



Improving Awareness & Patient Outcomes

# Hot Topics in Polycystic Kidney Disease (PKD) Nutrition



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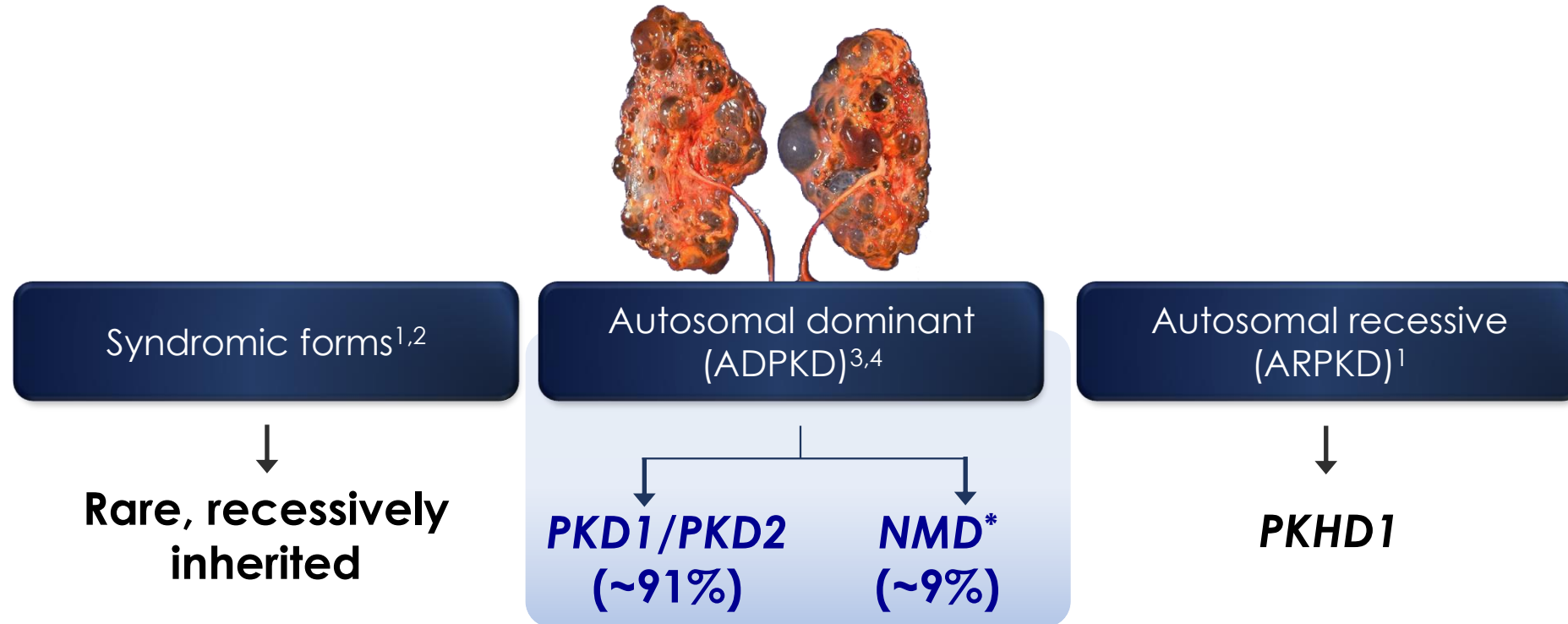
# Objectives

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- Overview of Polycystic Kidney Disease (PKD)
- Review the Current State of Nutrition Guidelines in PKD
- Discuss Hot Topics in PKD Nutrition
- Highlight Dietary Recommendations for PKD
- Explore Implementation Strategies
- Examine Resources

# What Is PKD?

Polycystic kidney disease (PKD) is a group of monogenic disorders characterized by the propensity to develop numerous renal cysts<sup>1</sup>



\*The “no mutation detected” (NMD) group may contain those patients with mutations in other genes impacting cystic development, such as GANAB.<sup>5</sup>

ADPKD=autosomal dominant PKD; ARPKD=autosomal recessive PKD; GANAB=gene encoding glucosidase II subunit- $\alpha$ ; NMD=no mutation detected; PKD=polycystic kidney disease; PKHD1=polycystic kidney and hepatic disease 1.

1. Harris PC and Torres VE. (2009). *Annu Rev Med.* 60:321-337. 2. Jauregui AR et al. (2005). *Exp Cell Res.* 305(2):333-342. 3. Heyer CM et al. (2016). *J Am Soc Nephrol.* 27(9):2872-2884.

4. Irazabal MV et al. (2017). *Nephrol Dial Transplant.* 32(11):1857-1865. 5. Lanktree MB, Chapman AB. (2017). *Nat Rev Nephrol.* 13(12):750-768.

# ADPKD Is the Most Common Life-threatening Inherited Renal Disease

ADPKD does not discriminate on gender, race, ethnicity, or geography<sup>1,2</sup>

- ADPKD affects both sexes equally, and occurs in all ethnicities<sup>3</sup>
- ADPKD is the fourth leading cause of ESRD in the United States<sup>2</sup>, and accounts for up to ~5% of all patients with ESRD<sup>2</sup>
- As many as 1:2000 people worldwide are currently diagnosed with ADPKD,<sup>4</sup> and between 1:400 and 1:1000\* people living today will be diagnosed with ADPKD in their lifetime<sup>1</sup>
- The median age of death or kidney failure in patients with a PKD1 mutation is 53 years<sup>5</sup>
- The median age of death or kidney failure in patients with a PKD2 mutation is 69 years<sup>5</sup>

\*The higher prevalence value of 1:1000 is believed to be inaccurate because the data are based on a postmortem study and therefore report lifetime morbid risk rather than point prevalence.

ADPKD=autosomal dominant polycystic kidney disease; ESRD=end-stage renal disease.

1. Torres VE, Harris PC. (2009). *Kidney Int.* 76(2):149-168. 2. United States Renal Data System. 2016 USRDS Annual Data Report Volume

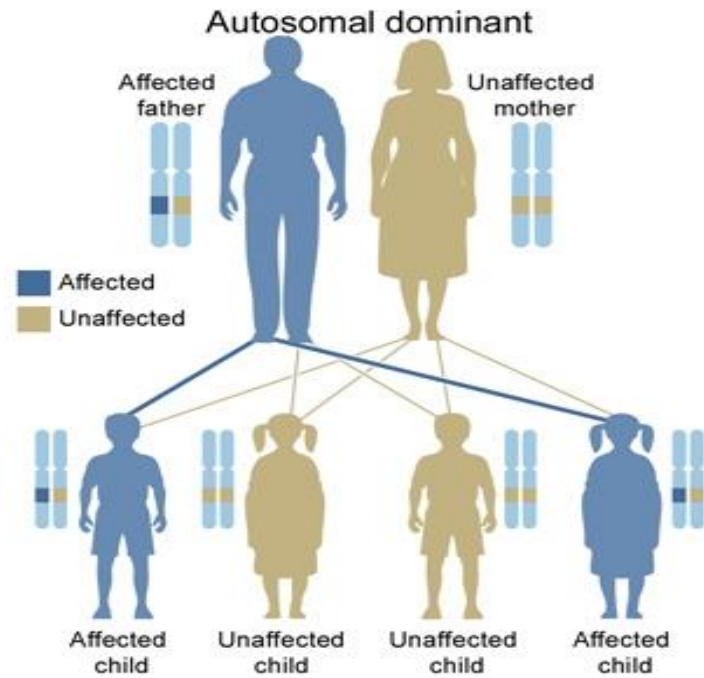
2. ESRD in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2016 (accessed 14 February 2019).

3. Chebib FT, Torres VE. (2016). *Am J Kidney Dis.* 67(5):792-810.

4. Willey C. DRAFT: The Descriptive Epidemiology of ADPKD in the U.S. 2017.

5. Hateboer N et al. (1999) *Lancet.* 353(9147):103-107

# ADPKD Variability in Disease Severity



U.S. National Library of Medicine

Figure adapted from U.S. National Library of Medicine

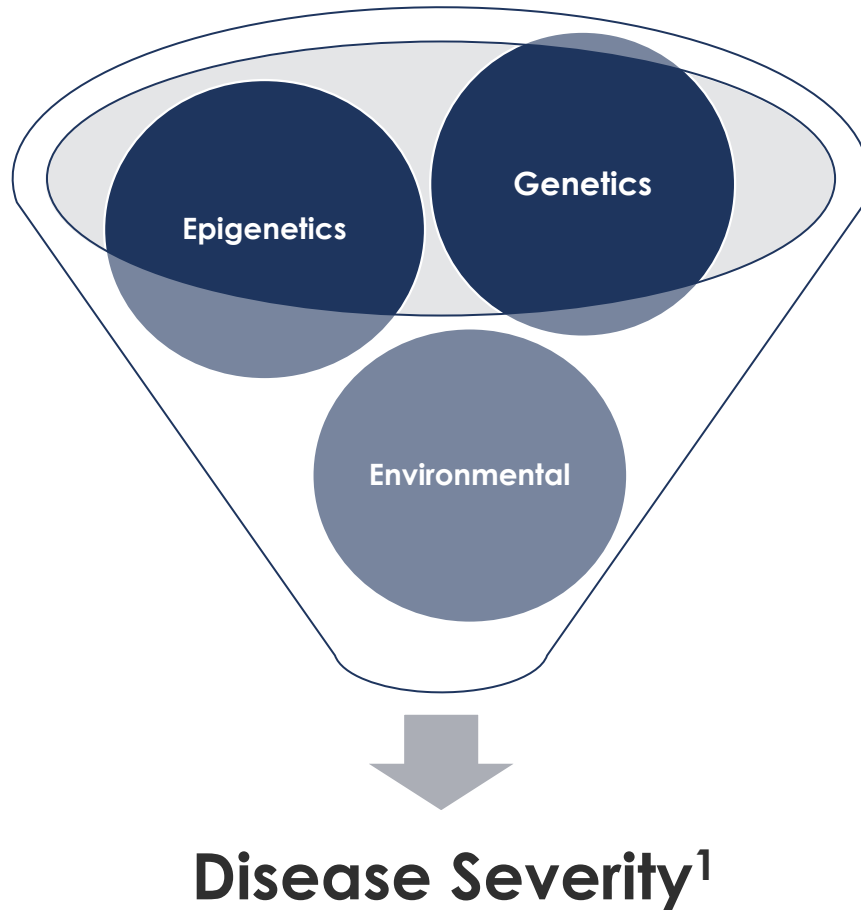
Inheritance pattern of autosomal dominant disease<sup>4</sup>

- ADPKD has a high degree of penetrance<sup>1</sup>
- A child of an affected parent has a 50% chance of inheriting ADPKD<sup>1</sup>
- Disease progression can be highly variable, even among family members sharing the same genetic mutation<sup>2</sup>

ADPKD=autosomal dominant polycystic kidney disease.

1. Harris PC, Rossetti S. (2010). *Nat Rev Nephrol.* 6(4):197-206. 2. Reed B et al. (2008). *Am J Kidney Dis.* 52(6):1042-1050.

# Factors Affecting Disease Severity

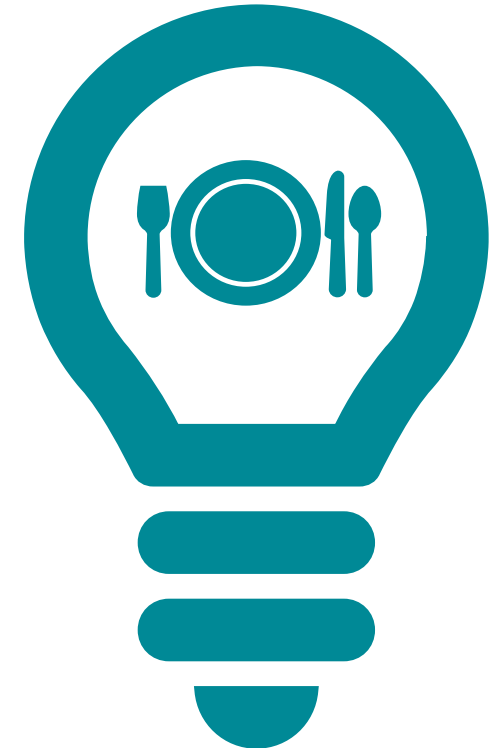


- **Environmental Factors** amenable to lifestyle modification can meaningfully impact disease progression<sup>2</sup>
- Obesity was found to be associated with a greater rate of kidney enlargement and functional decline in early-stage ADPKD<sup>2</sup>
- Components of metabolic syndrome are also associated with more severe ADPKD<sup>2</sup>

1. Chebib FT, Torries VF. Am J Kidney Dis 2021; 78: 282-292. 2. Pickel et al (2022). Adv Nutr. 13:652-666

# Nutrition and PKD

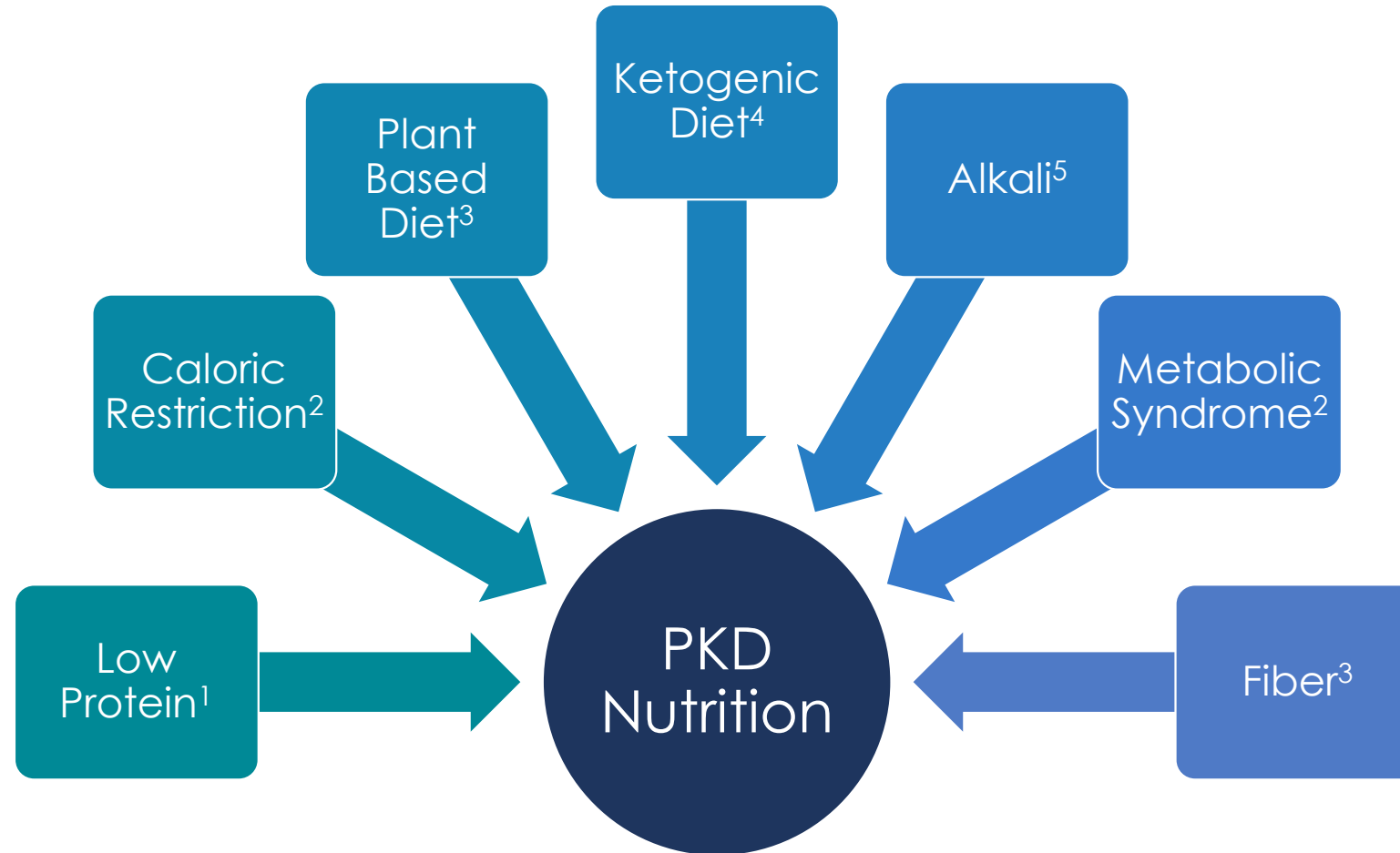
- Dietary intervention is a key part of the care of CKD patients and aims at preventing CKD progression, limiting the negative impact of CKD complications, or complications derived from the cause of CKD while preserving the nutritional status<sup>1</sup>
- Nutrition guidelines for PKD generally follow the same guidelines for CKD<sup>2</sup>, without specific dietary therapy to address mechanisms involved in cystogenesis, cyst growth, fibrosis, inflammation, and disease progression<sup>3</sup>
- However, recent evidence suggests that more tightly specified dietary regimens hold promise to slow disease progression, and the results of ongoing human clinical trials are eagerly awaited<sup>4</sup>



1. Carriazo S, Perez-Gomez MV, Cordido A, García-González MA, Sanz AB, Ortiz A, Sanchez-Niño MD. Dietary Care for ADPKD Patients: Current Status and Future Directions. *Nutrients*. 2019 Jul 12;11(7):1576.
2. Meijer E, Gansevoort RT. Emerging non-pharmacological interventions in ADPKD: an update on dietary advices for clinical practice. *Curr Opin Nephrol Hypertens*. 2021;30(5):482-492.
3. Bruen DM, Kingaard JJ, Munits M, Paimanta CS, Torres JA, Saville J, Weimbs T. Ren.Nu, a Dietary Program for Individuals with Autosomal-Dominant Polycystic Kidney Disease Implementing a Sustainable, Plant-Focused, Kidney-Safe, Ketogenic Approach with Avoidance of Renal Stressors. *Kidney and Dialysis*. 2022; 2(2):183-203.
4. Pickel L, Iliuta LA, Scholey J, Pei Y, Sung HK. Dietary Interventions in Autosomal Dominant Polycystic Kidney Disease, *Advances in Nutrition*, Volume 13, Issue 2, March 2022, Pages 652–666.



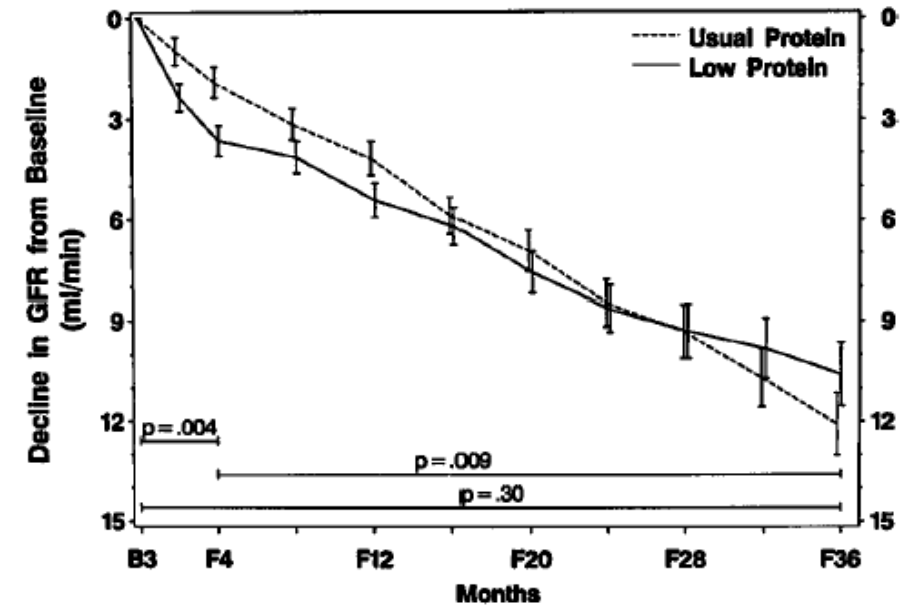
# Hot Topics



1. Klahr S et al. Dietary protein restriction, blood pressure control, and the progression of polycystic kidney disease. *Modification of Diet in Renal Disease Study Group. J Am Soc Nephrol.* 1995 Jun 1;5(12):2037–47. 2. Pickel L et al.; Dietary Interventions in Autosomal Dominant Polycystic Kidney Disease. *Advances in Nutrition, Volume 13, Issue 2, March 2022, Pages 652–666.* 3. Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. *Am J Kidney Dis.* 2021;77(2):287-296. 4. Bruen DM, Kingaard JJ, Munits M, Paimanta CS, Torres JA, Saville J, Weimbs T. Ren.Nu, a Dietary Program for Individuals with Autosomal-Dominant Polycystic Kidney Disease Implementing a Sustainable, Plant-Focused, Kidney-Safe, Ketogenic Approach with Avoidance of Renal Stressors. *Kidney and Dialysis.* 2022; 2(2):183-203. 5. Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017;377(18):1765–76.

# Low Protein

- Animal studies investigating the effect of protein source on PKD progression report better outcomes with soy (plant) compared to casein (animal)<sup>1</sup>
- In the Modification of Diet in Renal Disease (MDRD) study of 200 patients with ADPKD, a low-protein diet (0.58 g/kg/d) showed no protective effect for a GFR range of 25-55 mL/min/1.73 m<sup>22,3</sup>
- A secondary analysis of the MDRD study showed a 28% slower mean GFR decline in the low protein diet group from 4 months to end of follow-up (36 months)<sup>3</sup>
- An observational study following 589 patients with ADPKD for 4 years found that higher salt (9.1 g/day), but not higher protein intake (84 g/day), was significantly associated with kidney function decline<sup>4</sup>



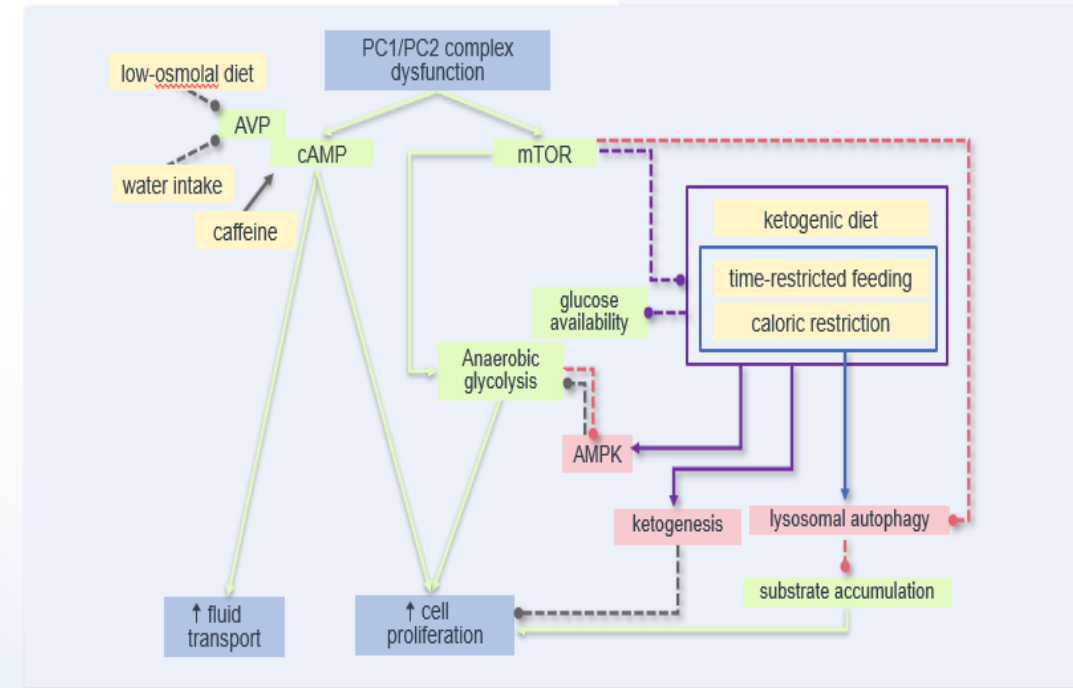
Although evidence on protein restriction is mixed for patients with PKD, many experts recommend avoiding excess protein to prevent an increased rate of kidney function decline

1. Pickel L et al.; Dietary Interventions in Autosomal Dominant Polycystic Kidney Disease, *Advances in Nutrition*, Volume 13, Issue 2, March 2022, Pages 652–666. 2. Klahr S et al. Dietary protein restriction, blood pressure control, and the progression of polycystic kidney disease. *Modification of Diet in Renal Disease Study Group. J Am Soc Nephrol.* 1995 Jun 1;5(12):2037–47. 3. Levey A. et al. Dietary protein Restriction and the Progression of Chronic Renal Disease: What Have All of the Results of the MDRD Study Shown? *J Am Soc Nephrol* 1999 10: 2426-2439. 4. Kramers BJ, Koorevaar IW, Drenth JPH, et al. Salt, but not protein intake, is associated with accelerated disease progression in autosomal dominant polycystic kidney disease. *Kidney Int.* 2020;98(4):989-998.

# Caloric Restriction

- The mammalian target of rapamycin (mTOR) signaling pathway is irregularly activated in renal cysts in patients with ADPKD<sup>1</sup>
- Suppression of the mTOR pathway via caloric restriction has been shown in animal models to effectively slow the course of disease progression in ADPKD<sup>1</sup>

## Potential dietary interventions in cellular pathways







Carrazio S, et al. *Nutrients*. 2018;11:1576.

1. Carrazio S, Perez-Gomez MV, Cordido A, García-González MA, Sanz AB, Ortiz A, Sanchez-Niño MD. Dietary Care for ADPKD Patients: Current Status and Future Directions. *Nutrients*. 2019 Jul 12;11(7):1576.

# Caloric Restriction

- In general, caloric restriction has many benefits for metabolic health and increasing lifespan<sup>1</sup>
- A recent pilot study that suggested that weight loss due to daily caloric restriction or intermittent fasting in obese and overweight individuals with ADPKD correlated with slowed kidney growth<sup>2</sup>

## Dietary interventions: benefits, risks, and status in PKD

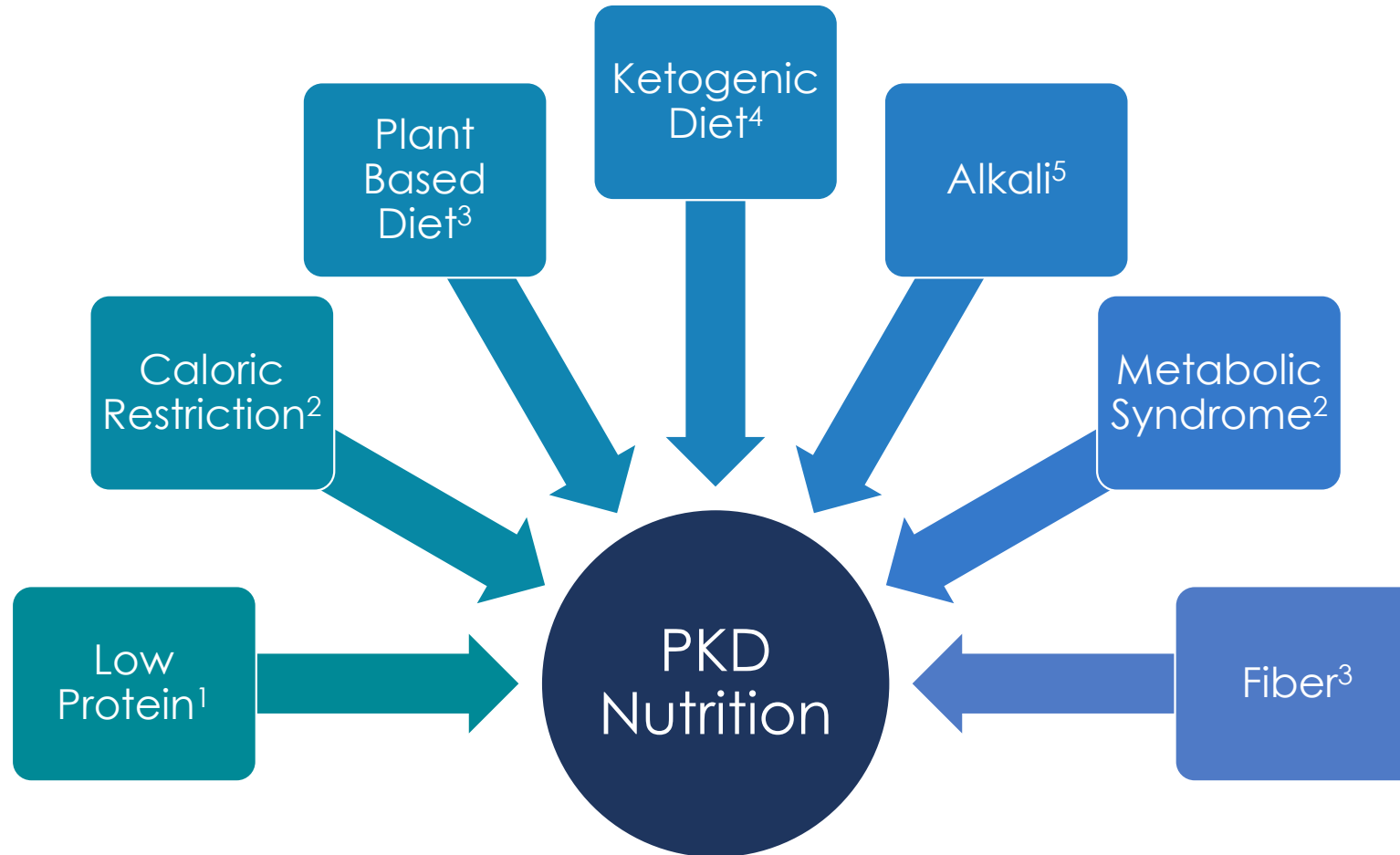
| DIET   | METABOLIC BENEFITS   | SIDE EFFECTS  | EVIDENCE IN ADPKD   |                     | CLINICAL TRIAL             |  |
|--|--|---|---|---------------------|----------------------------|--|
|  |  |   | Non-orthologous animals   | Orthologous animals |                            |  |
| <b>Caloric restriction (CR)</b><br>     | Daily restriction of energy intake   | ↓ weight<br>↓ blood pressure<br>↑ insulin sensitivity<br>• Improve lipids   | • hunger<br>• irritability<br>• fatigue<br>• loss of lean mass  | No                  | Yes (22, 63)               | Ongoing (NCT03342742; 34% CR)                    |
| <b>Intermittent fasting (IF)</b><br>    | Alternating days of ad libitum eating and fasting or severe CR             | ↓ weight<br>↓ blood pressure<br>↑ insulin sensitivity<br>↑ glycemic control<br>• improve lipids<br>• appetite control | • hunger during fasting period (less severe during TRE, may resolve with time)<br>• inconvenience, social eating challenges | No                  | No                         | Ongoing (NCT03342742; 34% CR) 0% CR, 3 days/week |
| <b>Time-restricted eating (TRE)</b><br> | Daily restriction of feeding window; ad libitum feeding during this window | ↓ weight<br>↓ blood pressure<br>↑ insulin sensitivity<br>• improve lipids<br>• appetite control                       | • hunger during fasting period (less severe during TRE, may resolve with time)<br>• inconvenience, social eating challenges | Yes (87)            | Yes (63)                   | Ongoing (NCT04534985)                            |
| <b>Ketogenic diet (KD)</b><br>          | High fat, moderate protein, very low carbohydrate (<20 g/day)              | ↓ weight<br>↓ blood pressure<br>↑ glycemic control<br>• appetite control  | • transient flu-like symptoms<br>• potential dyslipidemia   | Yes (87)            | Yes (Persian cats n=4, 87) | Ongoing, 2 (29; NCT04472624)                     |

Pickel L, et al. *Adv Nutrition*. 2022;13:652-666.

Dietary regimens including caloric restriction have shown promise in slowing ADPKD progression. Clinical trials currently underway promise to improve our understanding of the impact of diet on ADPKD.

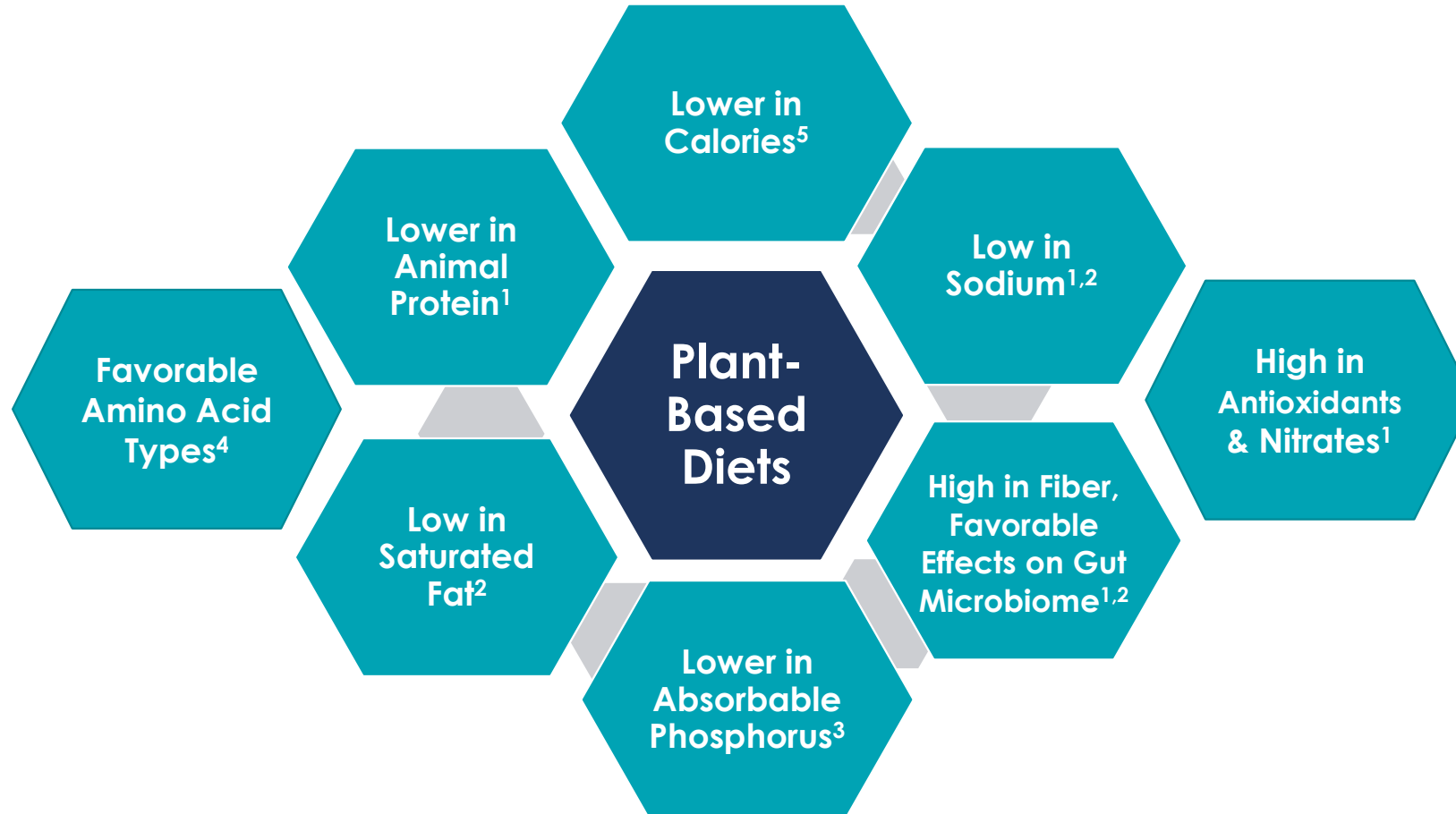
- Picca A. et al (2017). *Clin Interv Aging*. 12:1887-1902.
- Hopp K, Catenacci VA, Dwivedi N, et al. *iScience*. 2021;25(1):103697. Published 2021 Dec 27.
- Pickel L. et al (2022). *Adv Nutr*. 13:652-666

# Hot Topics



1. Klahr S et al. Dietary protein restriction, blood pressure control, and the progression of polycystic kidney disease. *Modification of Diet in Renal Disease Study Group. J Am Soc Nephrol.* 1995 Jun 1;5(12):2037–47. 2. Pickel L et al.; Dietary Interventions in Autosomal Dominant Polycystic Kidney Disease. *Advances in Nutrition, Volume 13, Issue 2, March 2022, Pages 652–666.* 3. Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. *Am J Kidney Dis.* 2021;77(2):287-296. 4. Bruen DM, Kingaard JJ, Munits M, Paimanta CS, Torres JA, Saville J, Weimbs T. Ren.Nu, a Dietary Program for Individuals with Autosomal-Dominant Polycystic Kidney Disease Implementing a Sustainable, Plant-Focused, Kidney-Safe, Ketogenic Approach with Avoidance of Renal Stressors. *Kidney and Dialysis.* 2022; 2(2):183-203. 5. Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017;377(18):1765–76.

# Some Potential Benefits of Plant-Based Diets



1. Joshi S, et al. Plant-based diets and hypertension. *Am J Lifestyle Med.* 2019, 14(4): 397-405.
2. Cases A, et al. Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients* 2019; 11: 1263.
3. Joshi S, Shah S, Kalantar-Zadeh K. Adequacy of plant-based proteins in chronic kidney disease. *J Renal Nutr.* 2019; 29 (2):112-117.

4. Tuttle KR, et al. Dietary amino acids and blood pressure: A cohort study of patients with cardiovascular disease. *Am J Kidney Dis.* 2012; 59(6):803-809.
5. Turner-McGrievy et al. A plant-based diet for overweight and obesity prevention and treatment. *JGC* 2017; 14: 369-374

# Examples and Descriptions of Various Plant-Based Diets

## DASH Diet

- A specific dietary strategy designed to emulate the health-promoting effects of plant-based diet but allow for some animal-based foods, such as lean meat and low-fat dairy. Modern iterations have emphasized the unprocessed forms of fruits, vegetables, legumes, and grains (as opposed to fruit juices, refined grains, etc).

## Mediterranean

- The Mediterranean diet typically emphasizes whole plant foods from that area with moderate consumption of lean meats, dairy, and seafood. Added sugars, processed foods, and red meat are generally excluded but healthy fats such as olive oil are included.

## Flexitarian

- Also commonly referred to as a "semi-vegetarian." Represents a diet that emphasizes plant-based foods but may periodically include meat and other animal-based foods.

## Vegetarian

- A diet that excludes meat (beef, pork, chicken) but may include fish, dairy, or eggs and often specified as a pescatarian, lactovegetarian, or ovovegetarian, respectively. Combinations of these are possible.

## Whole-Food Plant Based

- A diet that emphasizes the consumption of whole plant-based foods as opposed to refined or processed plant foods (such as potato chips or white bread) while still typically avoiding animal-based foods. It is also the diet most widely promulgated by health professionals recommending a plant-based diet.

## Vegan

- A diet and in some cases a lifestyle that avoids the use of products derived from animals.

## PLADO

- Plant-dominant low-protein diet for patients with kidney disease: 0.6-0.8 g/kg per day of dietary protein with >50% from plant-based sources, dietary sodium < 4 g/d (<3 g/d if uncontrolled hypertension or edema), and dietary energy of 30-35 Cal per kilogram of ideal body weight per day.

1. Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. *Am J Kidney Dis.* 2021;77(2):287-296.

# A Plant-Focused Ketogenic Diet for Patients with Polycystic Kidney Disease

## Design and Features

- Beta-test of 24 participants with Autosomal Dominant Polycystic Kidney Disease
- No control arm
- 12-week program
- Plant-based diet with some dairy, eggs, and fish
- Low-carb, high fat diet to promote ketone production
- Protein intake < 0.8 g/kg/day
- 2 servings of a medical food containing beta-hydroxybutyrate, citrate, electrolytes, and alkali

## Key Outcomes

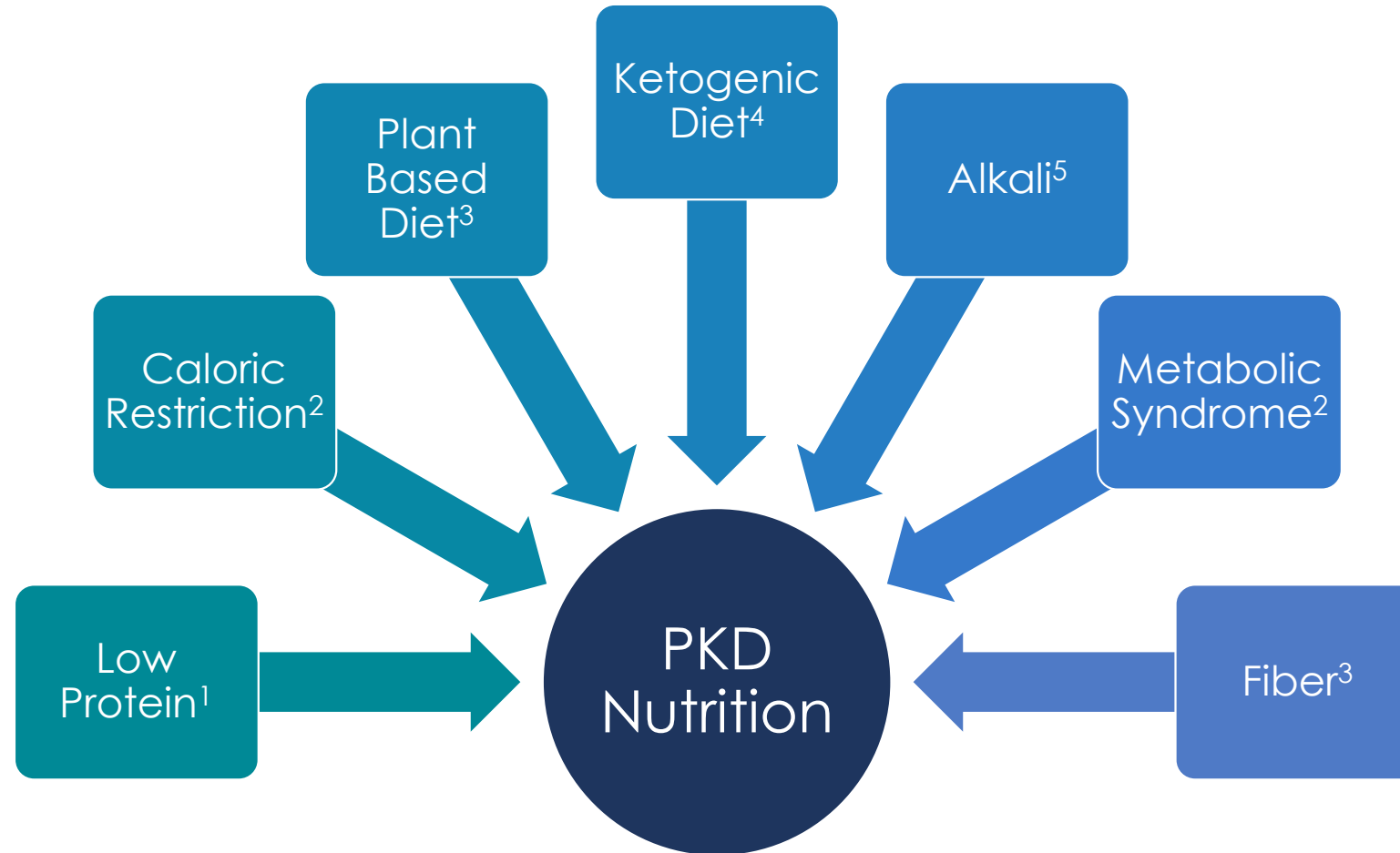
- 20 participants completed the beta test
- Favorable results in regard to satisfaction with the dietary program
- Average weight loss 8.9 lbs
- Fasting blood sugar decreased by 19 mg/dL
- BP improved (data not reported)
- Average creatinine decreased by 0.1 mg/dL and average eGFR increased by 4.4 mL/min/1.73m<sup>2</sup>

Initial studies of plant-focused ketogenic diets for PKD have been encouraging, but more research is needed

1. Bruen DM, Kingaard JJ, Munits M, Paimanta CS, Torres JA, Saville J, Weimbs T. Ren.Nu, a Dietary Program for Individuals with Autosomal-Dominant Polycystic Kidney Disease Implementing a Sustainable, Plant-Focused, Kidney-Safe, Ketogenic Approach with Avoidance of Renal Stressors. *Kidney and Dialysis*. 2022; 2(2):183-203.



# Hot Topics



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# Alkali

- Metabolic acidosis is associated with more rapid kidney disease progression and an increase in the overall risk of death<sup>1</sup>
- In patients with PKD, low serum bicarbonate within the normal range is associated with worse kidney function and further eGFR decline<sup>2</sup>
- Plant-based foods have natural dietary alkali in the form of citrate and malate, which can be converted to bicarbonate. Natural alkali in these foods may facilitate the intracellular movement of potassium, especially in metabolic acidosis<sup>3</sup>
- Adjunctive alkali therapy can also be considered to mitigate acidosis in patients with chronic kidney disease<sup>1</sup>

Alkali improves acidosis, and slows progression of chronic kidney disease<sup>4</sup>

1. Kalantar-Zadeh K, Fouque D. Nutritional management of chronic kidney disease. *N Engl J Med.* 2017;377(18):1765–76. 2. Charles J Blijdorp, David Severs, Usha M Musterd-Bhaggoe, Ronald T Gansevoort, Robert Zietse, Ewout J Hoorn, DIPAK Consortium, Serum bicarbonate is associated with kidney outcomes in autosomal dominant polycystic kidney disease, *Nephrology Dialysis Transplantation*, Volume 36, Issue 12, December 2021, Pages 2248–2255. 3. Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. *Am J Kidney Dis.* 2021;77(2):287-296. 4. Kalantar-Zadeh K, Jafar TH, Nitsch D, Neuen BL, Perkovic V. Chronic kidney disease. *Lancet.* 2021;398(10302):786-802.

# Obesity and Metabolic Syndrome

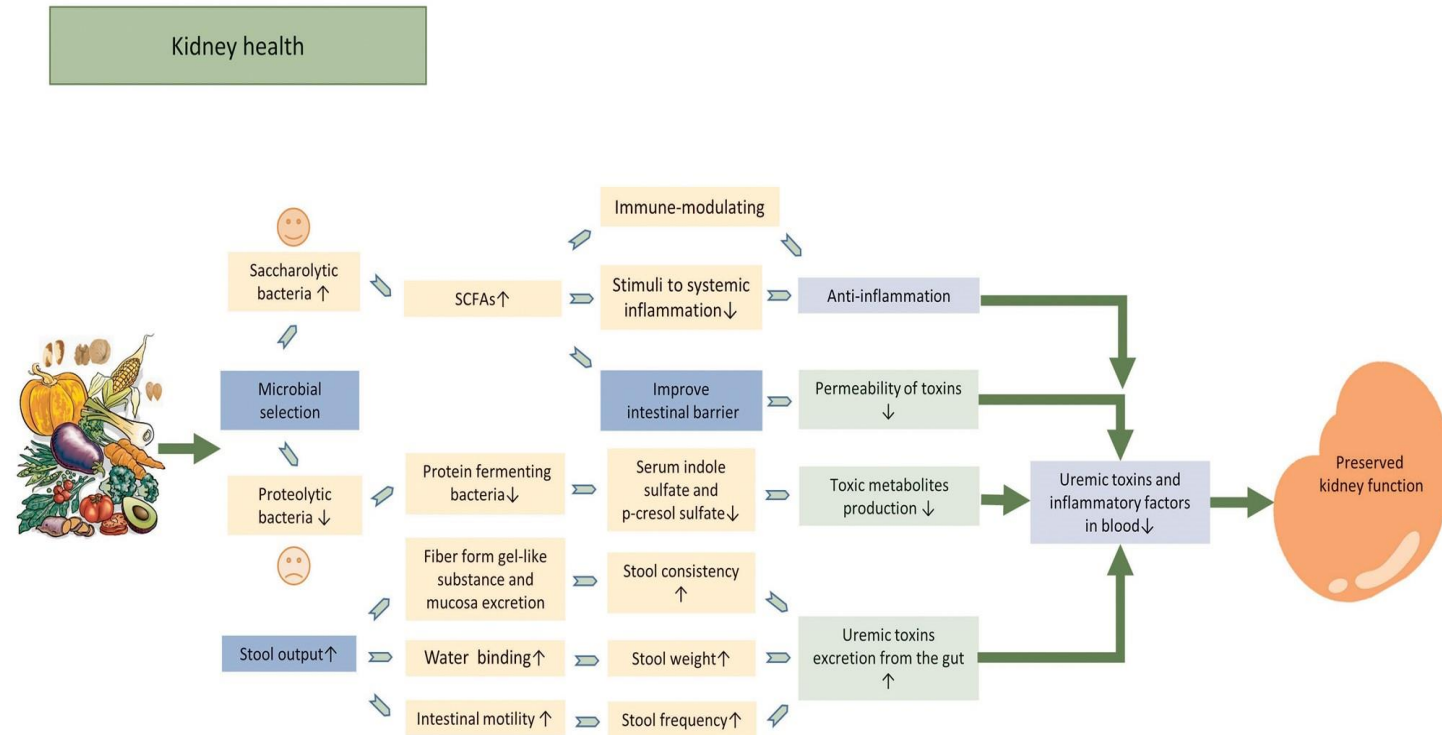
- In the HALT PKD trial, overweight body mass and particularly obesity were strong independent predictors of TKV growth and GFR decline in early-stage ADPKD<sup>1</sup>
- There is increasing evidence that in ADPKD, a defective metabolism exists involving a dysregulated lipid and mitochondrial metabolism, and a defective glucose mechanism, similar to the Warburg effect in cancer<sup>2</sup>
- Abnormalities in metabolic regulation observed in the cystic kidney share common features in individuals with metabolic disease and associated with obesity, including alterations in nutrient signaling pathways and the activation of chronic inflammation<sup>3</sup>

There is intriguing possibility to decrease cyst growth by influencing glucose metabolism by dietary interventions<sup>1</sup>

1. Carriazo S, Perez-Gomez MV, Cordido A, García-González MA, Sanz AB, Ortiz A, Sanchez-Niño MD. Dietary Care for ADPKD Patients: Current Status and Future Directions. *Nutrients*. 2019 Jul 12;11(7):1576. 2. Meijer E, Gansevoort RT. Emerging non-pharmacological interventions in ADPKD: an update on dietary advices for clinical practice. *Curr Opin Nephrol Hypertens*. 2021;30(5):482-492. 3. Pickel L et al., Dietary Interventions in Autosomal Dominant Polycystic Kidney Disease, *Advances in Nutrition*, Volume 13, Issue 2, March 2022, Pages 652–666.

# Fiber

- High fiber intake has been associated with lower mortality and incidence of chronic diseases both in general and CKD populations, by decreasing inflammation<sup>2</sup>
- Fibers are emerging as nutritional components fundamental in promoting gut microbiota balance, regulating uremic toxins, and decreasing local and systemic inflammation suggesting a potential nephroprotective role<sup>2</sup>



1. Guobin Su, Xindong Qin, Changyuan Yang, Alice Sabatino, Jaimon T Kelly, Carla Maria Avesani, Juan Jesus Carrero, on behalf of the ERA European Renal Nutrition Working Group, an official body of the ERA, Fiber intake and health in people with chronic kidney disease, *Clinical Kidney Journal*, Volume 15, Issue 2, February 2022, Pages 213–225. 2. Carriazo S, Perez-Gomez MV, Cordido A, García-González MA, Sanz AB, Ortiz A, Sanchez-Niño MD. Dietary Care for ADPKD Patients: Current Status and Future Directions. *Nutrients*. 2019 Jul 12;11(7):1576.

# Dietary Recommendations in PKD

## Dietary Fiber<sup>5</sup>

25-38 g/day

## Increase fruits and vegetables<sup>3</sup>

2-4 cups/d

## Diet low in phosphorus<sup>1,4</sup>

Avoid processed foods

## Caloric Restriction to maintain a normal BMI<sup>1,2,4</sup>

20-25 kg/m<sup>2</sup>

## Consult a Renal Dietician

## Plant-Based Diets<sup>3,4</sup>

(e.g., DASH/PLADO Diet)

## Moderate sodium restriction<sup>1,2,4</sup>

2.3-3 g daily

## Moderately enhanced hydration, spread out over 24 hours<sup>1,2</sup>

Maintain urine osmolality  $\leq 280$  mOsm/kg

## Lower protein diet<sup>1,2</sup>

0.8-1.0 g/kg ideal body weight

## Anticipated Management Recommendations

Keto Diet, Microbiome

PKD= polycystic kidney disease; BMI=body mass index.

1. Chebib FT et al. (2018). *J Am Soc Nephrol*. 29(10):2458-2470. 2. Meijer E, Gansevoort RT. Emerging non-pharmacological interventions in ADPKD: an update on dietary advices for clinical practice. *Curr Opin Nephrol Hypertens*. 2021;30(5):482-492. 3. Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. *Am J Kidney Dis*. 2021;77(2):287-296. 4. Kalantar-Zadeh K, Jafar TH, Nitsch D, Neuen BL, Perkovic V. Chronic kidney disease. *Lancet*. 2021;398(10302):786-802. 5. Carriazo S, Perez-Gomez MV, Cordido A, García-González MA, Sanz AB, Ortiz A, Sanchez-Niño MD. Dietary Care for ADPKD Patients: Current Status and Future Directions. *Nutrients*. 2019 Jul 12;11(7):1576.

# Putting Plant Foods into Practice: *Strategies to Implement*

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“Meet patients where they are at”

Start with small changes

Provide recipes, meal and snack examples

Simplify

# Interested in Learning More? Check Out These Resources

- [NephU Kidney Kitchen Creations Cookbook](#): The NephU Kitchen Creations for Kidney Health Cookbook from the NephChef provides an assortment of kidney-friendly recipes ranging from appetizers to entrées to kidney-healthy desserts, that are rich in flavor and meet several nutritional guidelines. Download your copy today.
- [NephU Nutrition & The NephChef™](#): NephU provides a platform to emphasize the importance of proper nutrition and diet for patients with acute and chronic kidney diseases. The NephU Nutrition & The NephChef™ contains evidence-based information, best practices, and insights to help with shared decision-making.
- [www.kidney.org/atoz/content/plant-based](http://www.kidney.org/atoz/content/plant-based): An informative series of webpages created by the National Kidney Foundation to help educate patients and physicians alike on plant-based diets for the prevention and treatment of kidney disease, its causes, and its complications
- [www.nutritionfacts.org](http://www.nutritionfacts.org): A not-for-profit website offering evidence-based information in the form of videos and articles on timely aspects of plant-based nutrition and other dietary issues
- [www.PCRM.org](http://www.PCRM.org): A not-for-profit organization focused on improving patient and societal health through the consumption of plant-based diets, offering free physician education, including CME, and patient education materials, such as starter kits and brochures
- <https://vegetariannutrition.net/>: The consumer/patient website of the Vegetarian Nutrition Dietetic Practice Group, a dietetic practice group of the Academy of Nutrition and Dietetics, offering patient-level information on plant-based diets
- [www.vndpg.org](http://www.vndpg.org): The professional website of the Vegetarian Nutrition Dietetic Practice Group, a dietetic practice group of the Academy of Nutrition and Dietetics, offering professional information for health care professionals, including registered dietitians

1. Joshi S, McMacken M, Kalantar-Zadeh K. Plant-Based Diets for Kidney Disease: A Guide for Clinicians. *Am J Kidney Dis.* 2021;77(2):287-296.