

Diet in Chronic Kidney Disease (CKD)

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Overview...

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Principle of nutritional management in CKD

- To maintain good nutritional status
- To prevent or minimize uremic toxicity
- To reduce cardiovascular risk
- To slow down the progression of renal failure

Dietary factors may have an effect on the progression of kidney disease and its complications.

Over nutrition results in

- Sodium and volume overload
- Hyperkalemia
- Hyperphosphatemia and
- Accumulation of toxic metabolites of protein degradation.

- **Undernutrition**, on the other hand, exacerbates the risk for malnutrition and wasting.

Appropriate dietary interventions may have an effect on clinical outcomes in the CKD population.

The optimal diet for individual CKD patients varies depending upon the

- Estimated glomerular filtration rate (eGFR),
- Type of kidney disease (ie, proteinuric or nonproteinuric), and
- The presence of other comorbidities such as diabetes, hypertension, or heart failure.

- Dietary modification is not needed for patients with **eGFR ≥ 60 mL/min/1.73 m²**.
- Such patients should follow the same dietary recommendations as for the general population

We should focused on the following components for dietary management plan in CKD patients

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- Protein
- Salt
- Potassium
- Calcium
- Phosphorus
- Carbohydrate
- Fat
- Fiber
- Daily calorie and fluid balance

Protein: Which is better for CKD pts ?

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- Lower biological value protein produces more nitrogenous products than high biological value protein
- Obviously, it is more advantageous to consume animal protein than plant protein in CKD



Protein Content....

- 100 gm meat contain 21 gm protein
- 100 gm fish contain 17 gm protein
- 1 egg white contain 4 gm protein
- 1 glass of milk contain (protein)
 - Cow 8.0 gm
 - Goat 9.0 gm
 - Sheep 15.0 gm

USDA Nutrient Database

Renal Handling of protein

- Increased dietary protein intake leads to increased splanchnic and renal blood flow with increased GFR and worsening of proteinuria in patients with pre-existing proteinuria

Protein should be restricted or not ??

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Most clinical guidelines, including Kidney Disease: Improving Global Outcomes (KDIGO), suggest restriction in protein intake for CKD patients

Benefits of low protein diet

- Low protein diet generates lower potentially toxic nitrogenous metabolites
- Because the low protein diet generally contains less phosphorous and potassium, the intake of these minerals can be reduced more readily with this diet

Protein recommendation in NS

- Nephrotic Syndrome – recommended protein intake
0.70 g/kg/day
- And additional 1.0 g/day of high biologic value protein for each gm of urinary protein lost each day above 5.0 g/day
- i.e. a man of 60 kgs with proteinuria of 8 gms dietary protein recommendation is
$$= 0.7 \times 60 + 3 = 45 \text{ gm / day}$$

Protein intake in Renal Failure

- GFR more than **70** ml/min , Protein intake not routinely restricted

(except when renal function is clearly declining)
- GFR is **25 to 70** ml/min

0.6 to 0.75gm of protein kg/day

(of which at least 0.35 gm is high-biologic-value protein to ensure a sufficient intake of the essential amino acids)

- GFR less than 25 ml/min without dialysis

At this level of renal failure, the potential advantages of using a low-protein, low phosphorous diet becomes more vigorous.

The amount of protein intake is similar to previous group.

Follow up of CKD patients who are on protein restricted diet...

- Follow-up should be done every three to six months interval for adequate caloric intake and evidence of protein malnutrition.
- We usually follow the body weight as well as serum albumin

Three conditions must be met to avoid malnutrition:

- Adequate caloric intake must be maintained (by increasing polyunsaturated fats and by avoiding processed carbohydrates).
- At least 60 percent of the ingested protein must be of high biologic value or contain a high percentage of essential amino acids .

- Stimulation of skeletal muscle protein breakdown should be prevented to limit net nitrogen loss. **Metabolic acidosis** should be treated since metabolic acidosis stimulates skeletal muscle protein breakdown

Salt intake

Salt is nutritionally equivalent to sodium chloride:

1 g salt of NaCl contains 0.4 g (17 mEq) of Na ion.

- eGFR <60 mL/min/1.73 m² who have hypertension, volume overload, or increased protein excretion, sodium intake should be <2 g/day (5 g/day of salt).

- With absence of hypertension and volume overload sodium intake should be 2.3 g/day (5.75 g/day of salt [NaCl]).

Sodium restriction should not be <1500 mg/day (ie, salt <3 g/day). As very-low-sodium intake has been associated with increased mortality.

Among CKD patients, the benefits of salt restriction might include the following:

- Lower blood pressure (BP)
- Slower progression to end-stage renal disease (ESRD)
- Improved cardiovascular outcomes

Potassium intake

- Dietary potassium intake should be individualized based on the serum potassium.
- In general, potassium restriction is not required until the estimated glomerular filtration rate (eGFR) decreases to <30 mL/min/1.73 m².

- patients of CKD with higher eGFRs and who are on angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) will require potassium restriction to maintain a normal serum potassium.

High Potassium containing food..

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- ❑ Banana
- ❑ Orange
- ❑ Milk
- ❑ Dates
- ❑ Almonds
- ❑ Potato
- ❑ Tomato
- ❑ Pulses



Low potassium containing food..

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- Apple
- String beans
- Cabbage
- Carrot
- Cauliflower
- Cucumber
- Egg white
- Corns
- Pineapple



Calcium intake....

- Total calcium intake (both dietary and medication sources) ≤ 1500 mg/day.
- Calcium supplementation of 2 to 4 g/day results in suppression of parathyroid hormone levels in advanced CKD .

Calcium content of foods

High calcium foods

- **Milk**
- **Fish and chicken bones**
- **Cheese**
- **Yogurt**

Low calcium foods

- **Fruits**
- **Vegetables**

Phosphorus intake....

- Dietary phosphorus intake to a maximum of 0.8 to 1 g/day or modify the phosphorous intake to normalize the serum level in patients with an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m².
- phosphorus intake is not restricted in CKD patients who have normal serum phosphate levels and parathyroid hormone (PTH) values.

Low Phosphorous food

Rice

White bread

Jelly

honey

Carbohydrate and fat intake...

- Patients with an eGFR < 60 mL/min/1.73 m² who are not undergoing maintenance dialysis consume 30 to 35 kcal/kg/day .
- Fat should be restricted to <30 percent of daily energy intake, with saturated fat limited to <10 percent.

Fiber intake....

- Recommended daily dietary fiber intake for CKD patients with estimated glomerular filtration rate (eGFR) ≤ 60 mL/min/1.73 m² is 5 to 38 g/day, which is the same as for the general population.

Vitamins in CKD.....

- Patient with more advanced CKD are prone to deficiencies of water soluble vitamins because:
 - ▣ Vitamin intake is often low due to anorexia and restricted diets
 - ▣ The metabolism of certain water soluble vitamins tends to be altered in CKD
 - ▣ Many medications interfere with the intestinal absorption, metabolism or action of vitamins

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- Dialysis treatment removes water soluble vitamins
 - Vitamin B6, vitamin C, and folic acid are the most common deficient in both dialyzed and non dialyzed patients
 - Vitamin B12 deficiency is uncommon in CKD (daily requirement is low and stored in large quantities in the body, poorly dialyzed)

- Routine use of supplemental vitamin A is not recommended in CKD
- Additional vitamin E and K are not necessary
- Patients on antibiotics need supplemental vitamins as there is a chance of increase in creatinine levels because with antibiotics coliform bacteria in the intestine is destroyed which helps in removing a good amount of creatinine from the body.

Trace Elements

- Many trace elements are excreted primarily in the urine, and they may accumulate with renal failure
- Elements such as iron, zinc and copper which are protein bound, may be lost in excessive quantities when there are large urinary protein losses, such as in the nephrotic syndrome.

Summary and recommendations

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	with eGFR \leq 60 mL/min/1.73 m ²
Protein	≤ 0.8 g/kg/day ,
Salt	< 2.3 g/day (< 5 g/day of NaCl).
Potassium	Individualize to keep the serum potassium within a normal range.
Calcium	1.5 g/day from both dietary and medication sources.

Phosphorus

0.8 to 1 g/day or individualize to keep the value within a normal range. Increase vegetable source and avoid processed foods as much as possible.

Carbohydrate /fat

30 to 35 kcal/kg/day; <30% of total calories from fat and <10% of total fat from saturated fat; DASH diet pattern highly recommended.

Fiber

25 to 38 g/day

Foods proven harmful for the kidneys



Star Fruits consumption causes acute kidney injury



Averrhoa Bilimbi consumption causes acute kidney injury



