

# **Plant Based Diets In Dialysis**

## **Examining The Current Evidence**

Kate Zalewski, RDN, CSR, LDN

## **Objectives**

- Define plant-based diet and review current evidence supporting plant-based diets for various health conditions including ESRD
- Understand the current state of nutrition care for dialysis patients based on most recent KDOQI Guidelines, and discuss whether a plant based diet is compatible with these guidelines
- Discuss barriers to implementing plant based diets in dialysis population, examine key nutritional considerations for plant-based diets
- Help dietitians gain confidence in their abilities to counsel and support dialysis patients wishing to explore and implement plant-based diets

# Defining “Plant-Based”

## Defining “Plant Based”

- No strict definition
  - Can be thought of as diet that emphasizes nutrient-dense plant foods such as vegetables, fruits, grains, legumes, nuts, and seeds
- A 2020 review investigated how “plant-based diet” is defined in the literature (1)
  - 50% of papers used “plant-based” interchangeably with a vegan diet
  - ~30% of trials included dairy products
  - 20% emphasized a semi-vegetarian diet pattern

## **Plant based ≠ vegan**

- Despite sometimes synonymous use in the literature...
  - “Plant based” is a dietary pattern
  - Vegan refers to a diet free of animal products, rooted in an ethical lifestyle pattern
  - A common mistake: following a “vegan” diet with the assumption it imparts the health benefits of a nutrient-dense plant based diet

## **More accurate terminology**

- “Whole foods plant based” (WFPB) may more appropriate terminology to describe the dietary pattern associated with reduced incidence of chronic illness, improved weight management, etc
- Plant forward, plant focused

# Plant Based Diets in the Literature

## 2020-2025 USDA Dietary Guidelines for Americans

What the guidelines say

- Endorse a “Healthy Vegetarian Diet Pattern” as one of three recommended dietary patterns (in addition to a Healthy U.S.-Style Dietary Pattern and Healthy Mediterranean Style Diet Pattern” (2)

## **AND Position Statement**

- “It is the position of the Academy of Nutrition and Dietetics that appropriately planned vegetarian, including vegan, diets are healthful, nutritionally adequate, and may provide health benefits for the prevention and treatment of certain diseases.” (3)

J Acad Nutr Diet. 2016;116:1970-1980.

## **AND Position Statement, continued**

- “Vegetarians and vegans are at reduced risk of certain health conditions, including ischemic heart disease, type 2 diabetes, hypertension, certain types of cancer, and obesity.”

J Acad Nutr Diet. 2016;116:1970-1980.

## The traditional “renal diet”

- Based on the 2000 KDOQI Guidelines (4), 2003 KDOQI Clinical Practice Guidelines (5), 2004 KDOQI Guidelines (7) and 2010 Academy of Nutrition and Dietetics CKD Guidelines (see note)

Nutrient	Recommendation
<b>Protein Intake</b>	The recommended Dietary Protein Intake (DPI) for clinically stable MHD or CPD patients is 1.2 g/kg body weight/d (up to 1.3 g/kg/day for CPD patients). At least 50% of the dietary protein should be of high biological value. (4)
<b>Phosphorus</b>	Dietary phosphorus should be restricted to 800 to 1,000 mg/day (adjusted for dietary protein needs) when the serum phosphorus levels are elevated (>4.6 mg/dL [1.49 mmol/L]) at Stages 3 and 4 of CKD, (OPINION) and >5.5 mg/dL (1.78 mmol/L) in those with kidney failure (Stage 5) (5)
<b>Potassium</b>	Patients with CKD 3-5 should limit potassium to 2–4 g/d; patients with CKD stage 3–5 who have hyperkalemia should limit their dietary potassium intake to <2.4 g/d (6)

Note: unable to locate original copy of 2010 CKD Guidelines, only found referenced within other papers

## Updated renal diet guidelines

- 2020 KDOQI Guidelines (7)

Nutrient	Recommendation
<b>Protein</b>	1.0-1.2 g/kg body weight (on dialysis & metabolically stable) “Insufficient evidence to recommend a protein type”
<b>Phosphorus</b>	Adjust dietary phosphorus to maintain normal serum phosphorus; reasonable to consider bioavailability of phosphorus in foods.
<b>Potassium</b>	Reasonable to adjust dietary potassium to maintain normal serum potassium, consider non-dietary causes

KDOQI Clinical Practice Guidelines for Nutrition in CKD: 2020 Update <https://www.ajkd.org/action/showPdf?pii=S0272-6386%2820%2930726-5>

## A closer look: Statement on Protein Type

### KDOQI Clinical Practice Guideline for Nutrition in CKD (2020 Update)

- Guideline 3.2.1 (Statement on Protein Type): In adults with CKD 1-5D (1B) or posttransplantation (OPINION), there is **insufficient evidence to recommend a particular protein type** (plant vs animal) in terms of the effects on nutritional status, calcium or phosphorus levels, or the blood lipid profile.
  - Effect of plant protein on lipid panel: mixed results
  - “Phosphorus may be less absorbed with a VPD” benefiting ca/phos metabolism
  - VPD could reduce production of toxic middle molecules such as p-cresyl sulfate, indoxyl sulfate, and trimethylamine oxide, almost exclusively produced from animal source protein

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### ***Detailed Justification***

There is a scarcity of studies on this topic and we found no clinical trials on how modifying diet can influence serum potassium levels in patients with CKD. The work group emphasizes that factors other than dietary intake influence serum potassium levels. These include medications, kidney function, hydration status, acid-base status, glycemic control, adrenal function, a catabolic state, or gastrointestinal problems such as vomiting, diarrhea, constipation, and bleeding. All these factors should be considered when formulating a strategy to keep serum potassium levels within the normal range.

2020 KDOQI Guidelines Statement on Potassium Section 6.4

## **A closer look: Statement on F+V**

### **KDOQI Clinical Practice Guideline for Nutrition in CKD (2020 Update)**

- Guideline 3.3.2 (Fruits and Vegetables): 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).



# Promising Evidence for use of Plant Based Diets in Dialysis Patients

## Possible benefits & risk of plant-based diet in dialysis patients

- Increased fruit and vegetable intake (antioxidants)
- Fiber intake
  - Gut health
  - Improved GI motility - reduced constipation
- Improved hyperphosphatemia management

Léonie Dupuis, Amanda Brown-Tortorici, Kanyar Kalantar-Zadeh, Shivam Joshi; A Mini Review of Plant-Based Diets in Hemodialysis. *Blood Purif* 20 July 2021; 50 (4-5): 672-677.

## Fruits & Veggies

- Higher F+V consumption associated with decreased all cause mortality and decreased risk for cardiovascular death (8)
- Polyphenol-rich interventions in HD patients improved blood pressure, triglycerides, and oxidative stress (9)

## Fiber Intake Trends

- Mean daily fiber intake of 7.5 g fiber per 1000 calories (n=248) (10)
  - Average non-dialysis consumer: 8.1 g fiber per 1000 calories (12)
  - Average vegetarian 28g/day, vegan 44g/day (12)

## Improved Comorbids

- Higher fiber diet has been associated with improved blood pressure, improved glycemic control, improved lipid panel, and improved weight control among patients with kidney disease (13)
- Plant-based protein intake was associated with lower CVD and all cause mortality among patients on PD (n=884) (14)

## Higher Fiber Diet - Uremia

- Gut-kidney axis has been studied often in CKD, limited research among HD patients
- In one study (n=138) examining dialysis clearance of indoxyl sulfate (IS) and p cresyl sulfate (PCS), vegetarian patients had lower IS and PCS levels (15)
- Double blind RCT (n=50), high fiber supplement group showed statistically significant difference in creatinine and uric acid (16)

**From: Effects of fermentable high fiber diet supplementation on gut derived and conventional nitrogenous product in patients on maintenance hemodialysis: a randomized controlled trial**

Laboratory Data	Intervention group (HAM-R52)		Control group (placebo)		p-value	ES
	before	after	Before	after		
SUN	57.69 ± 13.63	52.34 ± 14.08	58.95 ± 16.13	58.61 ± 14.72	0.090	0.43
Creatinine	8.51 ± 2.05	7.48 ± 1.39	8.83 ± 2.45	9.35 ± 2.17	0.006	0.82
Uric acid	7.17 ± 1.11	6.59 ± 1.08	7.85 ± 1.00	7.16 ± 1.16	0.004	0.50
calcium	8.46 ± 0.05	8.66 ± 0.39	8.50 ± 0.64	8.38 ± 1.36	0.081	0.27

Table 2 - Khosroshahi, H.T., Abedi, B., Ghojzadeh, M. *et al.* Effects of fermentable high fiber diet supplementation on gut derived and conventional nitrogenous product in patients on maintenance hemodialysis: a randomized controlled trial. *Nutr Metab (Lond)* **16**, 18 (2019). <https://doi.org/10.1186/s12986-019-0343-x>

## Higher Fiber Diet - Constipation

- Constipation can lead to increased retention of uremic toxins & potassium (13)
  - Higher incidence of fruit intake was associated with decreased constipation (n=305) (17)
  - Patients given 40 grams almonds daily saw significant reduction in constipation (n=20) (18)

## Hyperphosphatemia management

- In the same study examining dialysis clearance of gut derived uremic toxins (n=138), vegetarian patients had lower pre-dialysis serum urea and phosphate (15)
- In a retrospective data analysis of hemodialysis patients (N=358), patients consuming a plant based diet had significantly lower phosphorus intake (19)

## No increased risk for hyperkalemia

- Studies have observed that increase in plant foods specifically resulted in no significant changes to serum potassium
  - In DIET-HD study - patients across a range of F+V intakes has similar pre-dialysis serum K (8)

Table 1. - Baseline characteristics of participants in the Dietary Intake, Death and Hospitalization in Adults with ESKD Treated with Hemodialysis (DIET-HD) study

Variable	No. of Participants with Data	Overall, n=8078	Fruit and Vegetable Intake, Servings per wk		
			0-5.5, n=2520	5.6-10, n=2958	>10, n=2600
<b>Laboratory variables</b>					
Albumin, g/dl	6139	4.0 (0.4)	4.0 (0.4)	4.0 (0.4)	4.0 (0.4)
Phosphorus, mg/dl	7837	4.7 (1.4)	4.7 (1.4)	4.7 (1.4)	4.6 (1.4)
Calcium, mg/dl	7838	8.9 (0.7)	8.9 (0.8)	8.9 (0.7)	9.0 (0.7)
Hemoglobin, g/dl	7837	11.1 (1.3)	11.1 (1.3)	11.1 (1.3)	11.1 (1.3)
Potassium, mEq/L	2353	5.0 (0.7)	5.1 (0.7)	5.0 (0.7)	5.0 (0.7)

Table 1 - Saglimbene, Valeria M et al. Fruit and Vegetable Intake and Mortality in Adults undergoing Maintenance Hemodialysis. *Clinical Journal of the American Society of Nephrology* 14(2):p 250-260, February 2019. | DOI: 10.2215/CJN.08580718

## No increased risk for hyperkalemia

- Additional studies
  - Observational study of 150 patients in one dialysis center showed higher adherence to a “healthy plant based diet” had no association to increased odds of hyperkalemia (19)
  - A small trial of 20 MHD patients prescribed 40 (~1.5 oz) grams almonds daily x4 weeks - no harmful changes in potassium were noted, but constipation was significantly improved (18)

Two great reviews on this topic:

- St-Jules DE, Goldfarb DS, Sevcik MA. Nutrient Non-equivalence: Does Restricting High-Potassium Plant Foods Help to Prevent Hyperkalemia in Hemodialysis Patients? *J Ren Nutr.* 2016 Sep;26(5):282-7. doi: 10.1053/j.jrn.2016.02.005. Epub 2016 Mar 12. Erratum in: *J Ren Nutr.* 2016 Nov;26(6):416. PMID: 26975777; PMCID: PMC5986180.
- 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 Nov;32(6):641-649. doi: 10.1053/j.jrn.2022.01.013. Epub 2022 Feb 5. PMID: 35131414.

# The current state of nutrition care in dialysis

## Goals of MNT in ESRD

- Symptom management
- **Maintain labs within normal range**
- Manage mineral bone disease
- Manage fluid balance
- Prevent malnutrition (common in ESRD patients d/t uremia, taste changes, hormone changes, diet restrictions)
- Address micronutrient deficiencies (often with renal specific multivitamin)
- Avoid worsening diabetes, HTN, heart disease, acidosis
- Maintain healthy weight especially if pursuing transplant (may involve weight loss or weight gain)

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- Symptom management
- Maintain labs within normal range
- Manage fluid balance
- **Prevent malnutrition**
- **Address micronutrient deficiencies**
- **Avoid worsening diabetes, HTN, heart disease, acidosis**
- **Healthy weight**
- **Good quality of life**

## The NEW “renal diet” can support a plant-based approach for dialysis patients

- Individualized based on lab results per the 2020 KDOQI Guidelines

Nutrient	Recommendation
<b>Protein</b>	1.0-1.2 g/kg body weight (on dialysis & metabolically stable) “Insufficient evidence to recommend a protein type”
<b>Phosphorus</b>	Adjust dietary phosphorus to maintain normal serum phosphorus; reasonable to consider bioavailability of phosphorus in foods.
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## **Key takeaways**

### **Comparing 2020 Guidelines to past guidelines**

- No longer includes recommendation to emphasize HBV protein
- NO specific daily allowance for dietary phosphorus & consider bioavailability
- NO specific daily allowance for dietary potassium & consider non-dietary causes

**Potential barriers renal dietitians may face regarding plant based nutrition approaches**



## **First: start with yourself**

- Consider own approach and biases

## **Examination of own beliefs regarding plant foods & dialysis diets**

- As dietitians, we need to start by examining our own beliefs regarding plant based diets and whether they are compatible with a dialysis diet
  - Concerns about protein type/quality/amount
  - Concerns about phosphorus
  - Concerns about potassium

## Micronutrients of concern for a plant-based diet

### Micronutrients of concern on a plant based diet

- Risk for micronutrient deficiency on a plant based diet, if not well planned
- Many ESRD patients already take a multivitamin
  - At the minimum these renal MVI include a B-complex with vitamin C
    - Patients following a *fully* plant based diet should also consider nutrients such as omega 3 fatty acids, iron, B12, iodine, calcium, zinc

## Omega-3 fatty acids

- Academy position paper: “Alpha-linolenic acid (ALA) intakes of vegetarians and vegans are similar to those of nonvegetarians, dietary intakes of the long-chain n-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are lower in vegetarians and typically absent in vegans.”
  - Clinical significance of this is not known
  - Conversion of ALA to DHA/EPA is inefficient and further impaired with DM/HTN (3, 21, 22)
- Supplementing with fish oil or long chain omega-3 fatty acids may be prudent to recommend to dialysis patients on a vegan diet

## Vitamin B12

- A fully vegan diet is lacking in vitamin B12 and it must be taken as a supplement on a fully plant based diet
  - Renal MVI's do contain a small amount of B12
  - Due to poor GI absorption of B12 however a higher dose is typically recommended, if B12 deficiency is a concern
- Recommended dose: 25-100 mcg daily or 2000 mcg weekly (23) orally

## Iodine

- Many of our patients follow a low sodium diet - iodized salt is a primary source of iodine in many American diets
  - Good sources of iodine include fish, dairy, eggs, liver, chicken
  - Found in smaller amounts in plant foods such as nuts
  - Note that the salt in processed foods may not be iodized salt
- Normal levels of iodine seen in HD patients (24) in general
- My suggestion: it is reasonable for dialysis patients following a fully plant based diet should plan to incorporate small amounts of iodized salt into their daily meal plan (½ tsp per day provides ~150mg iodine)

Note: seaweed is a very high iodine plant food but vegan patients on dialysis may want to shy away using as a primary source iodine intake, as cases of iodine toxicity in the general population have been reported in the literature with very high seaweed intake. (25)

## Zinc

- Zinc deficiency prevalent among dialysis patients (26) - and also a nutrient of concern among vegetarians (27)
- Reasonable to use a MVI that contains zinc especially for vegetarian patients

# Helping patients implement plant based diets

## Patient education

- Potential barriers to anticipate in educating patients
  - Resistance to incorporating “off limits” foods like beans, nuts, etc.
  - Resistance to unfamiliar foods such as tofu, tempeh, lentils
  - Misunderstanding of “plant based” - with the prevalence of mock meats patients may interpret guidance to eat plant based as suggestions to choose Beyond Meat, Impossible Meat, etc.
  - Misunderstanding “plant based” as a 100% vegan diet

## **First Steps to exploring plant forward diet changes with patients**

- Use terminology that patients are receptive to hearing:
  - Consider using terminology like plant-forward or plant-focused
  - Instead of talking broadly about a plant based diet, consider discussing specific changes such as opportunities to increase plant proteins or ways to increase F+V

## **First Steps to exploring plant forward diet changes with patients**

- Open discussion regarding plant foods patients may already enjoy and want to incorporate into their diet
  - Ex: peanut butter, mixed nuts, beans, lentils
  - Ask patients: “how would you use this food in a meal?”

## First Steps to exploring plant forward diet changes with patients

- Provide sample plant forward meal plan, recipe ideas
- Recommend protein supplement, if needed, to meet daily need

## Sample Meals for a 90g Protein Day

1.2 grams protein/kg body weight - 170 lb adult

- Breakfast: 15 g protein
  - 1 whole grain waffle, 2 Tbsp peanut butter, 1 medium banana, ½ c soy milk (15g protein)
  - ½ c oatmeal, 1 c blueberries, 2 Tbsp hemp seeds, ½ c soy milk (17g protein)
- Protein drink:
  - Kate Farms Renal Support Nutrition Shake (20g protein)
  - Soylent Complete Protein Shake (30g protein)
- Lunch:
  - Tofu “egg salad” sandwich on whole grain bread, medium apple (18 g protein)
  - ⅔ cup brown rice, ⅔ cup shelled edamame, 2 oz avocado, ½ c chopped cucumber, 1 Tbsp sesame seeds with ginger sesame dressing (18g protein)
  - Homemade black bean flax burger on a whole grain bun, 2 cups chopped veggie salad (18g protein)
  - Sweet Earth Frozen Veggie Lo Mein Bowl (17g protein)
- Snack:
  - 1 cup celery + 2 Tbsp peanut butter (9g protein)
  - 5oz soy yogurt, ⅓ cup granola, ½ chopped pear (9g protein)
- Dinner:
  - Bowl of lentil soup, 1 cup steamed broccoli (16 g protein)
  - Stirfry with 4oz tofu, 1 cup mixed veggies, ½ cup whole wheat noodles (22g protein)
- Snack:
  - ½ cup roasted chickpeas, 2 mandarin oranges (10g protein)
  - 4oz silken tofu chocolate pudding (10g protein)

## Summary

- There is promising evidence for use of plant based diets in dialysis patients
- Current kidney nutrition guidelines allow for the flexibility of incorporating plant foods
- In practice, we should anticipate running into implementation barriers and be prepared to discuss changing nutritional guidance with patients
- We can help patients eating more plant based get an appropriate balance of nutrients and enjoy varied, flavorful meals

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