Overview of the Nutrition in CKD Guidelines

Introduction

Nutrition in CKD is complex. The guidelines provide a framework for understanding the complexities of nutrition in chronic kidney disease (CKD). It is essential to consider various factors, including protein intake, fluid management, and mineral and vitamin supplementation, to optimize nutrition in patients with CKD.

Agenda

- Introduction – Alp Ikizler, MD
- Guideline Development Process – Alison Steiber, PhD, RDN
- What is Different in the Updated Guideline? – Alp Ikizler, MD
- Conclusion – Alp Ikizler, MD

Objectives

- Explain the guideline development process and the benefits of multidisciplinary collaboration between the National Kidney Foundation and the Academy of Nutrition and Dietetics to produce global evidence-based nutrition guidelines for patients with chronic kidney disease.
- Recognize the differences between the KDOQI Nutrition 2000 and KDOQI Nutrition 2020 recommendations.

Faculty Disclosures

T. Alp Ikizler, MD
Consultant and received honoraria for his consulting work from Abbott Renal Care, Fresenius Kabi, Nestle, and Reata.

Alison Steiber, PhD, RDN
Employed by the Academy of Nutrition and Dietetics; grants from Ajinomoto, Relypsa, American Council on Exercise, Commission on Dietetic Registration; socks in Nephroceuticals, Inc.
Clinical Practice Guidelines for Nutrition in Chronic Renal Failure

✓ Published in 2000
✓ Content and relevance changed
✓ Not graded

International representation of Work Group Members

NKF-KDOQI and Academy-EAL collaboration on CKD Guideline Work Group Members

Co-Chairs: T. Alp Ikizler, MD & Lillian Cuppari, PhD

Macronutrients
Laura Byham-Gray, PhD, RDN, FNKF (Chair)
Denis Fouque, MD, PhD
Winnie Chan, PhD, RD
Jerrilynn Burrowes, PhD, RD, CDN
Daniel Teta, MD, PhD

Micronutrients
Angela Wang, MD, PhD (Chair)
Jordi Fuchs, DSc, APN, NP, RDN
Joel Kopple, MD
Sana Ghaddar, PhD, RDN
Alp Ikizler, MD

Electrolytes & other nutrients
Juan Jesus Carrero, PhD Pharm, PhD Med, MBA (Chair)
Katrina Campbell, PhD, RD
George Kaplan, MD, PhD
Alfonso Ehrman, MD, FASN
Lilian Cuppari, PhD

Guideline Development Process

1. Determine scope of the guideline
2. Conduct Systematic Review
   - Draft guideline recommendations using the NCP model as framework***
3. Finalize guideline (during a face-to-face meeting, when resources allow)
4. Conduct internal/external review and revise (AGREE II)
5. Obtain approval by Evidence-Based Practice Committee
6. Publish guideline* in EAL; Evaluate for Revision**

SR process:
1. Formulate question
2. Gather and classify the research
3. Critically appraise each article
4. Summarize the evidence in an overview table and evidence summary
5. Develop conclusion statement and grade the strength of the supporting evidence

Steps in conducting a Systematic Review

1. Develop the Question
2. Gather and Classify the Research
3. Critically Appraise Each Article
4. Summarize the evidence in an Overview Table and Evidence Summary
5. Develop Conclusion Statement and Grade the Strength of the Supporting Evidence

Grade ≠ GRADE

Evidence-Based Practice Cycle
Question Development: PICO format

- Questions are organized by subtopics and within subtopics by Nutrition care process:
  - Macronutrients
  - Micronutrients
  - Electrolytes
- Overview of questions within subtopics are focused on:
  - Assessment questions
  - Intervention questions
  - Monitoring questions

Outcomes of Interest (not all are presented here)

- Major categories of outcomes:
  - Electrolyte biomarkers:
    - Na, K, Mg, Phos, Ca, Acid load etc
  - Micronutrient biomarkers:
    - Serum or urinary excretion for all included micronutrient
  - CKD progression:
    - eGFR, s. creatinine, etc
  - Comorbidity outcomes
    - Lipid profile, BP etc

Gather and Classify the Research: Search Process – A Rigorous Process

Workgroup Oversees/Decision Makers

- Search Plan
  - Brief Inclusion criteria
    - CKD all stages
  - Searched databases from 1985 to 2016
  - Limited to controlled trials for intervention questions
    - At least n=6 in each arm
  - Limited to controlled trials + observational studies for assessment questions
  - Assessment questions: studies needed to have a comparative tool/method
  - Searched multiple databases
  - Hand searched published Systematic reviews and other guidelines

Search Results

Critically Appraise Each Article and data extraction: Risk of bias

- Academy of Nutrition and Dietetics Quality criteria checklist (QCC) was used
  - QCC is based on RGB domains of Cochrane
- Data extraction
  - Data extraction guide based on questions that needed to be answered was developed
  - Used Academy’s online data extraction tool (DET)
- Read and analyze articles
  - Complete worksheets (DET for each article)
  - Complete quality checklists
Double Blind Bias Assessment

Evidence Statements and Study Details for each Outcome

Conclusion Statement:

As presented, the effects of dietary phosphate restriction and phosphorus/phosphate biomarkers on CKD progression were mixed and any evidence was limited to one study. A prospective cohort study, dietary protein and phosphate restriction and phosphate restriction only did not show any significant difference in mean rate of fall of creatinine clearance, plasma creatinine, or distribution of those who improved, worsened or were unchanged. Compared to control, dietary protein and phosphate restriction and phosphate restriction only did not show any significant difference in mean rate of fall of creatinine clearance, plasma creatinine, or distribution of those who improved, worsened or were unchanged (Williams et al, 1991; dietary protein and phosphate restriction: protein: 0.6 g/kg/day; phosphate: 800 mg, energy intake ≥ 30 kcal/kg/day; dietary phosphate restriction only: protein: 0.8 g/kg/day, phosphate: 800 mg, energy intake ≥ 30 kcal/kg/day). Greater 24-hr urinary phosphate excretion was not associated with ESRD (i.e., progressed to ESRD) in Selamet et al, 2016, while greater urinary phosphorus excretion per creatinine clearance was associated with greater CKD progression (e.g., progression to ESRD or 50% reduction of eGFR) in Kawasaki et al, 2015.

Results from SR = Evidence Summary Table

SR to Practice Recommendations
Overview of the Nutrition in CKD Guidelines

**Slides**

**GRADE Methodology**
Assigns separate grades for:
1) Evidence Quality
2) Strength of Recommendation

Limitations and issues
- Literature search was intended to be comprehensive, however, they were not exhaustive.
- Were not able to contact authors for incomplete data. Data presented in published original research was used in data analysis.
- Eligible studies published after search dates or in congress proceedings have not been included.
- Inconsistent reporting of clinical outcomes of interest resulted in evidence synthesis difficulty. (standardization of outcomes is needed in this field)
- Low quality evidence in certain areas required substantial use of WG expertise to draft a recommendation
- Issues with nutrition studies: baseline exposure, nutrient status, confounding variables...

**What is different in the Updated Guidelines?**

**KDOQI 2000 guideline**
- Population: Maintenance Dialysis; Adv. CRF without Dialysis

**Update KDOQI-Academy of Nutrition and Dietetics guideline**
- Population: Adults with Chronic Kidney Disease: Stages 1-5, including dialysis and post-kidney transplant
- Literature search dates: 1985 - 2016

**What is different in the Updated Guidelines?**

- Topic covered
  - Evaluation of Protein Energy Nutritional Status
  - Management of Acid Base Status and Phosphorus and Energy Status
  - Nutritional Counseling and Follow-up
  - Carnitine
- Topics covered
  - More comprehensively covered and additional "New" statements; more evidence-based statements
  - Carnitine - literature in this area was NOT explored in this update
  - Micronutrients - NEW
  - Electrolytes - NEW

**Assessment Recommendations**
- Composite Nutrition Assessment Scores
- Dietary Intake Assessment
- Resting Energy Expenditure
- Laboratory Values
- Anthropometric and other measures to assess body composition
- Technical Devices to assess body composition

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### Assessment Recommendations

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>No specific screening recommendation</strong></td>
<td></td>
<td><strong>New</strong></td>
</tr>
<tr>
<td>- Adult with CKD stage 5D and post transplant, it is reasonable to consider routine nutrition assessment in adults who have no access to dialysis (Evidence)</td>
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</tr>
<tr>
<td><strong>N/A</strong></td>
<td></td>
<td><strong>New</strong></td>
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<tr>
<td>- Adult with CKD stage 5D and post transplant, there is limited evidence to support the use of new tools to evaluate for identifying those at risk of energy wasting (Evidence)</td>
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### Assessment Recommendations - Serum Biomarkers

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<tbody>
<tr>
<td><strong>Serum Albumin</strong></td>
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<td><strong>Updated</strong></td>
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<tr>
<td>- Serum albumin is a valid and clinically useful measure of protein energy nutritional status in maintenance dialysis (MD) patients (Evidence)</td>
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<tr>
<td><strong>Serum Albumin Levels</strong></td>
<td></td>
<td><strong>Updated</strong></td>
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<tr>
<td>- Adult with CKD stage 5D and post transplant, low serum albumin may be used as a predictor of hospitalization and mortality (3A)</td>
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<tr>
<td><strong>Serum Prealbumin</strong></td>
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<td><strong>Serum Cholesterol</strong></td>
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<tr>
<td><strong>Serum Creatinine</strong></td>
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<tr>
<td>- Serum prealbumin, cholesterol and creatinine are valid and clinically useful markers of protein-energy nutritional status in maintenance dialysis patients (Evidence and Opinion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>No specific statement</strong></td>
<td></td>
<td><strong>Updated</strong></td>
</tr>
<tr>
<td>- Covered under Rationale Section</td>
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### Assessment Recommendations - SGA/MIS

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<tbody>
<tr>
<td><strong>Subjective Global Nutritional Assessment (SGA)</strong></td>
<td></td>
<td><strong>Updated</strong></td>
</tr>
<tr>
<td>- SGA is a valid and clinically useful measure of protein-energy nutritional status in maintenance dialysis patients (Evidence)</td>
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<tr>
<td><strong>7-point Subjective Global Assessment (SGA)</strong></td>
<td></td>
<td><strong>Updated</strong></td>
</tr>
<tr>
<td>- In adults with CKD stage 5D and post transplant, we recommend the use of the 7-point Subjective Global Assessment as a valid and reliable tool for assessing nutritional status (1A)</td>
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<tr>
<td><strong>Malnutrition Inflammation Score (MIS)</strong></td>
<td></td>
<td><strong>New</strong></td>
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<tr>
<td>- Malnutrition Inflammation Score may be used to assess nutritional status (2C)</td>
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### Assessment Recommendations - Nutrient Intake

<table>
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<tbody>
<tr>
<td><strong>Dietary Interviews and Diaries</strong></td>
<td></td>
<td><strong>Updated; New Statements</strong></td>
</tr>
<tr>
<td>- Dietary interviews and/or diaries are valid and clinically useful for measuring dietary protein and dietary energy intake in maintenance dialysis patients (Evidence and Opinion)</td>
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<tr>
<td><strong>Considerations when Assessing Dietary Intake</strong></td>
<td></td>
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<tr>
<td>- In adults with CKD stage 4D and post transplant, it is reasonable to consider routine nutrition assessment in adults who have no access to dialysis (Evidence and Opinion)</td>
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<tr>
<td><strong>3 Day Food Records to Assess Dietary Intake</strong></td>
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<tr>
<td>- In adults with CKD stage 5D, we suggest the use of a 3-day food record conducted during both dialysis and non-dialysis treatment days (when applicable), as a preferred method to assess dietary intake (2A)</td>
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### Intervention Recommendations

- Medical Nutrition Therapy (MNT)
- Energy requirements
- Protein Energy supplements (oral, dialysate, IDPN, enteral & parenteral)
- Omega-3 supplements
- Dietary Patterns
- Micronutrients
- Electrolytes

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Overview of the Nutrition in CKD Guidelines

Intervention Recommendations - MNT


- Intensive Nutritional Counseling With Maintenance Dialysis (MD)
  - Every MD patient should receive nutrition counseling focused on individualized goals and self-care education at least at the time of commencement of MD therapy.
  - A plan of care for nutritional management should be based on nutrition assessment or on the first post-MD clinic visit and updated frequently based on the patient’s medical and social conditions.
  - The plan of care should be updated at least every 3 to 4 months.
  - Nutrition counseling should be intensive initially and provided throughout the first 3 months and more frequently if inadequate nutrition status, medication regimen changes, or medical conditions necessitate additional counseling.

**KDOQI-AND (2019)**

- Medical Nutrition Therapy
  - In adults with CKD-5D, we recommend that a registered dietitian nutritionist (RDN) or an appropriately licensed provider (e.g., physician assistant or nurse practitioner) provide medical nutrition therapy (MNT). Goals include optimizing nutritional status, and to minimize risks imposed by protein-to-phosphorus ratios and alterations in the management of diabetes, CVD, and renal clinical outcomes. (OPINION)
  - MNT should be included in the individual’s treatment regimen.

**Changes**

- **Updated**

Intervention Recommendations - DPNL


- Dietary Protein Intake (DPI) for Nondialyzed Patients - DM
  - N/A

**KDOQI-AND (2019)**

- Protein Intake During Acute Illness
  - The optimum protein intake for a maintenance dialysis patient who is acutely ill is at least 1.2 g protein/kg/d to maintain a stable nutritional status and optimize glycemic control. (Opinion)
  - N/A

**Changes**

- **New/W Opinion**

Intervention Recommendations - DPI_CKD


- Dietary Protein Intake (DPI) in Maintenance Hemodialysis (MHD)
  - The recommended DPI for dialysis patients is 1.2 g protein/kg/d. (Evidence)
  - In adults with CKD 3, CKD 4, or CKD 5D (or PD) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.60 g protein/kg/d should be considered. (Opinion)
  - In adults with CKD 3, CKD 4, or CKD 5D (or PD) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.80 g protein/kg/d should be considered. (Opinion)
  - In adults with CKD 3, CKD 4, or CKD 5D (or PD) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.28 to 0.43 g protein/kg/d should be considered. (Opinion)

**KDOQI-AND (2019)**

- Protein Restriction, Non-Dialysis
  - For individuals with chronic renal failure (GFR ≤ 35 ml/min) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.60 g protein/kg/d should be considered. (Evidence)
  - For individuals who will not accept such a diet or who are unable to maintain adequate dietary intake with such a diet, an intake of up to 1.0 g protein/kg/d may be prescribed. (Evidence and Opinion)

**Changes**

- **Updated**

Intervention Recommendations - DPI_MHD


- Dietary Protein Intake, MHD/PD
  - N/A

**KDOQI-AND (2019)**

- Dietary Protein Intake, Maintenance Hemodialysis and Peritoneal Dialysis
  - In adults with CKD 3, CKD 4, or CKD 5D (or PD) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.60 g protein/kg/d should be considered. (Evidence)
  - In adults with CKD 3, CKD 4, or CKD 5D (or PD) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.80 g protein/kg/d should be considered. (Evidence)
  - In adults with CKD 3, CKD 4, or CKD 5D (or PD) who are not undergoing maintenance dialysis, the institution of a planned low protein diet providing 0.28 to 0.43 g protein/kg/d should be considered. (Evidence)

**Changes**

- **Updated**

Intervention Recommendations – Protein type


- Protein Type
  - In adults with CKD 1-5D (1B) and post-transplant (OPINION), there is insufficient evidence to make conclusions about the effects of protein type (plant vs animal) on nutritional status, calcium or phosphorus levels, or the blood lipid profile.

**KDOQI-AND (2019)**

- Protein Type

**Changes**

- **New Opinion**
Overview of the Nutrition in CKD Guidelines

**Intervention Recommendations - Energy CKD/MD**

<table>
<thead>
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<tbody>
<tr>
<td>Dietary Energy Intake (DEI) for Nondialyzed and Maintenance Dialysis Patients</td>
<td>Energy, CKD 1-5D and post-Tx</td>
<td>Updated Opinion</td>
</tr>
<tr>
<td>• The recommended DEI for individuals with chronic kidney failure (CKD 1-5D) and/or those undergoing maintenance dialysis is 1.1-1.2 kcal/kg for those who are younger than 60 years old and 1.0 to 1.1 kcal/kg if for individuals who are 60 years of age or older. (Evidence and Opinion)</td>
<td>In adults with CKD 1-5D (1C) and post-transplant (OPINION) who are metabolically stable, we recommend prescribing an energy intake of 22-25 kcal/kg ideal body weight per day based on age, gender, level of physical activity, body composition, weight status goals, CKD stage, and concurrent chronic inflammatory state to maintain normal nutritional status. (Evidence and Opinion)</td>
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**Intervention Recommendations - Nutritional Supplementation**

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<tbody>
<tr>
<td>Indications for Nutritional Support</td>
<td>Oral Protein-Energy Supplementation</td>
<td>Updated</td>
</tr>
<tr>
<td>• In adults with CKD 3-D and post-transplant (OPINION) at risk of or with protein-energy wasting, we suggest a minimum of a 3-month trial of oral/nutritional supplements to improve nutritional status if dietary counseling alone does not achieve sufficient energy and protein intake to meet nutritional requirements. (Evidence and Opinion)</td>
<td>In adults with CKD 3-D and post-transplant (1C) and post-transplant (OPINION) who are at risk of or with protein-energy wasting, we suggest a minimum of a 3-month trial of oral/nutritional supplements to improve nutritional status if dietary counseling alone does not achieve sufficient energy and protein intake to meet nutritional requirements. (Evidence and Opinion)</td>
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</table>

**Dietary Protein and Energy Intake Implementation considerations**

- Increase the training and number of specialized renal dietitians worldwide.
- Gradual implementation is more likely to succeed.
- Enforce the dietary interventions to improve symptoms when chronic dialysis is not a treatment option or is to be postponed (vascular access maturation, organizing pre-emptive renal transplant, ...)
- If wasting is present, priority should be given to the correction of wasting.
- Compliance to diets should be monitored frequently during the first year of dietary intervention by dietary interviews (3 are optimal) and urine collection for urea output measures.
- Then yearly follow-up recommended until start of maintenance dialysis.

**Specifics of Oral Nutritional Supplementation**

- **Who**
  - All versus at-risk
- **When**
  - During Dialysis; In-between meals
- **How much**
  - Replacement versus Supplementation
- **How long**
  - > 3-months
- **How to monitor**
  - Weight Biomarkers

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Overview of the Nutrition in CKD Guidelines

Intervention Recommendations - Nutritional Supplementation

<table>
<thead>
<tr>
<th>Indications for Nutritional Support</th>
<th>Dialysate Protein-Energy Supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes</td>
<td>Updated</td>
</tr>
</tbody>
</table>

*Updated*:

- In adults with CKD on peritoneal dialysis with protein-energy wasting, we suggest not substituting conventional dextrose dialysate with amino acid dialysate as a general strategy to improve nutritional status (2C), although in selected cases of protein-wasting when energy intake is inadequate, 1.1% amino acid dialysate with allant supplements may ameliorate protein deficits (OPINION).

Intervention Recommendations - LC n-3 PUFA

<table>
<thead>
<tr>
<th>LC n-3 PUFA Nutritional Supplements for Lipids, Mortality and CVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>KDOQI (2000)</td>
</tr>
<tr>
<td>Changes</td>
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<tr>
<td>N/A</td>
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</tbody>
</table>

*New*:

- In adults with CKD on HD, we suggest not routinely prescribing long-chain n-3 PUFA, including those derived from fish or flaxseed, or reduced risk of mortality (2C) or cardiovascular events (2C).
- In adults with CKD on HD, we suggest that 1.3–4.4 g/d long chain n-3 PUFA may be prescribed to reduce triglycerides and subcutaneous (2B) and visceral (2C) triglycerides and LDL cholesterol (2B).
- In adults with CKD on PD, it is reasonable to consider prescribing 3.4–9.2 g/d long chain n-3 PUFA to improve the lipid profile (OPINION).

Intervention Recommendations - Dietary Patterns

<table>
<thead>
<tr>
<th>Mediterranean Diet</th>
<th>Mediterranean Diet</th>
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<tbody>
<tr>
<td>Changes</td>
<td>New</td>
</tr>
<tr>
<td>N/A</td>
<td>Weak, Conditional</td>
</tr>
</tbody>
</table>

*New*:

- In adults with CKD stage 1-5 (non-dialysis and post-transplant, with or without diabetes), we suggest that prescribing a Mediterranean Diet may improve lipid profiles (2C).

Generalities: Vitamins and Trace-Elements

Ideal amounts of daily vitamins and trace elements are those required to:

- Maintain health / prevent diseases
- Maintain nutritional status
- Reverse deficiencies
- Prevent toxicity

Recommendations for vitamins/trace element intakes are challenging:

- Depend on physical properties (hydro vs fat-solubility)
- Depend on type of population: General population vs CKD patients
- Depend on body stores, previous supplementation, nutritional status and intake, gut absorption, impaired renal metabolism, additional losses through dialysis
### Recommended Dietary Allowances for Adult General Population

<table>
<thead>
<tr>
<th>Micronutrients</th>
<th>Recommended Dietary Allowance (per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiamin</td>
<td>1.2mg (M), 1.1mg (F)</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>2.4µg (M &amp; F)</td>
</tr>
<tr>
<td>Folic acid</td>
<td>400 µg (M &amp; F)</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>10 µg (M), 5 µg (F)</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>15mg (M &amp; F)</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>120 µg (M), 90 µg (F)</td>
</tr>
<tr>
<td>Selenium</td>
<td>55 µg (M &amp; F)</td>
</tr>
<tr>
<td>Zinc</td>
<td>11mg (M), 8 mg (F)</td>
</tr>
</tbody>
</table>

### Intervention Recommendations - Vitamins

**Folic Acid and B vitamins N/A**

- In adults with CKD and post transplant who have hyperhomocysteinemia associated with kidney disease, we recommend not routinely supplementing folic acid for hyperhomocysteinemia with or without cardioprotection since there is no evidence demonstrating reduction in cardiovascular outcomes (1A).

**Folic Acid Deficiency and Insufficiency**

- In adults with CKD 1-5D and post transplant (OPINION), we suggest prescribing folic acid and/or B-complex supplement to correct for folic acid deficiency (2B).

**New Intervention Recommendations - Vitamins**

- **Vitamin C**
  - N/A
  - Vitamin C Supplementation Limit (KDOQI (2000) vs KDOQI-AND (2019))
  - New

- **Vitamin D**
  - N/A
  - Anticoagulant Medication and Vitamin K Supplementation (KDOQI (2000) vs KDOQI-AND (2019))

**Vitamin A and E Supplementation and Toxicity**

- In adults with CKD on MHD or PD, it is reasonable to not routinely suggest vitamin A or E supplementation because of the potential for vitamin toxicity. However, if supplementation is warranted, it is reasonable to use caution and monitor patients for toxicity (OPINION).

**Vitamin D Supplementation for Vitamin D Deficiency and Insufficiency**

- In adults with CKD 1-5D and post transplant (OPINION), we suggest prescribing vitamin D supplementation in the form of cholecalciferol or ergocalciferol to correct 25(OH)D deficiency or insufficiency.

**Vitamin D Supplementation with Proteinuria**

- In adults with CKD and chronic nephrotic-range proteinuria (OPINION), it is reasonable to consider supplementation of cholecalciferol, ergocalciferol or other safe and effective 25(OH)D precursors (OPINION).
Overview of the Nutrition in CKD Guidelines

**Intervention Recommendations - Electrolytes**

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<thead>
<tr>
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<tbody>
<tr>
<td>Phosphorus</td>
<td>N/A</td>
<td></td>
<td>Now</td>
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<tr>
<td>Dietary Phosphorus Amount</td>
<td></td>
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<tr>
<td>- In adults with CKD 3-5 and on MHD, we recommend adjusting dietary phosphorus intake to maintain serum phosphate levels in the normal range (1B).</td>
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<tr>
<td>Dietary Phosphorus Source</td>
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<tr>
<td>- It is reasonable to consider prescribing high-phosphorus intake (diet or supplements) in order to replete serum phosphorus (OPINION).</td>
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<tr>
<td>Phosphorus Intake with Hypophosphatemia</td>
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<tr>
<td>- In adults with CKD 1-5D and post-transplant, it is reasonable to adjust dietary phosphorus intake to maintain serum phosphate levels in the normal range (1B).</td>
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**Calcium**

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<tbody>
<tr>
<td>Calcium</td>
<td>N/A</td>
<td></td>
<td>Now</td>
</tr>
<tr>
<td>Dietary Calcium Amount</td>
<td></td>
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<tr>
<td>- In adults with CKD 3-4 not taking active vitamin D analogs, we suggest that a total elemental calcium intake of 800-1,000 mg/d (including dietary calcium, calcium supplementation and calcium-based phosphate binders) be prescribed to maintain a neutral calcium balance (2D).</td>
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**Sodium**

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<tbody>
<tr>
<td>Sodium</td>
<td>N/A</td>
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<td>Now</td>
</tr>
<tr>
<td>Dietary Sodium Amount</td>
<td></td>
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<tr>
<td>- In adults with CKD 3-5 and post-transplant, we suggest limiting sodium intake to less than 100 mmol/day (or &lt;2.3 g/day) to reduce blood pressure and improve volume control (1B).</td>
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**Potassium**

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</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>N/A</td>
<td></td>
<td>Now</td>
</tr>
<tr>
<td>Dietary Potassium Amount</td>
<td></td>
<td></td>
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<tr>
<td>- In adults with CKD 3-5 on MHD (2D) and post-transplant (OPINION) with either hyperkalemia or hypokalemia, we suggest that dietary or supplemental potassium intake be based on a patient’s individual needs and clinician judgment.</td>
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</tbody>
</table>

**Conclusion**

Thank you!

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Questions?