



Improving Awareness & Patient Outcomes

# Nutritional Considerations in Peritoneal Dialysis (PD)



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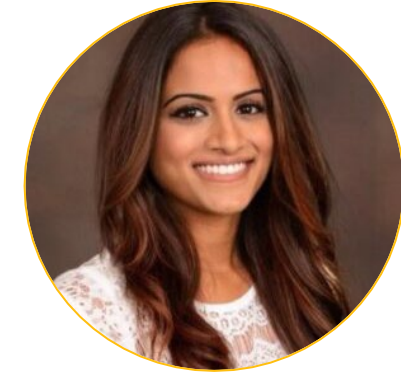
# Today's Presenters:



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# Objectives

1. Review the key differences between peritoneal dialysis (PD) and hemodialysis (HD)
2. Discuss the relationship between PD and dietary macronutrients and electrolytes
3. Discuss nutritional recommendations and considerations for patients receiving PD

# PD Overview

# Peritoneal Dialysis (PD) vs Hemodialysis (HD)

## PD

- Ongoing dialysis that collects waste from the blood by washing the empty space in the abdomen<sup>1</sup>
- Benefits of PD compared to HD include<sup>2</sup>:
  - Improved quality of life
  - Reduced cost
  - More flexible dietary restrictions
  - Improved residual kidney function preservation and early survival benefit
- Challenges include<sup>1-3</sup>
  - More “hands on”
  - Dextrose absorption from dialysate and protein loss
  - Gastric emptying

## HD

- Intermittent dialysis (3 to 5 times a week) that filters waste from the blood
- Benefits of HD include<sup>4</sup>:
  - More “hands off”
- Challenges include<sup>4</sup>:
  - Increased dietary restrictions
  - Reduced autonomy, flexibility, and quality of life
  - Increased cost

1. National Kidney Foundation. *Peritoneal Dialysis* <https://www.kidney.org/atoz/content/peritoneal>. Reviewed 3. June 1, 2021. Accessed on August 4, 2023.

2. Mayo Clinic. *Peritoneal Dialysis*. <https://www.mayoclinic.org/tests-procedures/peritoneal-dialysis/about/pac-20384725>. Reviewed May 2, 2023. Accessed on August 4, 2023.

Teta, D. *Nutrition support in peritoneal dialysis patients*.

[https://www.llnnutrition.com/mod\\_III/TOPIIC15/m154.htm](https://www.llnnutrition.com/mod_III/TOPIIC15/m154.htm). Accessed August 4, 2023.

4. National Kidney Foundation. Understanding the pros and cons of hemodialysis. <https://www.kidney.org/contents/understanding-pros-and-cons-hemodialysis>. Accessed August 4, 2023

# Epidemiology of PD and Malnutrition



>130,000 individuals newly diagnosed with end stage kidney disease (ESKD) in the United States in 2020, of which 12.7% receive PD<sup>1</sup>



PD utilization varies by country and income<sup>2</sup>



It is estimated that 30-50% of patients on PD and 28-54% of patients on HD experience malnutrition<sup>3-4</sup>

1. United States Renal Data System. 2022 USRDS Annual Data Report: Epidemiology of kidney disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2022.

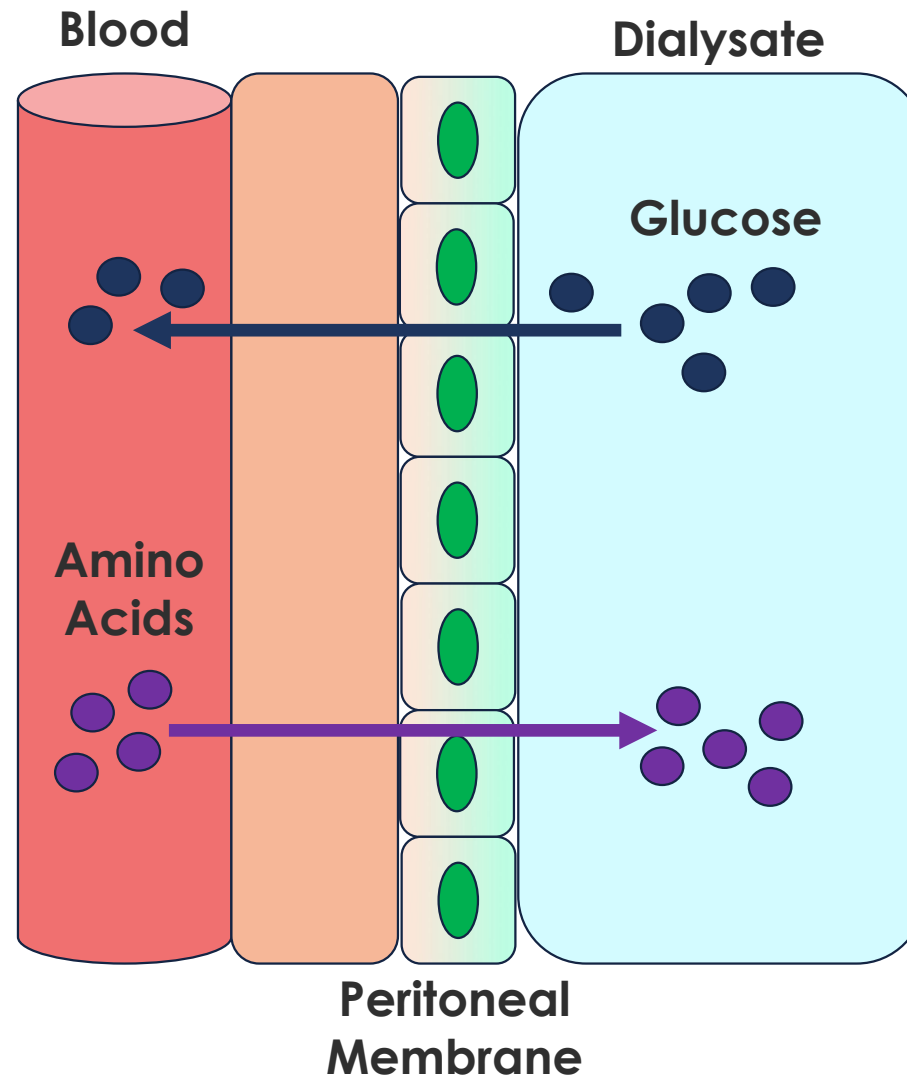
2. Lee T, Flythe JE, Allon M. Dialysis Care around the World: A Global Perspectives Series. *Kidney360*. 2021;2(4):604-607. doi:10.34067/kid.0001082021

3. Kiebalo T, Holotka J, Habura I, Pawlaczyk K. Nutritional status in peritoneal dialysis: Nutritional guidelines, adequacy and the management of malnutrition. *Nutrients*. 2020;12(6):1-14. doi:10.3390/nu12061715

4. Carrero JJ, Thomas F, Nagy K, et al. Global Prevalence of Protein-Energy Wasting in Kidney Disease: A Meta-analysis of Contemporary Observational Studies From the International Society of Renal Nutrition and Metabolism. *J Ren Nutr*. 2018;28(6):380-392. doi:10.1053/J.JRN.2018.08.006



# PD Bidirectional Solute Transport – Dextrose and Protein



# PD and Residual Kidney Function (RKF)

- As compared with conventional HD, PD is associated with a slower decrease in RKF
- There are numerous nutrition-related benefits to PD with respect to RKF
  - Improved nutritional status
  - Increased sodium excretion and improved fluid status
  - Phosphate and uric acid levels
  - Lipid levels

1. Marron B, et al. Benefits of preserving residual renal function in peritoneal dialysis. *Kidney Int Suppl.* 2008 Apr;(108):S42-51. doi: 10.1038/sj.ki.5002600.

# PD and Nutrition

# Nutritional Parameters in PD

| Parameter                                     | Limitation  |
|---|---|
| Albumin                                       | <ul style="list-style-type: none"><li>• Altered in Inflammatory states (Acute phase reactant)</li><li>• Obscured due to peritoneal loss</li><li>• Decreased synthesis in PD</li><li>• Hypoalbuminemia common in PD patients</li></ul> |
| Normalized Protein Nitrogen Appearance (nPNA) | <ul style="list-style-type: none"><li>• Lacks accuracy in anabolic or catabolic states</li><li>• Underestimates nutrition status due to loss of amino acids in dialysate</li><li>• Inconsistent normalization</li></ul>               |

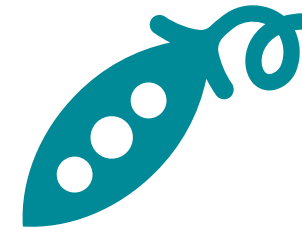
1. Table obtained with permission from Shamma, A, Joshi, S, and Shah A. Nutrition in Peritoneal Dialysis Tables and Figures. *Advances in Kidney Disease and Health*. Accessed August 4, 2023

# Protein and Energy Recommendations in PD



## Encourage adequate food intake

Daily energy intake 35kcal/kg of body weight for patients <60 years and 30-35 kcal/kg of body weight for patients >60 years<sup>1</sup>



## Protein intake

1.0 – 1.2 g/kg of body weight per day<sup>1</sup>  
Some data suggests that eating more plant-based protein may help mitigate mortality in the PD population<sup>2</sup>

1. Ikizler T et al. KDOQI CLINICAL PRACTICE GUIDELINE FOR NUTRITION IN CKD: 2020 UPDATE | VOLUME 76, ISSUE 3, SUPPLEMENT 1, S1-S107, SEPTEMBER 2020
2. Liebman S and Joshi S. Plant-Based Diets and Peritoneal Dialysis: A Review. Nutrients. 2022 Mar 19;14(6):1304. doi: 10.3390/nu14061304.

# Protein Energy Wasting (PEW)

- PEW describes the exhaustion of energy supplies, typically protein and fat, in patients with CKD/ESKD
  - 28 to 54% of patients on PD have protein energy wasting
    - Associated with morbidity, mortality, peritonitis, and poor quality of life

1. Carrero JJ, Thomas F, Nagy K, et al. Global Prevalence of Protein-Energy Wasting in Kidney Disease: A Meta-analysis of Contemporary Observational Studies From the International Society of Renal Nutrition and Metabolism. *J Ren Nutr.* 2018;28(6):380-392. doi:10.1053/J.JRN.2018.08.006

# Markers of PEW



## Biochemical

Albumin <3.8g/100ml

Serum prealbumin  
<30 mg/100ml on  
maintenance dialysis

Serum cholesterol  
<100mg/100ml



## Body Mass

BMI <23kg/m<sup>2</sup>

Unintentional weight loss  
5% over 3 months or 10%  
over 6 months

Total body fat percent  
<10%



## Muscle Mass

Muscle wasting (loss of 5%  
over 3 months or 10% over  
6 months)

Reduced mid-arm muscle  
circumference area  
(reduction >10% in  
relation to 50th percentile  
of reference population)

Creatinine appearance



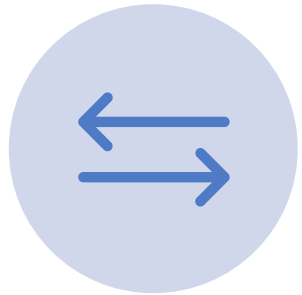
## Dietary Intake

Unintentional low dietary  
protein intake  
<0.8g/kg/day for at least 2  
months for dialysis patients  
or <0.6g/kg/day for  
patients with CKD 2-5

Unintentional low dietary  
energy intake  
<25kcal/kg/day for at  
least 2 months

1. Fouque D et al. A proposed nomenclature and diagnostic criteria for protein–energy wasting in acute and chronic kidney disease. A proposed nomenclature and diagnostic criteria for protein–energy wasting in acute and chronic kidney disease. MEETING REPORT | VOLUME 73, ISSUE 4, P391-398, FEBRUARY 02, 2008.

# Protein Loss from Dialysis



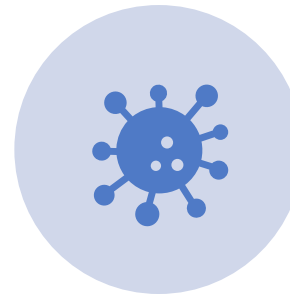
Peritoneal transport is a bi-directional process



Average daily protein loss in continuous ambulatory peritoneal dialysis (CAPD) is 6-8 grams and approximately 10 grams per day in continuous cyclic peritoneal dialysis (CCPD)



Factors affecting protein loss include tonicity, duration of dwell, and peritoneal transport status



Protein loss increases during peritonitis

1. Shamma, A, Joshi, S, and Shah A. Nutrition in Peritoneal Dialysis. *Advances in Kidney Disease and Health*. Accessed August 4, 2023



# Dextrose Absorption From Dialysate

- Major concern with PD is the use of dextrose as the primary osmotic agent and absorption of dextrose across the peritoneal membrane
- Dextrose absorption varies between 10 and up to 180 g/day with greater absorption with greater tonicity, larger volume, longer dwell time, and higher peritoneal solute transport rate
- Approximately 60 to 70 percent of dextrose is absorbed in CAPD and approximately 40 to 50% absorbed in CCPD

1. Shamma, A, Joshi, S, and Shah A. Nutrition in Peritoneal Dialysis. *Advances in Kidney Disease and Health*. Accessed August 4, 2023

# Sodium Homeostasis in PD

- Primarily responsible for extra cellular fluid volume
- Volume overload is common upon starting PD
  - Those above 75th percentile volume overload at one month had a 60% increase in mortality
- Limit dietary sodium intake to <100mmol/day (<2.3g/day) in CKD 5 to improve blood pressure and volume control



1. Shamma, A, Joshi, S, and Shah A. Nutrition in Peritoneal Dialysis. *Advances in Kidney Disease and Health*. Accessed August 4, 2023

# Potassium Homeostasis in PD

**Hypokalemia** more frequently observed in PD than **hyperkalemia**

Factors contributing to hypokalemia include peritoneal dextrose absorption and resulting increase in insulin/potassium shift

Adjust dietary potassium intake to maintain levels within normal range (3.5-5 mEq/L) for CKD 3-5

Adjust dietary, or supplement, potassium intake based on individual needs/clinical judgement for patients with hyper/hypokalemia

1. Shamma, A, Joshi, S, and Shah A. Nutrition in Peritoneal Dialysis. *Advances in Kidney Disease and Health*. Accessed August 4, 202

# Metabolic Acidosis in PD

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A prospective study of more than 400 patients receiving PD showed that those with a serum bicarbonate  $<24$  mEq/L had a higher risk of becoming anuric and experiencing RKF decline compared with those  $>24$  mEq/L

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Sodium bicarbonate may be used to treat metabolic acidosis in patients with CKD, but sodium-load should be taken into consideration

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Two small randomized trials have examined using bicarbonate in PD patients with a bicarbonate level  $<24$  mEq/L. Both showed an improvement in acidosis

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Diets high in protein have the highest net acid production, but plant-based protein, fruits, and vegetables result in less acid production than animal-based protein

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Plant-based diets may benefit individuals on PD with respect to mitigating metabolic acidosis, but further research is warranted

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1. Liebman S and Joshi S. Plant-Based Diets and Peritoneal Dialysis: A Review. *Nutrients*. 2022 Mar 19;14(6):1304. doi: 10.3390/nu14061304

# Fiber: Mortality, Uremic Toxins, and Constipation

- Fiber is associated with reduced mortality in PD
- A long-term prospective cohort study of over 800 patients on PD found an independent association between fiber intake and all-cause mortality
- Each 1 gram per day increase in fiber intake correlated with a 13% reduction in all-cause mortality

1. Xu, Xiao, et al. "Dietary fibre and mortality risk in patients on peritoneal dialysis." *British Journal of Nutrition* 122.9 (2019): 996-1005.

# Phosphorus

Worldwide, 75% of patients receiving PD are prescribed phosphate binders

Despite this, phosphorus levels remain elevated at 5.5 mg/dL or above in 37% of PD patients

Per the KDOQI guideline for CKD3-5D patients (Grade 1B), it is recommended to adjust dietary phosphorus intake to maintain levels in the normal range (2.7-4.6 mg/dL)

Plant-based phosphorus in the form of phytate is less absorbable than animal protein

Phosphorous bioavailability in plant-based foods can vary depending on processing and preparation methods

1. Liebman S and Joshi S. Plant-Based Diets and Peritoneal Dialysis: A Review. *Nutrients*. 2022 Mar 19;14(6):1304. doi: 10.3390/nu14061304

# Summary

1. Benefits of PD include improved quality of life, reduced cost, more flexible dietary restrictions, and improved residual kidney function preservation<sup>1</sup>
2. Protein energy wasting and dietary protein intake recommendations are important considerations for patients receiving PD
3. Sodium, potassium, phosphorus, and acid/base recommendations are similar to those for CKD patients, with further research needed for recommendations specific to patients receiving PD

1. National Kidney Foundation. *Peritoneal Dialysis* <https://www.kidney.org/atoz/content/peritoneal>. Reviewed June 1, 2021. Accessed on August 4, 2023.

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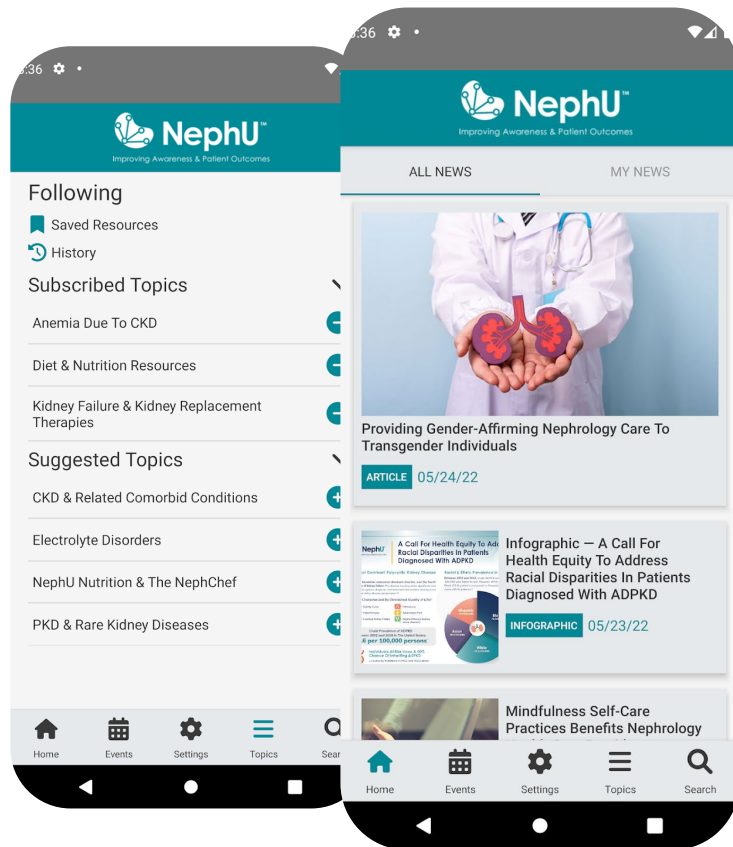
on March 9<sup>th</sup>, 2022

*Reza Maghadam, PharmD, MBA*  
Executive Director, Head of Field Medical Affairs, OPDC

1 Contact Hour

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