation (PT): **encourage diet that meets the RDA for all vitamins and minerals** (O).
- CKD 3-5D or PT: **assess dietary vitamin intake periodically, consider multivitamin for inadequate intake** (O).
- CKD 3-5D or PT with **hyperhomocysteinemia**: **no routine supplementation of folate**.
- CKD 1-5D (2B) or PT (O) with **folate/vitamin B12 deficiency/insufficiency:** prescribe **folate, vitamin B12, and/or B complex supplement**.
- CKD 1-5D or PT and **at risk of vitamin C deficiency**: **supplement to meet RDA** (90 mg/d for men and 75 mg/d for women (O). *(+35 mg/d for smokers)
- CKD 3-4 w/o active vitamin D analogs: prescribe **800-1,000 mg/d total elemental calcium** intake (from diet, supplements, binders) (2B).
- CKD 1-5D (2C) or PT (O) with **25-hydroxyvitamin D (25(OH)D) deficiency/insufficiency**: **prescribe cholecalciferol or ergocalciferol**.
- CKD 1-5 with **nephrotic-range proteinuria**: consider **supplementation of cholecalciferol, ergocalciferol, or other 25(OH)D precursors** (O).
- CKD 1-5D or PT **with anticoagulants- inhibitors of vitamin K**: **avoid vitamin K supplements** (O).
- CKD 1-5D: **do not routinely supplement selenium or zinc** (2C).
- CKD 3-5D: **reduce net acid production** (NEAP) **through increased bicarbonate or a citric acid/sodium citrate solution supplementation** (1C).
- CKD 3-5: **prescribe ~2 g/d LC n-3 PUFA to lower serum triglyceride levels** (2C).

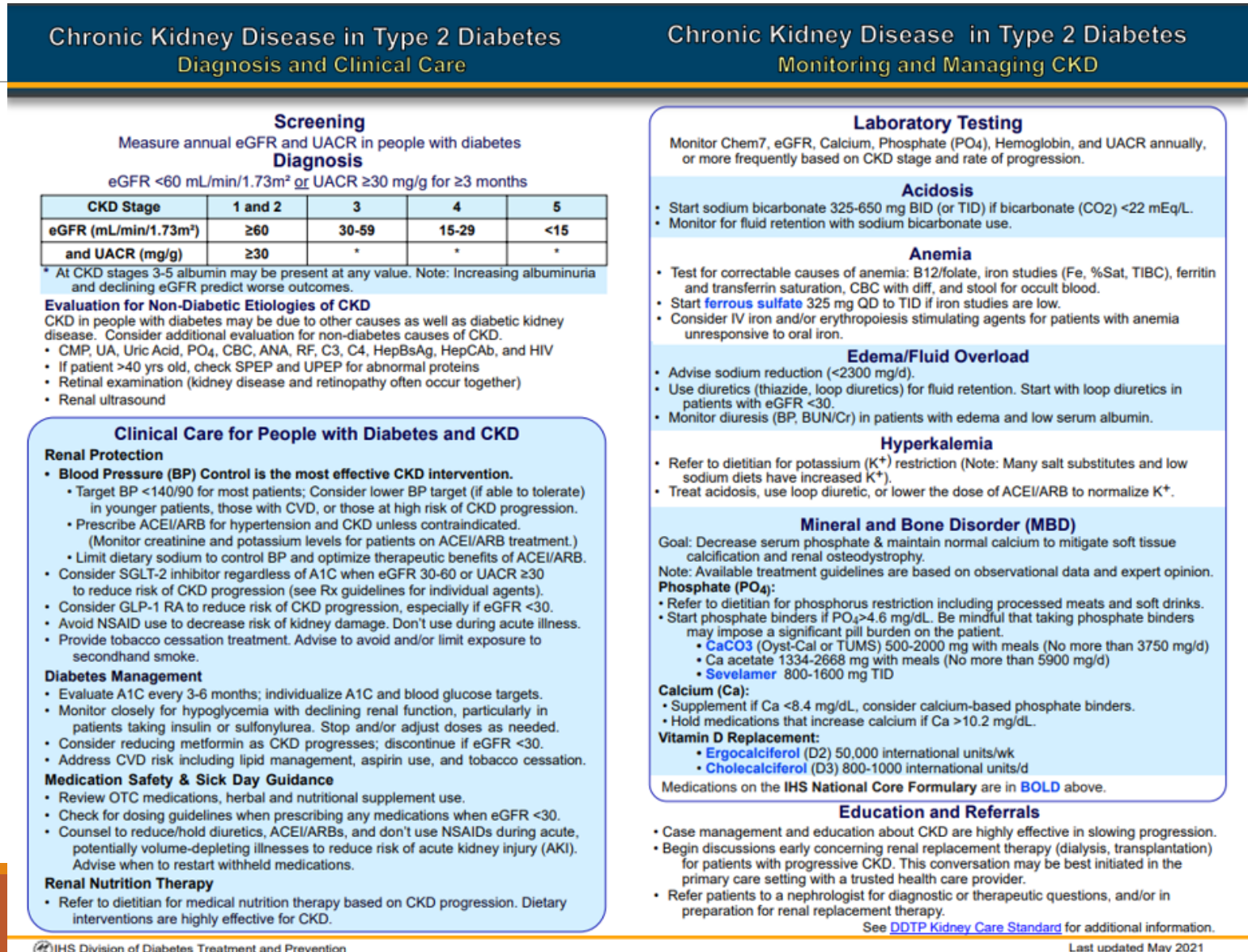
Food Groups

	Fruits	Vegetables	Grains	Dairy	Protein	Fats & Condiments
						
Sodium	Small amount	If canned → NO SALT ADDED Pickling brine often has salt	Content varies, bread in top 10 sources	Content varies, cheese in top 10 sources	Content varies – higher in processed animal sources	Use garlic powder instead of garlic salt, sauces are high
Potassium	Varies Canned<Frozen<Fresh Whole fruit<Juice<Dried fruit	Content varies Canned<Frozen<Fresh Whole vegetable<Juice Food prep affects content	Higher in whole grains	Varies	Varies	Cream of tartar and many sauces are high
Phosphorus	Small amount	Content varies Legumes highest	Higher in whole grains, bran, enriched grains, more bioavailable in leavened vs unleavened bread	Usually high	Content varies – higher in processed animal sources	Replace baking powder with baking soda + acid (e.g. vinegar)
Other	Base-producing, can help correct acidosis, Fiber can help with gut microbiota	Base-producing, can help correct acidosis, Fiber can help with gut microbiota	Fiber can help with gut microbiota	Cheese has high potential renal acid load	Animal protein → dietary acidosis	Sodium bicarbonate can help correct acidosis, Choose heart-healthy fats

CKD Algorithm

Available for download here: https://www.ihs.gov/sites/diabetes/themes/responsive2017/display_objects/documents/algorithms/DM_algorithm_CKD_508c.pdf

All Diabetes Treatment Algorithms here: https://www.ihs.gov/diabetes/clinician-resources/dm-treatment-algorithms/



Chronic Kidney Disease in Type 2 Diabetes
Diagnosis and Clinical Care

Screening

Measure annual eGFR and UACR in people with diabetes

Diagnosis

eGFR <60 mL/min/1.73m² or UACR ≥30 mg/g for ≥3 months

CKD Stage	1 and 2	3	4	5
eGFR (mL/min/1.73m²)	≥60	30-59	15-29	<15
and UACR (mg/g)	≥30	*	*	*

* At CKD stages 3-5 albumin may be present at any value. Note: Increasing albuminuria and declining eGFR predict worse outcomes.

Evaluation for Non-Diabetic Etiologies of CKD

CKD in people with diabetes may be due to other causes as well as diabetic kidney disease. Consider additional evaluation for non-diabetes causes of CKD.

- CMP, UA, Uric Acid, PO_4, CBC, ANA, RF, C3, C4, HepBsAg, HepCAb, and HIV
- If patient >40 yrs old, check SPEP and UPEP for abnormal proteins
- Retinal examination (kidney disease and retinopathy often occur together)
- Renal ultrasound

Clinical Care for People with Diabetes and CKD

Renal Protection

- **Blood Pressure (BP) Control is the most effective CKD intervention.**
  - Target BP <140/90 for most patients; Consider lower BP target (if able to tolerate) in younger patients, those with CVD, or those at high risk of CKD progression.
  - Prescribe ACEI/ARB for hypertension and CKD unless contraindicated. (Monitor creatinine and potassium levels for patients on ACEI/ARB treatment.)
  - Limit dietary sodium to control BP and optimize therapeutic benefits of ACEI/ARB.
- Consider SGLT-2 inhibitor regardless of A1C when eGFR 30-60 or UACR ≥30 to reduce risk of CKD progression (see Rx guidelines for individual agents).
- Consider GLP-1 RA to reduce risk of CKD progression, especially if eGFR <30.
- Avoid NSAID use to decrease risk of kidney damage. Don't use during acute illness.
- Provide tobacco cessation treatment. Advise to avoid and/or limit exposure to secondhand smoke.

Diabetes Management

- Evaluate A1C every 3-6 months; individualize A1C and blood glucose targets.
- Monitor closely for hypoglycemia with declining renal function, particularly in patients taking insulin or sulfonylurea. Stop and/or adjust doses as needed.
- Consider reducing metformin as CKD progresses; discontinue if eGFR <30.
- Address CVD risk including lipid management, aspirin use, and tobacco cessation.

Medication Safety & Sick Day Guidance

- Review OTC medications, herbal and nutritional supplement use.
- Check for dosing guidelines when prescribing any medications when eGFR <30.
- Counsel to reduce/hold diuretics, ACEI/ARBs, and don't use NSAIDs during acute, potentially volume-depleting illnesses to reduce risk of acute kidney injury (AKI). Advise when to restart withheld medications.

Renal Nutrition Therapy

- Refer to dietitian for medical nutrition therapy based on CKD progression. Dietary interventions are highly effective for CKD.

Chronic Kidney Disease in Type 2 Diabetes
Monitoring and Managing CKD

Laboratory Testing

Monitor Chem7, eGFR, Calcium, Phosphate (PO_4), Hemoglobin, and UACR annually, or more frequently based on CKD stage and rate of progression.

Acidosis

- Start sodium bicarbonate 325-650 mg BID (or TID) if bicarbonate (CO_2) <22 mEq/L.
- Monitor for fluid retention with sodium bicarbonate use.

Anemia

- Test for correctable causes of anemia: B12/folate, iron studies (Fe, %Sat, TIBC), ferritin and transferrin saturation, CBC with diff, and stool for occult blood.
- Start **ferrous sulfate** 325 mg QD to TID if iron studies are low.
- Consider IV iron and/or erythropoiesis stimulating agents for patients with anemia unresponsive to oral iron.

Edema/Fluid Overload

- Advise sodium reduction (<2300 mg/d).
- Use diuretics (thiazide, loop diuretics) for fluid retention. Start with loop diuretics in patients with eGFR <30.
- Monitor diuresis (BP, BUN/Cr) in patients with edema and low serum albumin.

Hyperkalemia

- Refer to dietitian for potassium (K^+) restriction (Note: Many salt substitutes and low sodium diets have increased K^+).
- Treat acidosis, use loop diuretic, or lower the dose of ACEI/ARB to normalize K^+.

Mineral and Bone Disorder (MBD)

Goal: Decrease serum phosphate & maintain normal calcium to mitigate soft tissue calcification and renal osteodystrophy.

Note: Available treatment guidelines are based on observational data and expert opinion.

Phosphate (PO_4):

- Refer to dietitian for phosphorus restriction including processed meats and soft drinks.
- Start phosphate binders if PO_4>4.6 mg/dL. Be mindful that taking phosphate binders may impose a significant pill burden on the patient.
  - **CaCO3** (Oyst-Cal or TUMS) 500-2000 mg with meals (No more than 3750 mg/d)
  - Ca acetate 1334-2668 mg with meals (No more than 5900 mg/d)
  - **Sevelamer** 800-1600 mg TID

Calcium (Ca):

- Supplement if Ca <8.4 mg/dL, consider calcium-based phosphate binders.
- Hold medications that increase calcium if Ca >10.2 mg/dL.

Vitamin D Replacement:

- **Ergocalciferol** (D2) 50,000 international units/wk
- **Cholecalciferol** (D3) 800-1000 international units/d

Medications on the **IHS National Core Formulary** are in **BOLD** above.

Education and Referrals

- Case management and education about CKD are highly effective in slowing progression.
- Begin discussions early concerning renal replacement therapy (dialysis, transplantation) for patients with progressive CKD. This conversation may be best initiated in the primary care setting with a trusted health care provider.
- Refer patients to a nephrologist for diagnostic or therapeutic questions, and/or in preparation for renal replacement therapy.

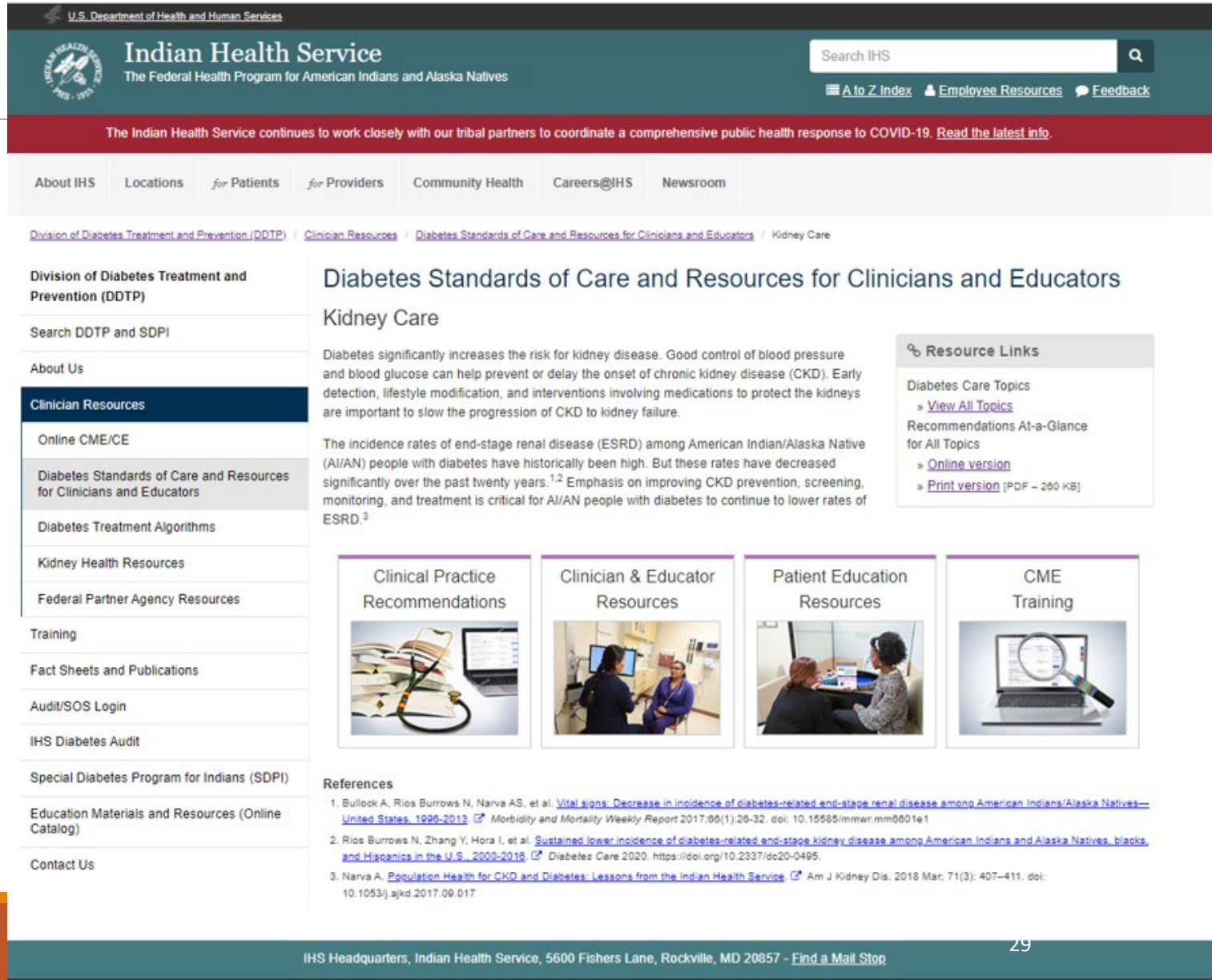
See DDTP Kidney Care Standard for additional information.

IHS Division of Diabetes Treatment and Prevention

Last updated May 2021

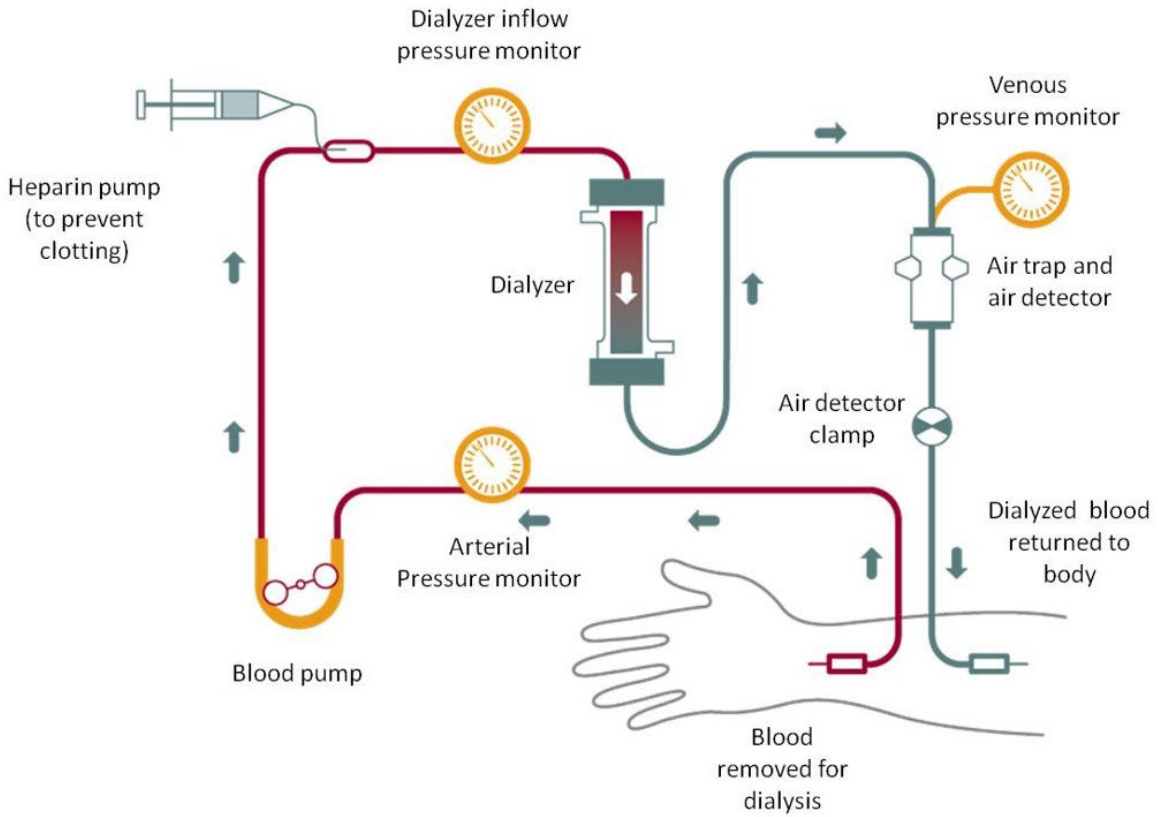
Kidney Care Standards

Website: https://www.ihs.gov/diabetes/clinician-resources/soc/kidney-care/

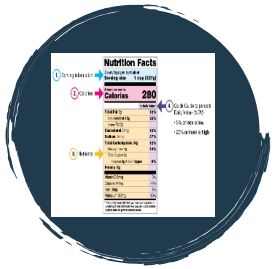


End Stage Kidney Disease

Hemodialysis



Hemodialysis
Focal points



Calories

25-35 kcal/kg

Protein

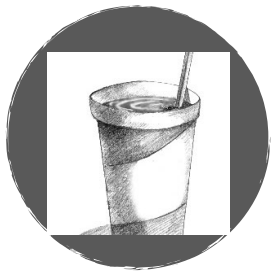
1.0-1.2 g/kg

Sodium

<2300 mg

Potassium

Individualize



Phosphorus

Individualize

Fluids

Usually 1000 cc/1L + urine output

Iron

Supplement in anemia, deficiency

Calcium

Adjust to avoid overload

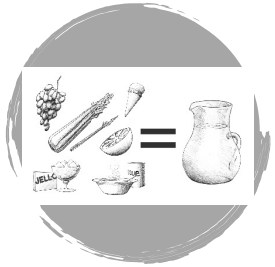
Fluid Restriction

What counts as fluid?

Water
Ice cubes, ice chips

Other beverages
Coffee, tea, alcohol, juices, soft drinks, nutritional drinks, smoothies

Dairy
Yogurt, ice cream, sherbet, milk, liquid creamer, pudding, custard, frozen yogurt



Other foods
Gelatin, gravy, popsicles, watermelon, soups, broth, syrups, snow cones, sorbet

Sodium restriction → Better thirst management.

Glycemic control → Prevention of hyperglycemia-induced thirst.

Fluid restriction tips for patients:

- Visualize daily fluid allowance.
  - Space out fluid intake throughout the day.
- Use smaller glasses/cups.
- Maintain mouth moisture with:
  - lip balms
  - mouth rinses
  - sugar-free gum/hard candy
  - frozen fruit/lemon wedges
- Maintain good oral health.
- Keep beverages cold with reusable ice cubes.
- Take medications with meals/applesauce.

Fluid Intake and Urine Output Diary

Typically used for urinary incontinence.

- Can be used to monitor fluid intake and urine output.

Available here:

https://www.niddk.nih.gov/-/media/Files/Urologic-Diseases/diary_508.pdf

Your Daily Bladder Diary

NIH National Institute of Diabetes and Digestive and Kidney Diseases

This diary will help you and your health care team figure out the causes of your bladder control trouble.
The "sample" line shows you how to use the diary.

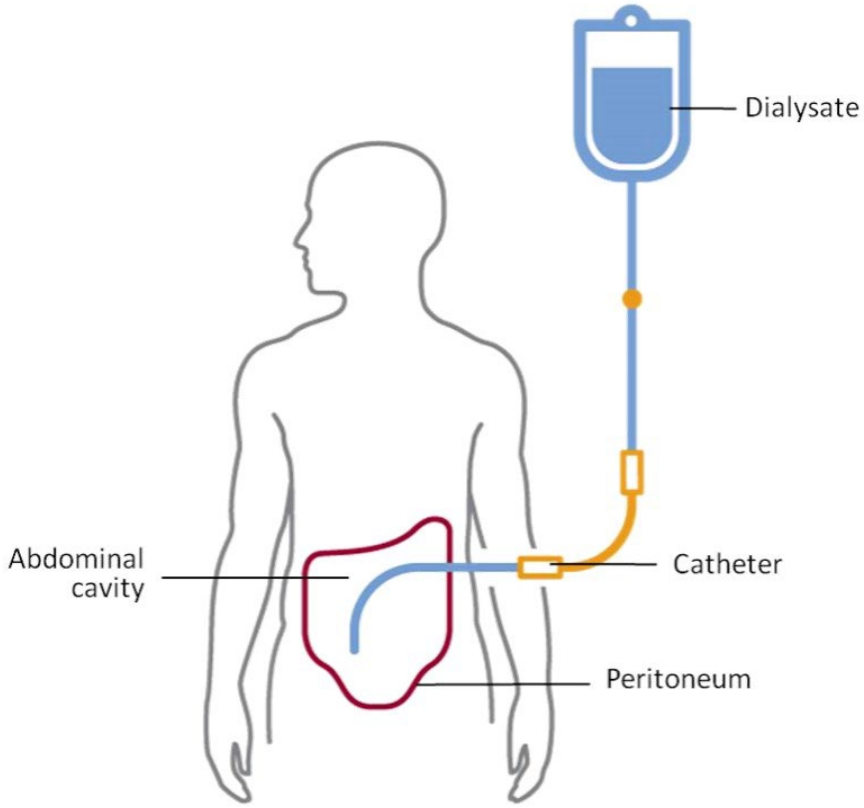
Time	Drinks: What kind?	Drinks: How much? oz, mL, cups	Trips to the Bathroom: How many times?	Trips to the Bathroom: How much urine?	Accidental Leaks: How much urine?	Did you feel a strong urge to go?	What were you doing at the time? Sneezing, lifting, arriving home, sleeping, etc.
Sample	Juice	8 ounces	✓✓	sm med lg	sm med lg	(Yes) No	Running
6–7 a.m.				sm med lg	sm med lg	Yes No	
7–8 a.m.				sm med lg	sm med lg	Yes No	
8–9 a.m.				sm med lg	sm med lg	Yes No	
9–10 a.m.				sm med lg	sm med lg	Yes No	
10–11 a.m.				sm med lg	sm med lg	Yes No	
11–12 noon				sm med lg	sm med lg	Yes No	
12–1 p.m.				sm med lg	sm med lg	Yes No	
1–2 p.m.				sm med lg	sm med lg	Yes No	
2–3 p.m.				sm med lg	sm med lg	Yes No	
3–4 p.m.				sm med lg	sm med lg	Yes No	
4–5 p.m.				sm med lg	sm med lg	Yes No	
5–6 p.m.				sm med lg	sm med lg	Yes No	
6–7 p.m.				sm med lg	sm med lg	Yes No	
7–8 p.m.				sm med lg	sm med lg	Yes No	
8–9 p.m.				sm med lg	sm med lg	Yes No	
9–10 p.m.				sm med lg	sm med lg	Yes No	
10–11 p.m.				sm med lg	sm med lg	Yes No	
11–12 mid.				sm med lg	sm med lg	Yes No	
12–1 a.m.				sm med lg	sm med lg	Yes No	
1–2 a.m.				sm med lg	sm med lg	Yes No	
2–3 a.m.				sm med lg	sm med lg	Yes No	
3–4 a.m.				sm med lg	sm med lg	Yes No	
4–5 a.m.				sm med lg	sm med lg	Yes No	
5–6 a.m.				sm med lg	sm med lg	Yes No	

Use this sheet as a master for making copies that you can use as a bladder diary for as many days as you need.

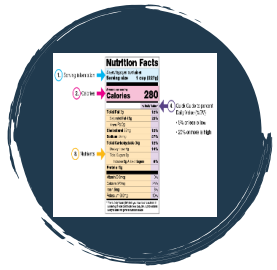
I used _____ pads today. I used _____ diapers today (write number).

Questions to ask my health care team: _____

Peritoneal Dialysis



Peritoneal Dialysis
Focal points



Calories

25-35 kcal/kg

Protein

1.0-1.2 g/kg

Sodium

<2300 mg

Potassium

May need restriction –
Assess labs & Individualize

Phosphorus

Individualize

Fluids

Usually 1000 cc/1L +
urine output

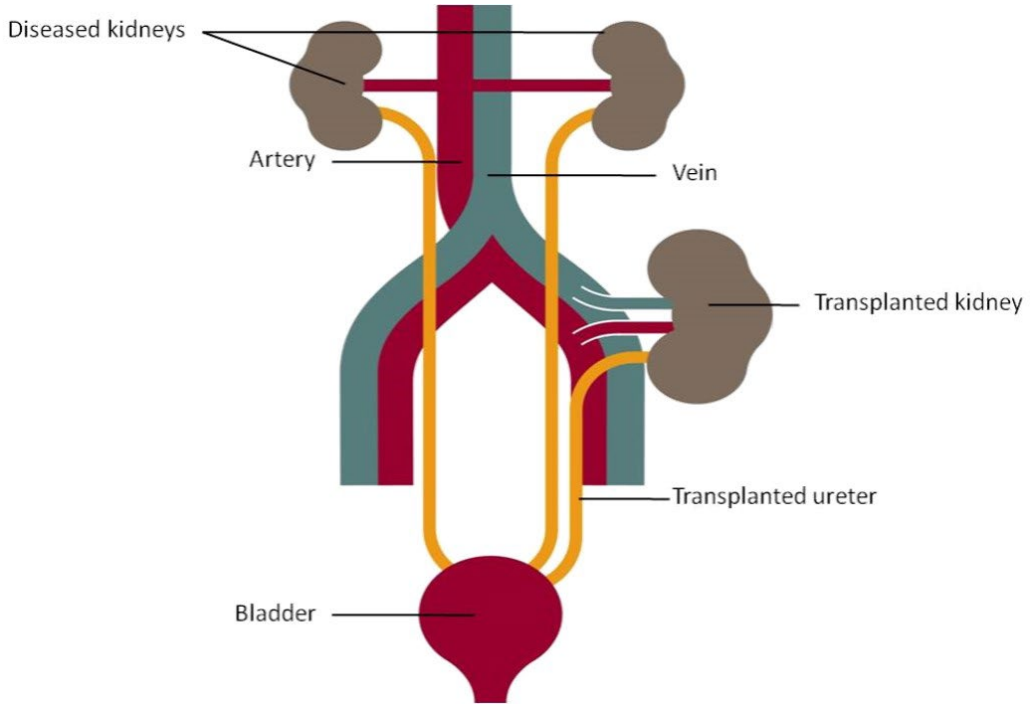
Iron

Supplement in anemia, deficiency

Calcium

Adjust to avoid overload

Kidney Transplantation



Considerations:

- Phase of transplant
- Kidney function after transplant
- Immunosuppressant medications
  - Food safety
- Caloric intake
  - Prevent weight gain after transplant
- Protein intake
  - May need to be higher right after the surgery.
  - Check kidney function to determine optimal intake.
- Sodium intake
  - May require restriction

Conservative Management

Goals:

- Deceleration of loss of kidney function.
- Symptom management.
- Comorbidity management.
- Preservation/optimization of quality of life.
- Creation of crisis management plan with the patient and caretakers.

Trainings in CKD Management

- Chronic Kidney Disease Nutrition Management Training Program (5 modules)

https://www.niddk.nih.gov/health-information/professionals/education-cme/management-training-program

- Helping Diabetes Educators Care for Patients With Kidney Disease (4 modules)

https://www.niddk.nih.gov/health-information/professionals/education-cme/helping-diabetes-educators-kidney-disease

- Individualizing Care for People with Progressive Kidney Disease (webinar)

- Answers to the Most Common Questions About Kidney Disease (webinar)

https://www.ihs.gov/diabetes/training/cmece-online-edu/recorded-cme-ce-webinars/clinical/

Additional Resources for Educators

- Explaining Your Kidney Test Results: https://www.niddk.nih.gov/health-information/professionals/clinical-tools-patient-education-outreach/explain-kidney-test-results
- Quick Reference on GFR and UACR in Evaluating Patients with Diabetes for Kidney Disease: https://www.niddk.nih.gov/health-information/health-communication-programs/nkdep/a-z/quick-reference-uacr-gfr/Documents/quick-reference-uacr-gfr-508.pdf
- Making Sense of CKD – A concise guide for managing chronic kidney disease in the primary care setting (Guide): https://www.niddk.nih.gov/health-information/health-communication-programs/nkdep/a-z/Documents/ckd-primary-care-guide-508.pdf
- Kidney Test Results: http://nkdep.nih.gov/resources/kidney-test-results.shtml

Kidney-friendly recipes:

- BCRenal – Patient Education Resources: http://www.bcrenal.ca/health-info/managing-my-care/diet
- National Kidney Foundation – Resources for Plant-Based Eating: https://www.kidney.org/atoz/content/plant-based
- NW Kidney Centers Kidney Kitchen Kidney –Recipes: https://www.nwkidney.org/living-with-kidney-disease/recipes/
- Kidney Foundation of Canada – Kidney Community Kitchen Recipes: https://www.kidneycommunitykitchen.ca/kkcookbook/recipes/
- Puget Sound Kidney Centers (PSKC) – Kidney-friendly recipes and cooking tips: https://www.pskc.net/kidney-friendly-recipes/
- Renal Diet HQ – Recipes: https://www.renaldiethq.com/zydrecipes/zestify-diet-recipes/

References (1)

Wang HW, Jiang MY. Higher volume of water intake is associated with lower risk of albuminuria and chronic kidney disease. Medicine (Baltimore). 2021;100(20):e26009. doi:10.1097/MD.0000000000026009.

Roncal-Jimenez C, Lanaspa M, A, Jensen T, Sanchez-Lozada L, G, Johnson R, J: Mechanisms by Which Dehydration May Lead to Chronic Kidney Disease. Ann Nutr Metab 2015;66(suppl 3):10-13. doi: 10.1159/000381239.

Hsu RK, Hsu CY. The Role of Acute Kidney Injury in Chronic Kidney Disease. *Semin Nephrol*. 2016;36(4):283-292. doi:10.1016/j.semnephrol.2016.05.005.

Cheungpasitporn W, Thongprayoon C, O'Corragain OA, Edmonds PJ, Kittanamongkolchai W, Erickson SB. Associations of sugar-sweetened and artificially sweetened soda with chronic kidney disease: a systematic review and meta-analysis. Nephrology (Carlton). 2014 Dec;19(12):791-7. doi: 10.1111/nep.12343. PMID: 25251417.

Cai XY, Zhang NH, Cheng YC, Ge SW, Xu G. Sugar-sweetened beverage consumption and mortality of chronic kidney disease: results from the US National Health and Nutrition Examination Survey, 1999–2014, Clinical Kidney Journal, 2021;, sfab227, https://doi.org/10.1093/ckj/sfab227.

Bach KE, Kelly JT, Palmer SC, Khalesi S, Strippoli GFM, Campbell KL. Healthy Dietary Patterns and Incidence of CKD: A Meta-Analysis of Cohort Studies. Clin J Am Soc Nephrol. 2019 Oct 7;14(10):1441-1449. doi: 10.2215/CJN.00530119. Epub 2019 Sep 24. PMID: 31551237; PMCID: PMC6777603.

Alvirdizadeh S, Yuzbashian E, Mirmiran P, Eghtesadi S, Azizi F. A prospective study on total protein, plant protein and animal protein in relation to the risk of incident chronic kidney disease. BMC Nephrol. 2020 Nov 17;21(1):489. doi: 10.1186/s12882-020-02079-y. PMID: 33203389; PMCID: PMC7672990.

References (2)

Dong Z, Gao X, Chinchilli VM, Sinha R, Muscat J, Winkels RM, Richie JP Jr. Association of sulfur amino acid consumption with cardiometabolic risk factors: Cross-sectional findings from NHANES III. EClinicalMedicine. 2020 Feb 3;19:100248. doi: 10.1016/j.eclinm.2019.100248. PMID: 32140669; PMCID: PMC7046517.

Lew QJ, Jafar TH, Koh HW, Jin A, Chow KY, Yuan JM, Koh WP. Red Meat Intake and Risk of ESRD. J Am Soc Nephrol. 2017 Jan;28(1):304-312. doi: 10.1681/ASN.2016030248. Epub 2016 Jul 14. PMID: 27416946; PMCID: PMC5198288.

Iseki K, Ikemiya Y, Kinjo K, Inoue T, Iseki C, Takishita S. Body mass index and the risk of development of end-stage renal disease in a screened cohort. Kidney Int, 65 (2004), pp. 1870-1876.

Stengel B, Tarver-Carr ME, Powe NR, Eberhardt MS, Brancati FL. Lifestyle factors, obesity and the risk of chronic kidney disease. Epidemiology, 14 (2003), pp. 479-487.

Vupputuri S, Sandler DP. Lifestyle risk factors and chronic kidney disease. Ann Epidemiol, 13 (2003), pp. 712-720.

Chang A, Van Horn L, Jacobs DR Jr, Liu K, Muntner P, Newsome B, Shoham DA, Durazo-Arvizu R, Bibbins-Domingo K, Reis J, Kramer H. Lifestyle-related factors, obesity, and incident microalbuminuria: the CARDIA (Coronary Artery Risk Development in Young Adults) study. Am J Kidney Dis. 2013 Aug;62(2):267-75. doi: 10.1053/j.ajkd.2013.02.363. Epub 2013 Apr 17. PMID: 23601954; PMCID: PMC3720776.

Asghari G, Yuzbashian E, Mirmiran P, Azizi F. The association between Dietary Approaches to Stop Hypertension and incidence of chronic kidney disease in adults: the Tehran Lipid and Glucose Study. Nephrol Dial Transplant. 2017 Apr 1;32(suppl_2):ii224-ii230. doi: 10.1093/ndt/gfw273. PMID: 28201810.

References (3)

Briganti EM, Branley P, Chadban SJ, et al. Smoking is associated with renal impairment and proteinuria in the normal population: The AusDiab kidney study. Australian Diabetes, Obesity and Lifestyle Study. Am J Kidney Dis, 40 (2002), pp. 704-712.

Ejerblad E, Fored CM, Lindblad P, et al. Association between smoking and chronic renal failure in a nationwide population-based case-control study. J Am Soc Nephrol, 15 (2004), pp. 2178-2185.

Said S, Hernandez GT. The link between chronic kidney disease and cardiovascular disease.*J Nephropathol*. 2014;3(3):99-104. doi:10.12860/jnp.2014.19.

Donaldson MS. Nutrition and cancer: a review of the evidence for an anti-cancer diet. Nutr J. 2004 Oct 20;3:19. doi: 10.1186/1475-2891-3-19. PMID: 15496224; PMCID: PMC526387.

Mentella MC, Scaldaferri F, Ricci C, Gasbarrini A, Miggiano GAD. Cancer and Mediterranean Diet: A Review. *Nutrients*. 2019;11(9):2059. Published 2019 Sep 2. doi:10.3390/nu11092059.

Féart C, Samieri C, Barberger-Gateau P. Mediterranean diet and cognitive function in older adults. *Curr Opin Clin Nutr Metab Care*. 2010;13(1):14-18. doi:10.1097/MCO.0b013e3283331fe4.

Zbeida M, Goldsmith R, Shimony T, Vardi H, Naggan L, Shahar DR. Mediterranean diet and functional indicators among older adults in non-Mediterranean and Mediterranean countries. J Nutr Health Aging. 2014 Apr;18(4):411-8. doi: 10.1007/s12603-014-0003-9. PMID: 24676323.

Nerbass FB, Pecoits-Filho R, McIntyre NJ, McIntyre CW, Taal MW. High sodium intake is associated with important risk factors in a large cohort of chronic kidney disease patients. Eur J Clin Nutr. 2015 Jul;69(7):786-90. doi: 10.1038/ejcn.2014.215. Epub 2014 Oct 8. PMID: 25293433.

References (4)

Widmer RJ, Flammer AJ, Lerman LO, Lerman A. The Mediterranean diet, its components, and cardiovascular disease. Am J Med. 2015 Mar;128(3):229-38. doi: 10.1016/j.amjmed.2014.10.014. Epub 2014 Oct 15. PMID: 25447615; PMCID: PMC4339461.

Martín-Peláez S, Fito M, Castaner O. Mediterranean Diet Effects on Type 2 Diabetes Prevention, Disease Progression, and Related Mechanisms. A Review. *Nutrients*. 2020;12(8):2236. Published 2020 Jul 27. doi:10.3390/nu12082236.

Saneei P, Salehi-Abargouei A, Esmaillzadeh A, Azadbakht L. Influence of Dietary Approaches to Stop Hypertension (DASH) diet on blood pressure: a systematic review and meta-analysis on randomized controlled trials. Nutr Metab Cardiovasc Dis. 2014 Dec;24(12):1253-61. doi: 10.1016/j.numecd.2014.06.008. Epub 2014 Jun 27. PMID: 25149893.

Siervo, M, Lara, J, Chowdhury, S, Ashor, A, Oggioni, C, & Mathers, J (2015). Effects of the Dietary Approach to Stop Hypertension (DASH) diet on cardiovascular risk factors: A systematic review and meta-analysis. *British Journal of Nutrition, 113*(1), 1-15. doi:10.1017/S0007114514003341.

Kheirouri S, Alizadeh M. MIND diet and cognitive performance in older adults: a systematic review. Crit Rev Food Sci Nutr. 2021 May 14:1-19. doi: 10.1080/10408398.2021.1925220. Epub ahead of print. PMID: 33989093.

Satija A, Hu FB. Plant-based diets and cardiovascular health. Trends Cardiovasc Med. 2018 Oct;28(7):437-441. doi: 10.1016/j.tcm.2018.02.004. Epub 2018 Feb 13. PMID: 29496410; PMCID: PMC6089671.

Hemler EC, Hu FB. Plant-Based Diets for Personal, Population, and Planetary Health. Adv Nutr. 2019 Nov 1;10(Suppl_4):S275-S283. doi: 10.1093/advances/nmy117. PMID: 31728495; PMCID: PMC6855934.

References (5)

Ikizler TA, Burrowes JD, Byham-Gray LD, Campbell KL, Carrero JJ, Chan W, Fouque D, Friedman AN, Ghaddar S, Goldstein-Fuchs DJ, Kaysen GA, Kopple JD, Teta D, Yee-Moon Wang A, Cuppari L. KDOQI Clinical Practice Guideline for Nutrition in CKD: 2020 Update. Am J Kidney Dis. 2020 Sep;76(3 Suppl 1):S1-S107. doi: 10.1053/j.ajkd.2020.05.006. Erratum in: Am J Kidney Dis. 2021 Feb;77(2):308. PMID: 32829751.

Siener R. Dietary Treatment of Metabolic Acidosis in Chronic Kidney Disease. *Nutrients*. 2018;10(4):512. Published 2018 Apr 20. doi:10.3390/nu10040512.

Goraya N, Munoz-Maldonado Y, Simoni J, Wesson DE. Fruit and Vegetable Treatment of Chronic Kidney Disease-Related Metabolic Acidosis Reduces Cardiovascular Risk Better than Sodium Bicarbonate. Am J Nephrol. 2019;49(6):438-448. doi: 10.1159/000500042. Epub 2019 Apr 17. PMID: 30995657.

Osuna-Padilla IA, Leal-Escobar G, Garza-García CA, Rodríguez-Castellanos FE. Dietary Acid Load: mechanisms and evidence of its health repercussions. Nefrologia (Engl Ed). 2019 Jul-Aug;39(4):343-354. English, Spanish. doi: 10.1016/j.nefro.2018.10.005. Epub 2019 Feb 5. PMID: 30737117.

Dubey AK, Sahoo J, Vairappan B, Haridasan S, Parameswaran S, Priyamvada PS. Correction of metabolic acidosis improves muscle mass and renal function in chronic kidney disease stages 3 and 4: a randomized controlled trial. Nephrol Dial Transplant. 2020 Jan 1;35(1):121-129. doi: 10.1093/ndt/gfy214. PMID: 30053298.

Kalantar-Zadeh K, Rhee CM, Chou J, Ahmadi SF, Park J, Chen JL, Amin AN. The Obesity Paradox in Kidney Disease: How to Reconcile it with Obesity Management. Kidney Int Rep. 2017 Mar;2(2):271-281. doi: 10.1016/j.ekir.2017.01.009. Epub 2017 Feb 1. PMID: 28439569; PMCID: PMC5399774.

Koppe L, Cassani de Oliveira M, Fouque D. Ketoacid Analogues Supplementation in Chronic Kidney Disease and Future Perspectives. *Nutrients*. 2019;11(9):2071. Published 2019 Sep 3. doi:10.3390/nu11092071.

References (6)

Humalda JK, Navis G. Dietary sodium restriction: a neglected therapeutic opportunity in chronic kidney disease. *Curr Opin Nephrol Hypertens*. 2014;23(6):533-540. doi:10.1097/MNH.0000000000000073.

Krikken JA, Laverman GD, Navis G. Benefits of dietary sodium restriction in the management of chronic kidney disease, Current Opinion in Nephrology and Hypertension: November 2009 - Volume 18 - Issue 6 - p 531-538 doi: 10.1097/MNH.0b013e3283312fc8.

Frassetto LA, Morris RC Jr, Sebastian A. Dietary sodium chloride intake independently predicts the degree of hyperchloremic metabolic acidosis in healthy humans consuming a net acid-producing diet. Am J Physiol Renal Physiol. 2007 Aug;293(2):F521-5. doi: 10.1152/ajprenal.00048.2007. Epub 2007 May 23. PMID: 17522265.

McMahon EJ, Bauer JD, Hawley CM, Isbel NM, Stowasser M, Johnson DW, Campbell KL. A randomized trial of dietary sodium restriction in CKD. J Am Soc Nephrol. 2013 Dec;24(12):2096-103. doi: 10.1681/ASN.2013030285. Epub 2013 Nov 7. PMID: 24204003; PMCID: PMC3839553.

Judd E, Calhoun DA. Management of hypertension in CKD: beyond the guidelines. *Adv Chronic Kidney Dis*. 2015;22(2):116-122. doi:10.1053/j.ackd.2014.12.001.

Babich JS, Kalantar-Zadeh K, Joshi S. Taking the Kale out of Hyperkalemia: Plant Foods and Serum Potassium in Patients With Kidney Disease. J Ren Nutr. 2022 Feb 5:S1051-2276(22)00013-9. doi: 10.1053/j.jrn.2022.01.013. Epub ahead of print. PMID: 35131414.

Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. Am J Kidney Dis. 2021 Feb;77(2):287-296. doi: 10.1053/j.ajkd.2020.10.003. Epub 2020 Oct 16. PMID: 33075387.

References (7)

Dobre M, Yang W, Chen J, Drawz P, Hamm LL, Horwitz E, Hostetter T, Jaar B, Lora CM, Nessel L, Ojo A, Scialla J, Steigerwalt S, Teal V, Wolf M, Rahman M; CRIC Investigators. Association of serum bicarbonate with risk of renal and cardiovascular outcomes in CKD: a report from the Chronic Renal Insufficiency Cohort (CRIC) study. Am J Kidney Dis. 2013 Oct;62(4):670-8. doi: 10.1053/j.ajkd.2013.01.017. Epub 2013 Mar 13. PMID: 23489677; PMCID: PMC3701754.

Da J, Xie X, Wolf M, Disthabanchong S, Wang J, Zha Y, Lv J, Zhang L, Wang H. Serum Phosphorus and Progression of CKD and Mortality: A Meta-analysis of Cohort Studies. Am J Kidney Dis. 2015 Aug;66(2):258-65. doi: 10.1053/j.ajkd.2015.01.009. Epub 2015 Mar 21. PMID: 25804679.

Gong N, Xiao Z, Zhang F, Zhong X, He Y, Yi Z, Tang D, Yang C, Lin Y, Nie J, Ai J. Duration of Serum Phosphorus Control Associated with Overall Mortality in Patients Undergoing Peritoneal Dialysis. Kidney Dis (Basel). 2020 Nov;6(6):434-443. doi: 10.1159/000507785. Epub 2020 Sep 7. PMID: 33313064; PMCID: PMC7706521.

Zha Y, Qian Q. Protein Nutrition and Malnutrition in CKD and ESRD. *Nutrients*. 2017;9(3):208. Published 2017 Feb 27. doi:10.3390/nu9030208.

D'Alessandro C, Piccoli GB, Cupisti A. The "phosphorus pyramid": a visual tool for dietary phosphate management in dialysis and CKD patients. BMC Nephrol. 2015 Jan 20;16:9. doi: 10.1186/1471-2369-16-9. PMID: 25603926; PMCID: PMC4361095.

de Vries LV, Dobrowolski LC, van den Bosch JJ, Riphagen IJ, Krediet CT, Bemelman FJ, Bakker SJ, Navis G. Effects of Dietary Sodium Restriction in Kidney Transplant Recipients Treated With Renin-Angiotensin-Aldosterone System Blockade: A Randomized Clinical Trial. Am J Kidney Dis. 2016 Jun;67(6):936-44. doi: 10.1053/j.ajkd.2015.11.026. Epub 2016 Jan 21. PMID: 26803690.

References (8)

Ibrahim HN, Murad DN, Knoll GA. Thinking Outside the Box: Novel Kidney Protective Strategies in Kidney Transplantation. ClinJ Am Soc Nephrol. 2021 Mar 23;16(12):1890–7. doi: 10.2215/CJN.15070920. Epub ahead of print. PMID: 33757985; PMCID: PMC8729499.

Nolte Fong JV, Moore LW. Nutrition Trends in Kidney Transplant Recipients: the Importance of Dietary Monitoring and Need for Evidence-Based Recommendations. *Front Med (Lausanne)*. 2018;5:302. Published 2018 Oct 31. doi:10.3389/fmed.2018.00302.

Kluch M, Kurnatowska I, Matera K, Łokieć K, Puzio T, Czkwianianc E, Grzelak P. Nutrition Trends in Patients Over the Long Term After Kidney Transplantation. Transplant Proc. 2020 Oct;52(8):2357-2362. doi: 10.1016/j.transproceed.2019.12.055. Epub 2020 Jun 20. PMID: 32571697.

Rhee CM, Ahmadi SF, Kovesdy CP, Kalantar-Zadeh K. Low-protein diet for conservative management of chronic kidney disease: a systematic review and meta-analysis of controlled trials. J Cachexia Sarcopenia Muscle. 2018 Apr;9(2):235-245. doi: 10.1002/jcsm.12264. Epub 2017 Nov 2. PMID: 29094800; PMCID: PMC5879959.

Kalantar-Zadeh K, Joshi S, Schlueter R, Cooke J, Brown-Tortorici A, Donnelly M, Schulman S, Lau WL, Rhee CM, Streja E, Tantisattamo E, Ferrey AJ, Hanna R, Chen JLT, Malik S, Nguyen DV, Crowley ST, Kovesdy CP. Plant-Dominant Low-Protein Diet for Conservative Management of Chronic Kidney Disease. Nutrients. 2020 Jun 29;12(7):1931. doi: 10.3390/nu12071931. PMID: 32610641; PMCID: PMC7400005.

Zarantonello D, Rhee CM, Kalantar-Zadeh K, Brunori G. Novel conservative management of chronic kidney disease via dialysis-free interventions. Curr Opin Nephrol Hypertens. 2021 Jan;30(1):97-107. doi: 10.1097/MNH.0000000000000670. PMID: 33186220.

Questions?

Thank You!

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