

# End Stage Renal Disease

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## Overview

End Stage Renal Disease (ESRD) occurs when Chronic Kidney Disease (CKD) advances to a point where the kidney has lost more than 90% of its function. At this stage, the kidneys can no longer support healthy body functions and treatment is needed to replace the work of the kidneys. ESRD is fatal without dialysis treatment or a kidney transplant. Under normal conditions, kidneys function to regulate fluid and electrolyte balance, blood pressure, and acid-base balance. They also play a role in hormone production and the activation of vitamin D. With the loss of kidney function, fluids, electrolytes and waste products can build up in your body and cause severe complications such as cardiovascular disease, malnutrition, bone and mineral disorders, and anemia.

Nutrition therapy is a very important aspect of managing ESRD. Limiting your intake of restricted foods and eating enough of the right kinds of foods can help improve your quality of life and prevent associated complications from occurring.

## Causes

Kidney disease is caused by a disease or condition that impairs kidney function. The most common causes include poorly controlled diabetes and high blood pressure.

## Symptoms

- Nausea and vomiting
- Decreased or no urine output
- Decreased alertness
- Muscle twitching or cramps
- Loss of appetite
- Swelling of feet and ankles
- High blood pressure (hypertension)
- Persistent itching
- Shortness of breath, if fluid accumulates in the lungs
- Sleep problems
- Chest pain, if fluid accumulates in the heart
- Fatigue and weakness

## Nutrition and ESRD

The goals of nutrition therapy for patients with ESRD are targeted towards ensuring nutritional requirements are met, blood pressure and fluid status are kept stable, and associated complications are minimized. Nutrition interventions are determined by the type of treatment the patient is receiving. Patients that do not undergo a kidney transplant must be treated by dialysis. Dialysis is a renal replacement procedure that removes excess and toxic byproducts of metabolism from the blood. It works by replacing the filtering function of healthy kidneys and can maintain life once kidney disease progresses to ESRD. There are two types of dialysis, hemodialysis (HD) and peritoneal dialysis (PD). Dietary needs vary slightly, and it is important to understand the differences. In general, individuals on hemodialysis require a diet that is high in protein but controls intakes of potassium, phosphorous, fluids, and sodium. Patients receiving peritoneal dialysis tend to have a more liberalized diet than those undergoing hemodialysis because nutrients such as protein, potassium, and phosphorous tend to be lost during the treatment process.

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## Hemodialysis

In hemodialysis, blood is pumped out of your body into an artificial kidney machine where waste products are filtered out before it is returned to your body. This process takes approximately 3 to 6 hours and must be done around 3 times per week.

## Peritoneal Dialysis

Peritoneal dialysis differs from hemodialysis in that your peritoneum, or abdominal membrane, is used as a natural filter. Wastes are excreted from your body by a fluid called dialysate, which is delivered into your abdomen via a catheter and then drained back out. Each exchange takes approximately 30 to 40 minutes and is typically done 4 to 5 times per day.

## Protein

Protein is needed to maintain muscle and organ health. It provides the body with essential amino acids, is integral for repairing damaged tissues, and helps prevent infections. Patients on dialysis require higher protein intakes to maintain adequate nutrition as protein can be lost during treatment. It is important to note that not all proteins are equal. Protein from animal sources differ from plant proteins in that they contain all the amino acids your body needs to function effectively. Plant proteins are an equally beneficial protein source; however, they lack one or more of the essential amino acids, meaning you must eat a wide variety of foods to meet your needs. While animal protein foods are high quality sources, they also contain phosphorous and have been associated with increased mortality in individuals with advanced stages of kidney disease. Eating a balanced amount of both animal and plant proteins is the best way to get all the nutrients you need. Please consult your registered dietitian on the amount and type of protein that is right for you.

**Animal Protein Sources Include:** Meat; Poultry; Seafood; Dairy; Eggs

**Plant Protein Sources Include:** Beans; Lentils; Nuts and nut spreads (e.g. almond butter, peanut butter); Soy products (e.g. soy milk, tofu)

### Serving Sizes for Plant Protein

- ½ cup of cooked beans
- ¼ cup of nuts
- 1 slice of bread
- ½ cup of cooked rice or noodles

### Serving Sizes for Animal Protein

- A cooked portion of meat, poultry, or fish should be about 2 to 3 ounces or about the size of a deck of cards
- Dairy: a portion is ½ cup of milk or yogurt, or one slice of cheese

## Sodium

One of the kidneys' many functions is to filter sodium out of the body so it can be excreted in the urine. When the kidneys become damaged their ability to excrete waste is diminished resulting in a buildup of sodium. Without treatment, high levels of sodium can eventually lead to fluid retention and high blood pressure. For individuals on HD or PD, eating a diet that is low in sodium is required to prevent water retention and to reduce the risk of cardiovascular disease.

### Low Sodium Foods to Include:

- **Meats:** Fresh or frozen un-breaded meats; Eggs
- **Vegetables:** Fresh or frozen vegetables; Canned vegetables with no added salt

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- **Starches:** English muffins; Bagels; Plain pasta; Noodles; Rice; Cooked hot cereals; Unsalted crackers
- **Fats:** Vegetable oils (e.g. canola, olive); Unsalted butter
- **Seasonings:** Fresh garlic or garlic powder (not garlic salt); Fresh onion or onion powder (not onion salt); Black pepper; Lemon juice; Vinegar

## High Sodium Foods to Avoid:

- **Meats:** Processed deli meats (pepperoni, bologna, salami, pastrami, ham, turkey, corned beef); Sausage; Hot dogs; Breaded meats (chicken nuggets, fish sticks); Canned meats (*Spam*); Smoked or cured meats (salt pork, bacon); Lox and herring
- **Diary:** Buttermilk; Processed cheese spreads (*Cheez Wiz*, *Easy Cheese*); Processed cheese (*Velveeta*, American cheese, nacho cheese); Pimento cheese
- **Vegetables:** Regular canned vegetables and vegetable juices; Pickles; Relish; Olives; Pepperoni; Sauerkraut
- **Starches:** Biscuits; Prepared mixes (pancakes, muffins, cornbread); Seasoned rice, noodle, or potato mixes (*Rice-a-Roni*, macaroni and cheese); Coating mixes (seasoned bread crumbs, *Shake 'n' Bake*); Snack foods (potato chips, corn chips, pretzels, pork rinds, crackers, tortilla chips, nuts, popcorn, sunflower seeds)
- **Fats:** Bacon; Salt pork; Commercial salad dressings
- **Seasonings:** Table salt; Seasoning seasonings (garlic salt, onion salt, celery salt); Meat tenderizer; Bouillon cubes; Flavor enhancers; Condiments (BBQ sauce, steak sauce, soy sauce, teriyaki sauce, oyster sauce, ketchup)
- **Processed Foods:** Canned soups; Frozen prepared foods; Fast foods

## Potassium

Potassium is a mineral that is found in a wide variety of plant and animal foods. It is required for normal cell function, muscle contraction, and maintaining a healthy heartbeat. Under normal conditions, the kidney excretes 80-90% of the potassium consumed daily, however, in ESRD the kidneys can no longer perform this function and potassium begins to build up. Increased potassium levels, also known as hyperkalemia, can result in severe cardiovascular complications or death. Patients receiving hemodialysis require a diet that avoids foods high in potassium. Individuals on peritoneal dialysis often have low potassium levels due to the frequency of dialysis exchanges. For those receiving PD it is important to consume enough potassium in your diet to meet your needs. Discuss with your healthcare provider or registered dietitian whether an oral potassium supplement is necessary.

## Foods High in Potassium:

- **Fruits:** Apricot; Avocado; Banana; Cantaloupe; Dates; Dried fruits; Grapefruit juice; Honeydew; Kiwi; Mango; Nectarine; Orange, orange juice; Papaya; Pomegranate; Prunes, prune juice; Raisins
- **Vegetables:** Acorn squash; Artichoke; Bamboo shoots; Baked beans; Butternut squash; Refried beans; Beets, fresh then boiled; Black bean; Cooked broccoli; Brussels sprouts; Chinese cabbage; Raw carrots; Dried beans and peas; Greens (except kale); Hubbard squash; Kohlrabi; Legumes; Lentils; Canned mushrooms; Parsnips; White and Sweet Potatoes; Pumpkin; Rutabagas; Cooked spinach; Tomatoes, tomato products; Vegetable juices

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- **Other Foods:** Bran, bran products; Chocolate; Granola; Milk; Nuts and seeds; Peanut butter; Salt substitutes; Salt-free broth; Yogurt; Red meats; Poultry; Fish

## Foods Low in Potassium:

- **Fruits:** Apples, apple juice, applesauce; Apricots canned in juice; Berries (blackberries, blueberries, cherries, cranberries, raspberries, strawberries); Fruit cocktail; Half a grapefruit; Grapes, grape juice; Mandarin oranges; Peach (1 small peach or ½ a can); Pear (1 small pear or ½ can); Pineapple, pineapple juice; Plums; Tangerine; Watermelon (limit to 1 cup)
- **Vegetables:** Alfalfa sprouts; Asparagus; Green and red cabbage; Cooked carrots; Cauliflower; Celery; Fresh corn; Cucumber; Eggplant; Kale; Lettuce; Fresh mushrooms; Okra; Onions; Parsley; Green peas; Peppers; Radish; Rhubarb; Canned water chestnuts; Watercress; Yellow squash; Zucchini squash
- **Other Foods:** Rice; Noodles; Pasta; White Bread and bread products (not whole grains); Coffee (limit to 8 oz); Tea (limit to 16 oz); Cookies without nuts or chocolate

## Phosphorus

Phosphorous is a mineral found in your bones and is a major component in maintaining strong and healthy bone structure. In ESRD, the kidneys are no longer able to excrete phosphorous from the body and blood levels begin to rise. Increased circulating phosphorous causes calcium to be pulled out of your bones, making them weak and brittle. In addition to developing bone disease, high levels of phosphorous and calcium in the blood can result in calcification of blood vessels, lungs, eyes, and the heart.

Phosphorous is found in protein rich foods such as meat, poultry, fish, nuts, beans and dairy. It is also commonly added to processed foods, fast foods, and ready-to-eat-foods as a preservative. Patients receiving dialysis must control their phosphorous intake. Please speak to your healthcare provider or registered dietitian about whether you require a phosphorous binder to take with meals. Phosphorous binders help prevent the body from absorbing the phosphorous in your food.

## Limit Intake of these High Phosphorus Foods:

- **Vegetables:** Dried beans and peas (kidney beans, soy beans, black beans, Lima beans); Chickpeas; Baked beans; lentils; Split peas
- **Protein:** Carp, Crayfish; Fish roe; Oysters; Sardines; Beef liver; Chicken liver; Organ meats
- **Dairy Products:** Cheese; Custard; Milk; Cream soups; Cottage Cheese; Ice cream; Pudding; Yogurt
- **Other Foods:** Bran cereals; Caramels; Seeds; Whole-grain products; Brewer's yeast; Nuts; Wheat germ
- **Beverages:** Ale; Chocolate drinks; Drinks made with milk; Canned iced teas; Beer; Cocoa; Dark colas

## Enjoy these Low Phosphorus Foods:

- **Vegetables:** Fresh fruit and vegetables
- **Protein:** Mahi-Mahi; Salmon; Sea bass; Canned tuna; Shrimp; Egg whites

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- **Dairy:** Feta and parmesan cheese
- **Other Foods:** White rice, bread, pasta; Barley; Couscous; Corn and rice cereals; Rice cakes; Sorbet
- **Beverages:** Non-cola drinks; Rice milk (not enriched); Almond milk; Soy milk; Non-dairy creamers

## Iron

In addition to regulating body fluids and waste excretion, the kidneys produce erythropoietin (EPO), a hormone involved in red blood cell production. In ESRD, the impairment of EPO production frequently results in iron deficiency and anemia. Iron rich foods should be encouraged in order to decrease the risk of anemia. Sources of iron include poultry, fish, beans, lentils, tofu, and dark leafy greens. Speak to your registered dietitian whether an iron supplement should be taken.

### Tips for Increasing Iron Absorption

- Cook with a cast iron skillet
- Consume vitamin C rich foods (e.g. citrus fruits, dark leafy greens, or raw broccoli) with meals
- Avoid drinking coffee and tea during and after meals

## Fluids

Healthy kidneys maintain fluid balance and prevent water retention. When the body retains water, it can cause blood pressure to increase, swelling around the lungs and heart causing shortness of breath and increased strain on the heart. Individuals with ESRD must keep track of their fluid intake and output between dialysis treatments to ensure a healthy fluid balance is maintained. Talk to your health care provider or registered dietitian about how much fluid you should be drinking per day, as you may require a fluid restriction. It is important to note that when we speak about fluids, we are not just referring to liquids. Foods that are liquid at room temperature, or have a high fluid content, such as popsicles, soup, ice cream, yogurt, pudding and Jell-O are also considered fluids.

### Tips to Manage Thirst:

- Limit high salt foods.
- Use smaller glasses for drinking.
- Drink small portions during the day, rather than large ones all at once.
- Make ice cubes from your favorite drinks to suck on. This way you will take in less fluid.
- Freeze grapes and eat throughout day as one of your fruit servings.
- Colder drinks quench thirst better than warm.
- Suck on sugar free hard candy or chew sugar free gum.
- Add lemon juice to water or ice. The sour taste can help quench thirst.
- Brush teeth often. It is important to maintain oral hygiene.

## Fat and Cholesterol

Individuals on dialysis are at increased risk for developing coronary artery disease (CAD) and stroke. It is recommended that patients adhere to a heart healthy diet in order to lower

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cholesterol levels and reduce the risk of complications such as high blood pressure, obesity, and diabetes. Diets high in saturated fat, trans fat, and cholesterol are the greatest contributors to high cholesterol and associated co-morbidities. By eating a diet that emphasizes vegetables, fruits, whole grains, and low fat dairy sources you can lower your risk for heart disease.

## Heart Healthy Fats to Include:

- **Omega-3 Fatty Acids:** Tuna, salmon, mackerel, trout, herring, and sardines; Ground flaxseed and flaxseed oil; Soybeans; Walnuts; Seeds
- **Monounsaturated Fats:** Canola oil, olive oil, and peanut oil; Olives; Avocados; Nuts and nut butters (e.g. almond butter and peanut butter)
- **Polyunsaturated Fats:** Vegetable oils (e.g. safflower, sunflower, sesame, and soybean oil)

## Fats to Avoid:

- **Saturated Fats:** Animal foods (e.g. meat and dairy); Tropical oils (e.g. coconut, palm oil); Cocoa butter
- **Trans Fats:** Partially hydrogenated vegetable oils; Hydrogenated vegetable oil; Processed foods (e.g. cookies, snack foods)
- **Cholesterol:** Found only in animal foods (e.g. eggs (yolk), dairy products, meats)

## Other Vitamins and Minerals

During dialysis treatments certain vitamins and minerals are lost and may need to be supplemented either orally or intravenously. Consult your healthcare provider or registered dietitian to discuss an appropriate vitamin supplementation to support your overall health. Multivitamins may not be recommended as some can contain vitamin and mineral contents that are not suitable for patients with ESRD.

## Nutrients of Concern

- **Calcium.** Healthy kidneys function to regulate phosphorous and calcium in your body. High levels of phosphorous result in decreased bone calcium. Calcium levels should be monitored and supplemented as necessary.
- **Vitamin D.** Kidney function is required to activate vitamin D so it can be used by your body. Low levels of vitamin D contribute to bone disease and may need to be supplemented intravenously during dialysis treatment.
- **Water-Soluble Vitamins.** Supplementation of water-soluble vitamins is usually indicated for patients on dialysis due to increased losses during treatment.

## Tips for Reading Food Labels

1. Check for sodium on the Nutrition Facts Label. A Daily Value (DV) of 20% or higher means the food is high in sodium. A DV of 5% or less means it's low in sodium.
2. Common terms associated with sodium to look for on food labels:
  - **Sodium Free:** Less than 5 mg of sodium per serving.
  - **Very Low Sodium:** 35 mg or less of sodium per serving.
  - **Low Sodium:** 140 mg or less of sodium per serving.
  - **Reduced Sodium:** At least 25% less sodium than the original product.
  - **No Added Salt/Unsalted:** No salt was added during processing, not necessarily sodium free.

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3. Look for words that contain PHOS on the ingredient list. Many packaged foods contain phosphorous.
4. Look for potassium on the ingredient list. Potassium chloride can be used as a salt substitute in packaged foods like canned soups and tomato products.
5. Choose foods low in saturated fat, trans fat, and cholesterol. A DV of 5% or less is considered low.
6. Look for foods that contain fiber to help lower cholesterol levels. A DV of 20% or food items containing 5 grams per serving are considered high in fiber.

## **Nutrition and Lifestyle Guidelines**

- Choose and prepare foods that are low in salt in order to help control your blood pressure.
- Cook at home when possible. Prepared or packaged foods contain high amounts of sodium and phosphorous and restaurants often use sodium for flavoring.
- Use spices, herbs for seasoning instead of salt. Check with your registered dietitian about using salt substitutes as they may contain potassium.
- Buy lower sodium versions of foods at the supermarket when possible.
- Drain and rinse canned vegetables, fruits, beans, meats, and fish with water before eating to reduce the sodium content.
- Consult your registered dietitian on the amount and type of protein that is right for you.
- If you have high potassium levels, choose vegetables and fruits that are low in potassium.
- Peel and soak fruits and vegetables that are high in potassium in water for several hours to remove excess potassium. Drain and rinse before cooking.
- Animal protein foods are high in phosphorous and may need to be limited.
- Be familiar with foods that have a low phosphorous content.
- Avoid foods containing saturated fat, trans fat, and cholesterol.
- Keep alcohol consumption to 1 drink per day for women and 2 drinks per day for men.

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